



FROM EGOCITY TO ECOCITY

**AN ECOLOGICAL, COMPLEX SYSTEMS APPROACH TO
HUMANS AND THEIR SETTLEMENTS**

by

Vanda Barbara Rounsefell
Department of Geographical and Environmental Studies

VOLUME I

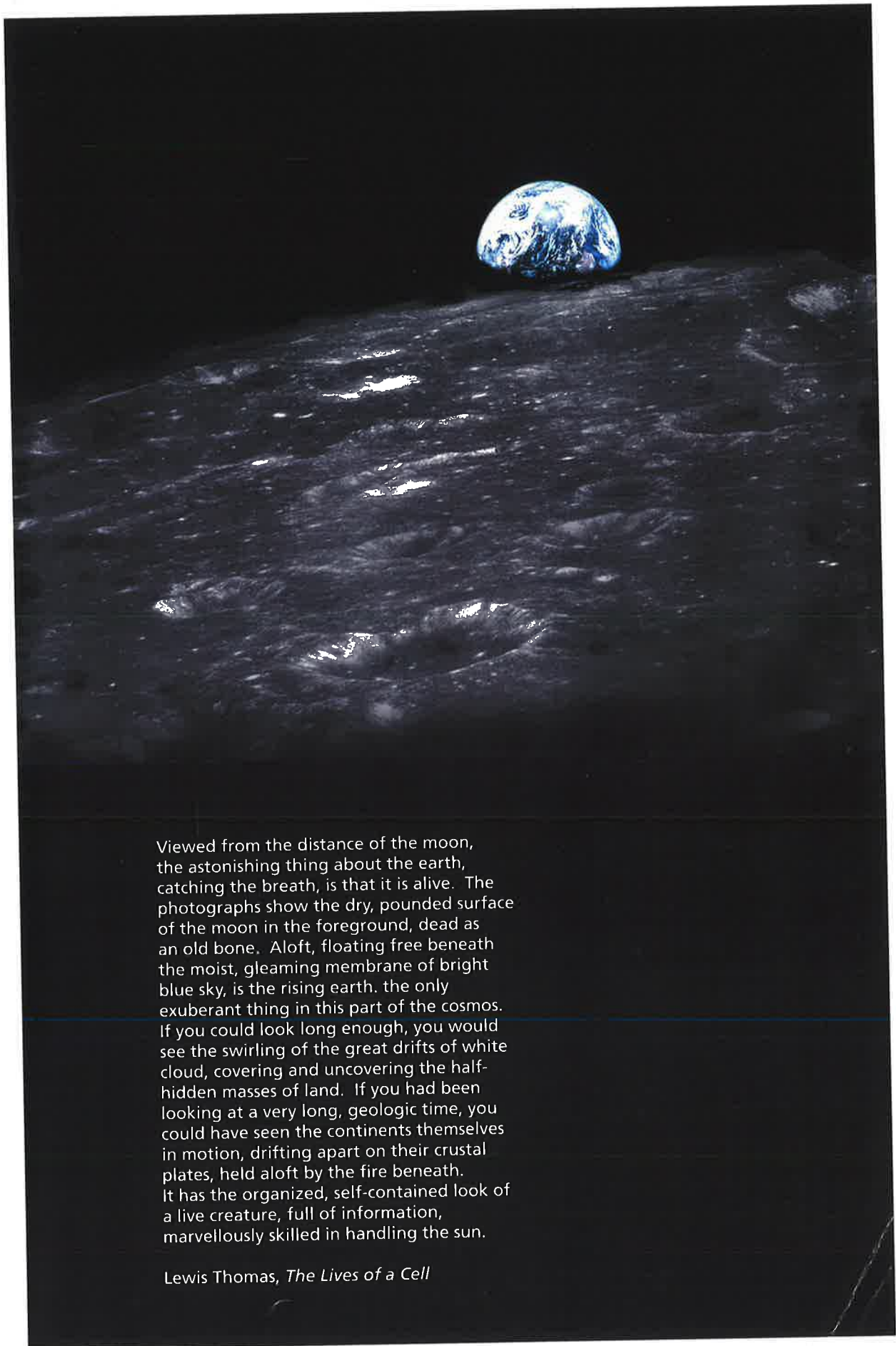
**A Thesis Submitted towards the
Degree of Doctor of Philosophy**

Adelaide University Australia
MARCH 2001

Plate 1: Context - The Living Earth

"Earthrise seen for first time by human eyes." View to SW towards Crater Gibbs, from approximately 70 miles orbital altitude. Colour views more famous. Hasselblad 70mm B&W negative (Anders 1968).

Text in Lovelock, 1988: frontispiece, appears to refer to this series.
Image editing & composition by author.



Viewed from the distance of the moon, the astonishing thing about the earth, catching the breath, is that it is alive. The photographs show the dry, pounded surface of the moon in the foreground, dead as an old bone. Aloft, floating free beneath the moist, gleaming membrane of bright blue sky, is the rising earth, the only exuberant thing in this part of the cosmos. If you could look long enough, you would see the swirling of the great drifts of white cloud, covering and uncovering the half-hidden masses of land. If you had been looking at a very long, geologic time, you could have seen the continents themselves in motion, drifting apart on their crustal plates, held aloft by the fire beneath. It has the organized, self-contained look of a live creature, full of information, marvellously skilled in handling the sun.

Lewis Thomas, *The Lives of a Cell*

**From EgoCity to EcoCity:
An Ecological, Complex Systems Approach to
Humans and Their Settlements**

Volume I

TABLE OF CONTENTS - VOLUME I

PLATES	xv
ABSTRACT	xvi
DECLARATION	xviii
ACKNOWLEDGMENTS	xix
1 INTRODUCTION TO DISSERTATION	1
1.1 PREAMBLE	1
1.2 THE PROBLEM	4
1.3 ON EGOCITIES AND ECOCITIES: EXPLANATION OF THE TITLE	11
1.4 AUTHOR'S BACKGROUND	16
2 METHODOLOGY	19
2.1 DEVELOPMENT OF RESEARCH TOPIC	19
2.1.1 PROCESS OF CONCEPTUALISATION	19
2.1.2 THE ECOLOGICAL PARADIGM PROPONENT ('EPP')	27
2.2 RESEARCH QUESTIONS	28
2.3 BIASES AND CONVENTIONS	29
2.3.1 ASSUMPTIONS & BIASES	29
2.3.2 CONVENTIONS	29
2.4 METHODOLOGICAL ISSUES	29
2.4.1 STRATEGIES	29
2.4.2 BIG PICTURE RESEARCH	29
2.4.3 INTERNAL CONSISTENCY	30
2.4.4 ACCURACY OF INFORMATION (RESEARCH JOURNEY)	30
2.4.5 RECORDING SYSTEM (PRELIMINARY WORK)	32
2.4.6 OBSERVANT PARTICIPATION IN ACTION RESEARCH	32
2.4.7 REPORTING OF CASES	33
2.5 RESEARCH STAGING	33
2.5.1 OVERVIEW OF RESEARCH STAGES	33
2.5.2 STAGE I: ECO-COMMUNITY AND SUSTAINABILITY PRINCIPLES	33
2.5.3 STAGE II: JOURNEY 1: OVERSEAS FIELD WORK	33
2.5.4 STAGE III: JOURNEY 2: AUSTRALIAN FIELD WORK	36
2.5.5 STAGE IV: THEORY DEVELOPMENT	37
2.5.6 STAGE V: APPLICATIONS	38
3 EARLY FINDINGS	39
3.1 JOURNEYS 1 & 2: PRINCIPAL FINDINGS (at 10/1993)	39
3.2 COMMENTS ON SELECTED FINDINGS	40
3.2.1 LIMITATION OF SCOPE OF DEVELOPMENTS	40
3.2.2 DEVIATION FROM ORIGINAL PLANS	41
3.2.3 FIRE SOULS AND 'BOTTOM UP' PARTNERSHIPS	43
3.2.4 BARRIERS TO IMPLEMENTATION	46
3.2.5 THE NEED FOR AN INTEGRATIVE MODEL	55
3.2.6 ESD vs ECD	55
3.2.7 PERMACULTURE, COHOUSING, ORGANICS & MIXED USE	56
3.2.8 PROVIDING DEMONSTRATIONS	57
3.2.9 PROJECT FAILURE: MFP-AUSTRALIA AND THE HALIFAX	59
3.2.9.1 The Halifax	59
3.2.9.2 MFP-Australia	65
3.2.9.3 Appraisal	67
4 MODELS AND MINDSCAPES	75
4.1 HUMAN (SETTLEMENT) ECOLOGY	75
4.1.1 WHAT DISCIPLINE IS THIS?	75
4.1.2 HUMAN ECOLOGY: A BRIEF HISTORY	77

4.2	CONCEPTS AND QUESTIONS	81
4.2.1	INTRODUCTION	81
4.2.2	THE NEED FOR AN ECOLOGICAL MODEL	81
4.2.3	CHARACTERISTICS REQUIRED OF AN ECOLOGICAL MODEL	84
4.2.4	THE APPLICATION OF ECOLOGICAL AND SYSTEMS CONSTRUCTS TO HUMAN SYSTEMS	84
4.2.5	HIERARCHY AND SCALE IN COMPLEX ECOLOGICAL SYSTEMS	90
4.2.6	CONTRIBUTIONS FROM THE 'NEW PHYSICS', PSYCHOLOGY, PHILOSOPHY AND METAPHYSICS	92
4.2.7	SUMMARY: CONCEPTS & QUESTIONS	97
4.3	BRIDGES FROM THEORY TO PRACTICE	98
4.3.1	INTRODUCTION	98
4.3.2	THE EMERGING SYNTHESIS OF HUMAN, ECOLOGICAL, SYSTEMS AND COMPLEXITY CONCEPTS IN SCIENCE AND PRACTICE	98
4.3.3	THE ECOCOMMUNITY - SUSTAINABILITY LITERATURE	104
4.3.4	SUMMARY: BRIDGES FROM THEORY TO PRACTICE	115
4.4	HUMAN SETTLEMENT ECOLOGY AND METAPHOR	116
4.4.1	INTRODUCTION: METAPHOR & MEANING	116
4.4.2	METAPHOR, PARADIGMS & THE CITY	121
4.4.3	DYNAMIC AND COMPOUND METAPHORS	129
4.4.4	AN ECOLOGY OF PARADIGMS	134
4.4.5	POLITICAL ARRANGEMENTS IN A DIVERSE SOCIETY: COMPETITIVE vs COOPERATIVE PARADIGMS	139
4.4.6	SUMMARY: HUMAN SETTLEMENT ECOLOGY & METAPHOR	147
5	THE SUBATOMIC SCALE	149
5.1	INTRODUCTION	149
5.2	RELATIVITY AND THE ECOLOGICAL SELF	149
5.3	QUANTUM THEORY AND ITS INTERPRETATIONS	152
5.3.1	IMPACTS OF THE NEW THEORY	152
5.3.2	UNCERTAINTY THEORIES	155
5.3.3	BOHR'S COMPLEMENTARITY PRINCIPLE	157
5.4	THE SYNERGY OF COMPLEMENTS	162
5.5	PLURALISM	165
5.6	SUMMARY: SUBATOMIC THEORY	168
6	ORDERING PRINCIPLES	171
6.1	WHAT IS NATURE LIKE, THAT WE MAY ALIGN WITH IT?	171
6.2	FUNDAMENTAL ORDERING PRINCIPLES	173
6.3	BOHM'S IMPLICATE ORDER	175
6.4	ORDER-THROUGH-FLUCTUATIONS	179
6.5	ORDER BEYOND THE SUBMICROSCOPIC	182
6.5.1	INTRODUCTION	182
6.5.2	MICRO-MACRO LINKAGES	182
6.5.3	PERSONAL, SOCIAL AND CULTURAL ORDERING	184
6.6	SUMMARY: ORDERING PRINCIPLES	186
7	HYPERCYCLIC SYSTEMS THEORY (THEORY OF COMPLEX, DYNAMIC, FAR-FROM-EQUILIBRIUM, DISSIPATIVE SYSTEMS)	189
7.1	INTRODUCTION	189
7.2	ENERGY & THERMODYNAMICS	191
7.2.1	INTRODUCTION	191
7.2.2	ENTROPY & NEGENTROPY	193
7.2.3	ENERGY FORMS, PERTURBATIONS, DISSIPATION, & TRIGGERING	195
7.2.4	ENERGY AND SOCIAL SYSTEMS	198

7.3	COMPLEXITY & CHAOS	200
7.3.1	INTRODUCTION	200
7.3.2	THE NATURE OF COMPLEXITY	203
7.3.3	COMPLEX ADAPTIVE SYSTEMS AND CHAOS THEORY	205
7.3.3.1	Medium Number Systems	205
7.3.3.2	Wolfram's Behavioural Classes	205
7.3.3.3	Other Classification Systems	206
7.3.3.4	The <i>Edge of Chaos</i>	207
7.3.3.5	Attractors & Repellers	208
7.3.3.6	Examples	209
7.3.3.7	Complexity and Economics	210
7.3.3.8	Observer Effects	211
7.3.3.9	Struggling With Dimensionality	212
7.3.3.10	Design Applications	212
7.3.3.11	Path Dependence	214
7.3.4	FRACTALS	215
7.3.5	BIFURCATION, CATASTROPHE AND SURPRISE	217
7.3.5.1	Introduction: What is Disconcerting About Chaos is That it is Unpredictable	217
7.3.5.2	Bifurcation Theory	218
7.3.5.3	Catastrophe Theory	219
7.3.5.3.1	Introduction	219
7.3.5.3.2	Is this Science?	221
7.3.5.4	Surprise	222
7.3.5.5	A Nonlinear Approach to Qualitative Risk Analysis	228
7.4	SYNERGETICS & PHASE TRANSITION	230
7.5	SELF-ORGANISATION	233
7.5.1	INTRODUCTION	233
7.5.2	AUTOPOIESIS (SELF-REPRODUCING SYSTEMS)	238
7.5.3	FEEDBACK LOOPS AND NETWORKS	238
7.5.4	SELF-ORGANISED CRITICALITY	243
7.6	TIME & CHANGE	245
7.6.1	TIME: A MULTI-DIMENSIONAL CONCEPT	245
7.6.2	EMERGENCE	247
7.6.3	STABILITY, SYSTEM STRUCTURE AND EVOLUTION	248
7.6.4	CO-EVOLUTION & THE RED QUEEN	251
7.6.5	FITNESS	254
7.6.5.1	Fitness as Ability to Survive	254
7.6.5.2	Fitness as Ability to Maintain Dissipative Status	255
7.6.5.3	Fitness as an Emergent From a Supportive Backcloth	256
7.6.5.4	Ultimate Fitness	256
7.7	FAR FROM EQUILIBRIUM SYSTEMS	257
7.7.1	EQUILIBRIUM AND ECOLOGICAL SYSTEMS	257
7.8	HOLLING'S INFINITY LOOP	259
7.9	SUMMARY COMPLEXITY THEORY	262
8	HIERARCHY AND SCALE	267
8.1	INTRODUCTION: HIERARCHY THEORY AS AN ORDERING SYSTEM	267
8.2	HIERARCHY THEORY: ECOLOGICAL AND OTHER HIERARCHIES	268
8.3	RATE-BASED HIERARCHIES: SYSTEM STRUCTURE AFTER T₁ ALLEN ET AL	272
8.3.1	INTRODUCTION	272
8.3.2	RELATIVE FREQUENCY AND SCALE	272
8.3.2.1	Scale Ranges, Time-Space Relations and General Perception	272
8.3.2.2	The Challenge of Reorientation from Static Space to Dynamic Time or Spacetime	275
8.3.2.3	Finding the 'Right' Scale(s)	275
8.3.2.4	Working with Context	277
8.3.2.5	Scaling for Scientific Research	277
8.3.3	INTER-SCALE TRANSLATION	279
8.3.4	CONTAINMENT	280

8.3.4.1	Holons (Whole: Part Relations)	280
8.3.4.2	Nesting	282
8.3.4.3	Boundaries, Surfaces	283
8.3.4.3.1	Introduction	283
8.3.4.3.2	Tangible Surfaces	284
8.3.4.3.3	Intangible Surfaces	284
8.3.4.4	Bond Strength & System Integrity	285
8.3.5	CONSTRAINT	286
8.3.5.1	Introduction	286
8.3.5.2	Connectivity, Connectance & Connectedness	286
8.3.5.3	An Optimal Connectivity Range for Stability	287
8.3.5.4	Connectedness in Globalising Social Systems	290
8.3.5.4.1	Now we are Globally Connected, we are Citizens of Every Scale	290
8.3.5.4.2	Arena vs. System Societies	291
8.3.5.4.3	Connectedness and Social Capital	292
8.3.5.5	Relative Disconnection (Functional Constraint)	294
8.3.5.5.1	Introduction	294
8.3.5.5.2	System Controls (Organising Principles)	295
8.3.5.5.3	Personal and Social Constraints	296
8.3.5.6	Seeking a Theory of Connectedness in Complex Dynamic Systems	298
8.4	SPATIAL HIERARCHY	299
8.5	DOMINANCE HIERARCHIES	301
8.6	CONCEPTUAL AND CONTEXTUAL HIERARCHY	305
8.6.1	META-STEPS	305
8.6.2	BATESON AND HIERARCHY	306
8.7	OTHER HIERARCHIES	308
8.8	A CONFERENCE ON SCALE IN SOCIOLOGY	309
8.8.1	INTRODUCTION	309
8.8.2	MICRO TO MACRO	310
8.8.3	MACRO TO MICRO	312
8.8.4	SUMMARY: SOCIAL SCIENCES	313
8.9	SYNTHESIS: A THEORY OF SCALE: ECOLOGICAL AND OTHER HIERARCHIES	314
9	UNIFIED ECOLOGY & ITS EXTENSION TO HUMAN SETTLEMENTS	317
9.1	INTRODUCTION	317
9.2	APPROACHING A STRUCTURAL FRAMEWORK	319
9.2.1	SCALE: GENERAL REVIEW	319
9.2.2	SCALE AND SPECIALISATION	324
9.2.3	DIFFERENTIATING ENVIRONMENTS & ECOSYSTEMS	324
9.2.4	OTHER MULTI-PARAMETER MODELS	325
9.2.5	DEFINING 'ECOLOGY' AND 'ECOSYSTEM'	326
9.3	COMBINING CRITERIA AND SCALE: UNIFIED ECOLOGY	330
9.3.1	CRITERIA AFTER ALLEN & HOEKSTRA	330
9.3.2	THE ALLEN & HOEKSTRA 'LAYERCAKE'	331
9.3.3	DIFFERENCES BETWEEN RESEARCH, MANAGEMENT AND DESIGN	332
9.4	UHSE INCPIT	333
10	UNIFIED HUMAN SETTLEMENT ECOLOGY	337
10.1	INTRODUCTION: UHSE DEFINITIONS, EXTENSIONS AND ADDITIONS	337
10.2	DEFINITIONS OF UHSE CRITERIA	338
10.2.1	SCALE	338
10.2.2	CRITERION UNSPECIFIED	338
10.2.3	CRITERION: COMMUNITY	338
10.2.4	CRITERION: LANDSCAPE	339
10.2.5	CRITERION: ELEMENTS	341
10.2.6	CRITERION: GENIUS LOCI	341

10.2.7	CRITERION: BIOTICS	342
10.2.8	CRITERION: ORGANISM	343
10.2.9	CRITERION: POPULATION	343
10.2.10	CRITERION: ECOCYCLES	344
10.2.11	CRITERION: CONNECTIVITY	345
10.2.12	CRITERION: FEEDBACKS	346
10.2.13	CRITERION: RHEOTICS	347
10.2.14	CRITERION: INDICATORS	348
10.3	SCALE & SCOPING	349
10.3.1	PROJECT SCOPING	349
10.3.2	ACCESSING DEMONSTRATION MATERIAL	349
10.3.3	PUBLIC POLICY: A SCALE BEYOND MOST DESIGNERS' CONTROL	350
10.4	CRITERION 0: UNSPECIFIED	351
10.4.1	CRITERIAL ESSENCE	351
10.5	CRITERION: COMMUNITY	352
10.5.1	CRITERIAL ESSENCE	352
10.5.2	THE COMMUNITY 'CASCADE'	353
10.5.3	SOFT POWER: INTANGIBLE STRUCTURES OF COMMUNITY	354
10.5.3.1	Introduction	354
10.5.3.2	Competitive vs Cooperative Paradigm	354
10.5.3.3	Living in Community	355
10.5.3.3.1	Introduction	355
10.5.3.3.2	Glue	356
10.5.3.3.3	Optimal Community Size	357
10.5.3.3.4	Values & Spiritual Aspects of Community	358
10.5.3.3.5	Decision Making	359
10.5.3.4	Clues To The Convivial Society: Helpful Models	362
10.5.3.4.1	On Love As The Biological Basis Of Social Life	362
10.5.3.4.2	Linkages from Intrapersonal to Community Scales (Human)	363
10.5.3.4.3	Maruyama's Mindscapes	365
10.5.3.4.4	Partnership	366
10.5.4	INSTITUTIONAL STRUCTURES	367
10.5.5	SERVANT LEADERSHIP	369
10.5.6	EDUCATION, LITERACY AND CAPACITY-BUILDING	369
10.5.7	THE FORMAL REGULATORY SPHERE: POINTERS FOR PLANNING AND DEVELOPMENT	372
10.5.8	LIVING IN COMMUNITY WITH NATURE	375
10.6	CRITERION: LANDSCAPE	376
10.6.1	CRITERIAL ESSENCE	376
10.6.2	PATTERN IN NATURE	376
10.6.3	PATTERNS OF NATURE IN HUMAN SETTLEMENTS	376
10.6.4	FRactal Impact Assessment: Patterns of Human Activity in 'Natural' Landscapes	377
10.6.5	LANDSCAPE ECOLOGY	378
10.6.6	LANDSCAPE ARCHITECTURE	380
10.6.6.1	Academic Training	380
10.6.6.2	Landscape Design Becoming Ecological Design	382
10.6.7	IMITATING NATURE BY DESIGN AND LANDSCAPE PLANNING	382
10.6.7.1	Introduction	382
10.6.7.2	Spirn	383
10.6.7.3	Context Replacement and Indigenous Planting Policy	384
10.6.7.4	Permaculture (Mollison)	385
10.6.7.5	Manning	386
10.6.7.6	Regenerative Design	388
10.6.8	ECOLOGICAL RESTORATION DEVELOPMENT	388
10.6.9	URBAN LANDSCAPE: HUMAN SCALE DESIGN & URBAN FORM	390
10.7	CRITERION: ELEMENTS	393
10.7.1	CRITERIAL ESSENCE	393
10.7.2	EARTH	393
10.7.3	WATER	395
10.7.4	FIRE	398
10.7.5	AIR	399
10.7.6	CLIMATE	400

10.8	CRITERION: GENIUS LOCI	401
10.8.1	ESSENCE	401
10.8.2	GENIUS LOCI AND BIOREGIONALISM IN HUMAN DOMINATED SYSTEMS	402
10.8.3	PERCEPTION OF PLACE	413
10.9	CRITERION: BIOTICS	415
10.9.1	ESSENCE AND THEMES	415
10.9.2	BIODIVERSITY CONSERVATION: BIOREGIONAL SCALE OF APPROACH	417
10.9.3	MANAGEMENT OF REMNANT VEGETATION	418
10.9.4	HUMAN-RELATED IMPACTS AND 'NATURALNESS'	420
10.9.5	ECOTONES	422
10.9.6	DIFFERING SCALES OF OCCUPATION OF LANDSCAPE	423
10.9.7	BIODIVERSITY & HUMAN COMMUNITY	424
10.9.8	BIOTECHNOLOGY	426
10.9.9	THE BIOTICS OF BUILDING	426
10.10	CRITERION: ORGANISM	428
10.10.1	CRITERIAL ESSENCE	428
10.10.2	ORGANISM AS 'ANIMAL'	428
10.10.3	NEEDS-BASED DESIGN	430
10.10.4	NATURE'S NEEDS	431
10.10.4.1	'Library' vs. Keystone Processes	431
10.10.4.2	Basic Needs Of Urban Biota	434
10.10.5	HUMAN HEALTH & SUSTAINABILITY SPACES AT DIFFERENT SCALES	435
10.10.5.1	Introduction	435
10.10.5.2	Wholistic & Preventive Health	437
10.10.5.3	High-Level Wellness	437
10.10.5.4	Human Ecology	438
10.10.5.5	Building Biology (Baubiologie)	439
10.10.5.6	Healthy Communities, Healthy Cities	441
10.10.6	HUMAN PSYCHO-SOCIAL NEEDS	443
10.10.6.1	Introduction	443
10.10.6.2	Steiner's 'Stroke Economy'	444
10.10.6.3	Logotherapy (Frankl)	444
10.10.6.4	Eco-Spirituality	444
10.10.6.5	Nature Guided Therapy	445
10.10.6.6	Human Scale Development	446
10.10.6.7	Maslow's Hierarchy	447
10.10.7	THE ORGANISM METAPHOR IN ARCHITECTURE & PLANNING: PATTERNS & THE 'ORGANIC LOOK'	447
10.10.8	'SUSTAINABILITY' & HEALING	449
10.11	CRITERION: POPULATION	450
10.11.1	ESSENCE OF CRITERION	450
10.11.2	POPULATION AT LARGER SCALES	451
10.11.3	POPULATION AT HUMAN SETTLEMENT or LARGE PROJECT SCALE	452
10.11.4	HUMAN SCALE DEVELOPMENT AND SATISFIERS	453
10.11.5	DESIGNING FOR POPULATIONS	455
10.12	CRITERION: ECOCYCLES	457
10.12.1	ESSENCE	457
10.12.2	ECOLOGICAL SERVICES	458
10.12.3	APPROPRIATE TECHNOLOGY (AT)	459
10.12.4	SYSTEMS THINKING & INDUSTRIAL ECOLOGY	460
10.12.4.1	Urban Metabolism	460
10.12.4.2	Loop Work	464
10.12.4.3	Dematerialisation: Mips, Wasps & Wasds	466
10.12.4.4	The '4 Rs'	467
10.12.4.5	Molecular Pollution & Energy Issues	468
10.12.4.6	Greenhouse Gases & Embodied Energy	469
10.12.4.7	'Ecocost' of Building Materials	471
10.12.4.8	South Australian Research into Domestic Energy Use	472
10.12.4.9	Urban Form and Greenhouse	472
10.12.5	STRATEGIES: RECAPITULATED	473
10.13	CRITERION: CONNECTIVITY	475
10.13.1	CRITERIAL ESSENCE	475
10.13.2	URBAN CONNECTIVITY	476
10.13.2.1	Accessibility & Relative Disconnection	476

10.13.2.2	Tele-Access	477
10.13.2.3	Transport & Transit Oriented Development	477
10.13.3	FUNCTIONAL CONNECTIVITY: INTEGRATIVE STRATEGIES: SYNERGY	479
10.14	CRITERION: FEEDBACKS	483
10.14.1	CRITERIAL ESSENCE	483
10.14.2	THE TNS 'FUNNEL'	484
10.14.3	NATURAL AND INSTITUTIONAL CONSTRAINTS AND THE REPLACEMENT OF CONTEXT	486
10.14.4	CATALYSTS	487
10.14.5	POLICY FEEDBACKS	488
10.14.6	COST FEEDBACKS	489
10.14.7	SOCIAL CONSTRAINTS: INDIVIDUAL, GROUP, SOCIETAL, MORAL, COSMOLOGICAL	491
10.14.8	MINIMAL MODELS, MONOCULTURES AND MEDICAL MODELS	491
10.14.9	FUZZY SUSTAINABILITY SPACE	494
10.14.10	DESIGN & IMPLEMENTATION ISSUES	495
10.15	CRITERION: RHEOTICS (UNFOLDING)	499
10.15.1	CRITERIAL ESSENCE	499
10.15.2	PULSES & CYCLES	500
10.15.3	HOLLING'S CYCLIC MODEL	501
10.15.4	CHANGE AND SELF-ORGANISATION	502
10.15.5	INCREMENTALISM	505
10.15.6	CUMULATIVE EFFECTS ASSESSMENT	506
10.15.7	THEMES OF CHANGE IN HUMAN SETTLEMENTS	508
10.16	CRITERION: INDICATORS	509
10.16.1	ESSENCE	509
10.16.2	THE WIDER CONTEXT	509
10.16.3	INDICATORS & SUSTAINABILITY	513
10.16.4	INDICATORS & BENCHMARKS IN PRACTICE	515
10.16.5	CRITERIA, STRETCH GOALS, BENCHMARKS AND COMPASSES	521
10.16.6	ECOLOGICAL FOOTPRINT	524
10.16.7	USE OF FUZZY SUSTAINABILITY SPACE AS A FUNCTIONAL (PROGRESS TRACKING) INDICATOR SYSTEM	526
10.16.8	TRAFFIC LIGHT INDICATOR	528
10.17	CONCLUSION UHSE	528
11	CONFLUENCE	529
11.1	INTRODUCTION	529
11.2	CASE STUDY: OPPOSING CITY WEST PROJECT (OCW)	529
11.2.1	INTRODUCTION	529
11.2.2	NATURE OF PROJECT	529
11.2.3	PHILOSOPHY	533
11.2.4	OBJECTIVES OF PARTICIPATING GROUPS	534
11.2.5	OCW DESIGN PROCESS	534
11.2.5.1	Description of Process	534
11.2.5.2	Data Management	539
11.2.5.3	Outputs	540
11.2.6	DISCUSSION: Critical Review	541
11.2.7	SUMMARY: LEARNINGS	542
11.3	STRUCTURE: UNIFIED HUMAN SETTLEMENT ECOLOGY FRAMEWORK	544
11.3.1	INTRODUCTION	544
11.3.2	ONTOLOGY	544
11.3.3	COSMOLOGY	545
11.3.3.1	God	545
11.3.3.2	Transpersonal Ecology	546
11.3.3.3	Ethics	547
11.3.3.4	Metaphor	548
11.3.3.5	Attitude	548
11.3.3.6	'Sustainability'	549
11.3.4	EPISTEMOLOGY: UHSE AS A FRAME-OF-REFERENCE	551
11.3.4.1	Introduction	551
11.3.4.2	Best Outcomes	552

11.4	PROCESS: WEAVING THE BACKCLOTH	554
11.4.1	METHODOLOGY	554
11.4.1.1	Conceptual Brief	554
11.4.1.1.1	Introduction	554
11.4.1.1.2	Integrative Strategies	554
11.4.1.1.3	Backcloth & Traffic	555
11.4.1.1.4	Context Rebuilding & Replacement (Backcloth Building)	556
11.4.1.1.5	The Human Brain as Fuzzy Computer	557
11.4.1.1.6	Pre-Emptying Environmental Impact Assessment (EIA) Through Design: Constraints, Imitating Nature, Lean Thinking & System Efficiencies	560
11.4.1.1.7	Prioritising Healing: Resilience and Dynamic Stability	561
11.4.1.1.8	Generalism	561
11.4.1.1.9	Generative Work	561
11.4.1.2	A New Approach to Development	562
11.4.1.2.1	Developers as Servants	562
11.4.1.2.2	Funding & Finance	564
11.4.1.2.3	Delivery Systems	567
11.4.1.2.4	Human Community	567
11.4.1.2.5	Education	569
11.4.1.2.6	Land Tenure	570
11.4.1.2.7	Retrofit	570
11.4.1.2.8	Partnership Transcending Social Bias	571
11.4.1.3	Scoping	572
11.4.1.3.1	Introduction	572
11.4.1.3.2	Scaling	572
11.4.1.3.3	Prioritising Rheotics: the Long-Term and Evolution	573
11.4.1.3.4	Chunking	573
11.4.1.3.5	Stakeholder Inclusion	574
11.4.1.3.6	'Sustainable' Regions	574
11.4.1.3.7	Fuzzy Sustainability Space & Indicators	575
11.4.1.4	Design Process	575
11.4.1.4.1	Introduction	575
11.4.1.4.2	Site Visits: Start With The Land	576
11.4.1.4.3	Designing Nature Into Urban Settings	577
11.4.1.4.4	Needs Based, Criteria-Enriched Design	581
11.4.1.4.5	Precautionary Principle	582
11.4.1.4.6	Learning System	582
11.4.1.4.7	20-Step Design Process	583
11.4.1.5	Data Management	584
11.5	TECHNOLOGY: TOOLS	586
11.5.1	INTRODUCTION	586
11.5.2	MATHEMATICAL UNDERPINNINGS	586
11.5.3	TOOLS LISTS	586
11.6	CONTENT FOR THE FRAMEWORK: PATTERN REPERTOIRES	587
11.6.1	INTRODUCTION	587
11.6.2	COMMENT ON COLLATED TABLES	588
11.6.3	INTEGRATIVE MODELS FOR POST-INDUSTRIAL COMMUNITY	590
11.6.3.1	Introduction	590
11.6.3.2	Intentional Community	592
11.6.3.2.1	EcoCommunity	592
11.6.3.2.2	Cohousing	601
11.6.3.2.3	Permaculture	605
11.6.3.2.4	Top-Down: EcoCommunity	613
11.6.3.2.5	Top-Down: RCD (ESD)	615
11.7	TRANSITION: A CHARM BRACELET	620
12	CONCLUSION	631
12.1	REVIEW OF PATH	631
12.2	ANSWERING THE RESEARCH QUESTIONS	632
12.3	EMERGENT UNDERSTANDING	636

PLATES

<i>Plate 1: Context - The Living Earth</i>	<i>iii</i>
<i>Plate 2: Collage: Blå Kilde Gårde</i>	<i>49</i>
<i>Plate 3: Collage: New Haven: The MFP 'Step-Up' Project</i>	<i>53</i>
<i>Plate 4: Collage: Urban Ecology Australia</i>	<i>63</i>
<i>Plate 5: Collage: MFP Aspirations</i>	<i>69</i>
<i>Plate 6: Collage: MFP Reincarnation 1994</i>	<i>73</i>
<i>Plate 7: Collage: Metaphor in the Built Environment</i>	<i>123</i>
<i>Plate 8: Collage: Placemaking</i>	<i>407</i>
<i>Plate 9: Collage: Places of the Soul</i>	<i>411</i>
<i>Plate 10: Collage: OCW Givens</i>	<i>531</i>
<i>Plate 11: Collage: OCW Process</i>	<i>537</i>
<i>Plate 12: Collage: Site Plans</i>	<i>579</i>
<i>Plate 13: Collage: Findhorn (A)</i>	<i>595</i>
<i>Plate 14: Collage: Findhorn (B)</i>	<i>599</i>
<i>Plate 15: Collage: Overdrevet</i>	<i>603</i>
<i>Plate 16 Collage: Permaculture</i>	<i>607</i>
<i>Plate 17: Collage: ESD (1) Der Seepark</i>	<i>611</i>
<i>Plate 18: Collage: ESD (2) Arabella Park</i>	<i>617</i>
<i>Plate 19: Rainforest</i>	<i>641</i>

ABSTRACT

This dissertation acts on the belief that inappropriate, egoistic reverence for Economism, Reductionism and specialisation have much to answer for in the unsustainable picture we see today. It therefore looks at the big picture, taking knowledge derived both from written sources across a number of disciplines, and from direct investigation of strategies, plans, behaviours and visions intended to sustain life or improve its quality for humans and other biota: to live in harmony, 'align with Nature' or 'heal the planet' through appropriate lifestyle, relationship and development practices.

Starting from the position of the 'Ecological Paradigm Proponent ('EPP'), it assumes the case that to the best of our knowledge, an ecological (inherently including social) crisis is in progress. It asks, this being so, 'What could an ecological approach to human settlements be?' If ecological integrity were our top priority, how could we approach the awesome, webby tangle presented to us by Nature, which looks so untidy yet operates with such rude efficiency? If we could understand directly that we share Nature's imprint ourselves, what types of tools are available in this most scientific of Ages, to help us respectfully to come to terms with this reality? And in terms of our own habitat, what is there to understand about the deeper structures that influence our outcomes?

Key subsidiary questions addressed are: 'How have people attempted to apply ecological principles to human settlement development?' 'If linear thoughts have let us down, what do we have instead?' 'What are the new Sciences of Complexity and how do they relate to the Philosophy and Science of an ecological approach?' 'Is this different from "Sustainable Development"?' and finally, 'How can all this be applied as a non-linear approach to human settlement policy, assessment, design and development?' In other words, 'What is Nature like, that we may align with it?' or 'her' as some say?

The work began with a sourcing and review of dozens of lists of principles and strategies, compiled mostly by painstaking, dedicated and knowledgeable groups, to characterise 'ecologically sustaining' human settlements. A Research Journey investigated attempts to implement fully integrated settlements or sustainable settlement elements, in ten 'developed' countries including Australia. The recognition of the powerful yet fragmented and unorganised nature of the underlying Ecological Philosophy led to a search for both the ontological roots of the paradigm and an understanding of the manner in which these concepts interface with the knowledge of Ecology as a discipline on one hand, and 'sustainable' practice and 'best practice' on the other. Further information was collected from attendance as delegate or presenter at many workshops, lectures, seminars and conferences from international to local, and from participation in several major ecological city-related public participation processes and design projects in Australia.

With increasing general consciousness of sustainability since UNCED in Rio de Janeiro (1992), and needing a model to organise research findings, the importance became apparent of developing a coherent model from which to approach research, development, management and education in eco-sensitive approaches, and the focus of this dissertation switched from cases and implementation to conceptual modelling: a research journey, followed by an intellectual journey.

The work spirals reflectively, allowing authors space for their own words, exploring the nature of Complexity from Ontology, through Epistemology, Methodology and Technology, to practice. It finally arrives at a tool set for working with education, assessment, data management, design and development activities. The 'Unified Human Settlement Ecology' Matrix and approach (UHSE) are presented and explained with examples. UHSE demands that ecological and social issues be fully incorporated into such activities, is derived from Ecology itself, and can be used at very different levels of understanding. This approach celebrates Complexity rather than trying to control it away.

The work is arranged in twelve sections. The first three deal with structural and process matters, documenting Methodology, the Research Journey and Early Findings. The fourth is an orientation to modelling and to the Human Settlement Ecology literature, and raises some issues of Philosophy and Metaphor. This precedes, a journey through ontological, subatomic and metaphysical matters including Organising Principles, then visits Thermodynamics, Chaos, Complexity and Catastrophe Theories, seeking cross-disciplinary relationships (5-7).

The eighth and ninth owe much to the ecological work of Professor of Botany, Tim Allen of Oakridge National Laboratory, Wisconsin, and his colleagues. Section 8 starts with Ecological Hierarchy Theory, drawing together several other strands to present a broader Theory of Scale and structure that underpins ecological thought across many disciplines. Section 9 overviews Allen & Hoekstra's *Unified Ecology*: their erudite approach to a working synthesis of Ecology's subdisciplines. Section 10 teases out a dozen *Criteria of Observation* which extend *Unified Ecology* for application to human settlements, in effect describing the basics for a course in '*Unified Human Settlement Ecology*'. It then (draws together a series of tools for use in tertiary education or development/design practice, using a case study to illustrate its use.

The dissertation concludes by cycling back (11) to the original sustainability strategies, presenting selected lists as a collated table representing thousands of person-hours of eco-social thought, and organised through the UHSE Criteria. It briefly presents comments and illustrations of cases from the field work, that attempt to implement such strategies. It ends by reviewing what some prominent EPP writers have claimed to be the keys to a passage to better times.

Because this is a multi-disciplinary dissertation, the device has been used of constructing explanatory tables and other material for the benefit of readers who may not be familiar with particular areas of theory, and placing these in the Appendix (Volume II) for easier access and to avoid distraction in an already highly complex discourse. Summaries following theoretical sections present overviews, recommended for preliminary orientation to a complex subject.

Perhaps the key outcome of this work is an understanding that whatever the details with which we choose to struggle, all the academic and applied disciplines appear to be affected by the same set of apparently simple but paradoxically complex, Organising Principles: the closest we may come to discovering a '*Theory of Everything*'.

DECLARATION

I hereby declare that none of the material contained in this thesis has been accepted for the award of any other degree or diploma in any institution and that, to the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference has been made in the text of the thesis. I consent to this thesis being made available for photocopying and loan, if applicable, and if it is accepted for the award of the degree.

Signed.

Date.....17.4.01.....

ACKNOWLEDGMENTS

I have been keeping a 'gratitude list' and a 'wants a copy' list for many years. The people and institutions below represent those who have gone out of their way to support me personally, practically or academically, sought access to the output, or contributed to incremental shifts in consciousness, sometimes without realising it. Others, especially family, have supported me through survival rations, shelter, affectionate caring, help with graphic design problems or money. Sometimes support has been in the form of listening, presiding over an 'aha!' experience, sending me documents, giving valuable work time for questions, or photocopying things for me. Sometimes it has been an expression of disbelief in a completion: always a good challenge.

My thanks to all of you, and particularly to the Department of Geographical & Environmental Studies at the University of Adelaide, my supervisors Dr Blair Badcock and Dr Sandra Taylor; my family, Bruce, Mandy, Nic, Cate, Ben, Kelly, Fran, Tup, Richard, Tim, Kim and Maman, & Ming[†]; to Alan Browning, who innocently gave me Lewin's "*Complexity*" for my birthday, taught me basic illustration-design and confronted me with left-field questions, and to my incomparable colleague questers, Simon Neldner and Keith Smith. Particular thanks to retired chalkie Hilary Marshall, who ran a targeted *mission-of-encouragement*, through emails, hours of editorial help and ongoing offers to 'rattle my cage' for further assistance; and to Margaret Turner who did her best to ensure that I stayed within my own *Sustainability Space*.

Many of the people and institutions who assisted me overseas are mentioned below. The following went way beyond my shy requests. In particular, Dr (now Assoc. Prof.) Morten Elle of the Technical University of Denmark, personally arranged a 10-day journey through Denmark, with minute-scale precision, interviews, meals with several colleagues, accommodation arrangements, buses, trains, contacts, people to meet me in other cities, community contacts, the Departmental car for a trip with him to Hundsted, and many other developments across Eastern Denmark ... an amazingly generous, detailed and informative journey organised for a complete stranger. I can only hope to display my thanks in kind some day. Others who made an extraordinary effort for me were Assoc. Prof. Gitte Marling (University of Ålborg), who welcomed me into her family, and spent much time talking to me at the Centre for Urban Ecology, introducing me to key colleagues, and took me personally to many Cohousing and other communities. Similar blessings came from Drs Per Berg and Susan Livsey (University of Uppsala), Richard Register (EcoCity Builders Berkeley), John Maskell (University of Waterloo), Jeanette Scoville (organiser of Ventura County Citizen Planners, Thousand Oaks CA) and Finn Andersen (Odense Municipality).

Many people helped me solve some extraordinarily difficult computer problems, consistently tolerant, ready to listen and make suggestions. These included the folk at Camtech (now Buzzle), especially Peter Daly, Eric, Sonja, Elvin, Dwaine, Fiona and several others, also Dr Ken Williams & Robert McWatters (Crandon Services), Luke Maslen (Pica Software) and Ian, Peter & Dawn of IPD; plus the ever-helpful Robin Maslen, Dr Bob Singh, Pedro Plowman, and several kind strangers on listservs. Warning: never use the MS Word Master Document feature for long documents, no matter what Microsoft says. Thanks to EndNote discussion group and their reference to John McGhie, Microsoft MVP, for guidance to the eventual solution.

The following have all contributed: I am most grateful. The list will inevitably have gaps, for which I apologise. Several have actually died(*) in the meantime, sadly unthanked.

Ahmanson Land Company, Lois Arkin, Australian Broadcasting Corporation, Jim Bettison, Dorte Bollerup, Brian Binning, Janis Birkeland, Isabell Blömer, Varis Bokalders, Stephen Boyden, Michael Bradley, Richard Bredsteen, Jeb Bruggeman, Heinz Bunse, Kathryn Burge, Dean Cameron, Chris Canfield, City of Århus Energy Advisory Centre, Peter Cock, Dorothy Craig, Leigh Crocker, CSIRO Canberra, Guy Dauncey, Ted Davis, Don de Angelis, Department of Geography University of Adelaide, Judith & Vladimir Dimitrov, Sabina Douglas-Hill, Paul Downton, Tim Doyle, Ulla Egebrecht, Ossama El Kaffash, Caroline Estes, Yanto Evans, Herr Fischer, Alison Foulsham, Fuzzy, Ruth & Steve, Tim Gentry[†], Jacquie Gillen, Peter Gould[†], Malcolm Green, Carole Grubisa & Mark, Malcolm Hall, Nick Hall, Loni Handcock, Angela Hazebroek, Healthy Cities Office Toronto, Susie Herzberg, Brooke Hill, Birgitte Hoffman, Ros Hofmeyer, Lindsay Holmes, Chérie Hoyle, Jim Hullick, John Hutchinson[†], ICLEI Toronto, Institute for Community Economics (USA), Institut pour le Conseil en Environment (Strasbourg), Hans Jacob Jacobsen, Finn Jensen, Ole Mikael Jensen, Thomas Jensen, Jeff Johnson, Chip Kauffman, Rod Keller, Jeff Kenworthy, Borvin Krackman, Jeppe Lassøe, Michael Lennon, Max Lindegger, Maureen Longmore, Henrik & Søsster Lund, Kathryn McCamant, Nadia McLaren, John Maitland, Derek Mallard, Ross Manthorpe, Mary Martin's, Marilyn & Alexander Mehlmann, Bill Metcalf, MFP Australia staff, Milton Keynes Energy Centre, Lynn Morrow, Municipal Conservation Association, Peter Newman, Ross Oke, Brady Peeks, David Pepper, Bill Perks, Esther Peter-Davis, Hugh Possingham, Lesley Potter, Quantum (Noelle, Suzie, Chetan), Valerie Redman, Joan Russow, Wendy Sarkissian, Anne Satchell, Mellissa Schliebs, Volker Scholz, Denise Sharp, Stewart Sherwin[†], Per-Eric Siljestam, Udo Simonis, Peter Smailes, Joseph Wayne Smith, Joseph Smythe, Lawrie Stanton, Alan Stewart, Peter Szekeres, John Talbot, Poul Tang, Estelle & Bruce Tayler, The Natural Step EIA, Robert Theobald[†], Karl Traeger, UBC Centre for Human Settlements, UCDavis Center for Cooperatives, Jens Ulrich, Universities of Adelaide, Calgary, South Australia, Stockholm School of Architecture Tekniska Högskolan Stockholm, Swedish University of Agriculture Uppsala, Tübingen; Urban Ecology Australia & USA, David Van Vliet, Mathis Wackernagel, Lewis Warren, Jo-anne Waters, Han Wezenaar, Tom White, John & Sue Wiese, Mary-Lou Wihman, Ed Wilby, Tony Williams, Thomas Williams; Cities of Adelaide, Almere, Altona, Århus, Berkeley, Brisbane, Calgary, Davis, Freiburg im Breisgau, Holluf Have, Hundsted, Manningham, Milton Keynes, Newcastle, Odense, Onkaparinga, Port Macquarie, Port Phillip, Stockholm, Thousand Oaks & Toronto; Communities: Alpha Farm, Cerro Gordo, Christiania, Crystal Waters, Findhorn, Fuzzies Farm, LA EcoVillage, Lost Valley, Muir Commons, Overdrevet Cohousing, Rainbow Cooperative, Sun Village and several unnamed communities & people in Denmark and Sweden.

1 INTRODUCTION TO DISSERTATION

1.1 PREAMBLE

Australia is not an easy continent for man to conquer ... The white man, armed with modern technology, came as an optimist. Here was a rich land, ready for the looting. The aborigines [sic] were soon brushed aside and exterminated but the land was not so easily beaten (Serventy 1966: 188).

Over the course of this century, the relationship between the human world and the planet that sustains it has undergone a profound change. When the century began, neither human numbers nor technology had the power radically to alter planetary systems. As the century closes, not only do vastly increased human numbers and their activities have that power, but major, unintended changes are occurring ... the rate of change is outstripping the ability of scientific disciplines and our current capabilities to assess and advise ... The next few decades are crucial. The time has come to break out of past patterns. Attempts to maintain social and ecological stability through old approaches to development and environmental protection will increase instability. Security must be sought through change ... it is to people that we address our report ... the ... human attitudes that we call for depend on a vast campaign of education, debate, and public participation. The campaign must start now ... We (members from "21 very different nations" and development levels) are unanimous in our conviction that the security, well being, and very survival of the planet depend on such changes, now. (World Commission on Environment and Development 1990: 21-2) ~ Overview of Report: "A Call For Action".

This dissertation addresses the meaning of 'aligning with Nature' in the context of integrated, wholistic, ecologically and socially sustaining human habitat design and development. In part it does this by 'walking the talk' of an ecological approach, through its own structure and process. I realised as I completed it that it represents a first attempt to define a new discipline called 'Human Settlement Ecology'.

The writing is of a theory development nature, not a reductionist study. Its primary task is integration, and it is essentially multi-disciplinary. Since it is unlikely that all readers will have the same trans-disciplinary interests as the author, the device has been used of appending explanatory tables, figures, information sheets and background papers, which explain or overview the conceptual frameworks woven into the dissertation. I have put as many supporting items as possible into footnotes or Volume II to preserve the main argument: as The Natural Step¹ would say, "keeping to the trunk and branches, avoiding getting lost in the leaves". However many of the leaves are present in table form. While there appears to be an intimidatingly large number of tables, most of these represent background information or conceptual extension exercises, to trace intellectual connections, or to link in the work of other authors, and are not designed to be pored over with the level of specificity of numerical tables (see further remarks in Vol II, 2.1 Introduction: Key to Appendices B-E). Many of these items need not be read at all, unless the reader is not familiar with the disciplinary area described, or is interested in the extension.

¹ See Criterion Indicators. Swedish sustainability training system initiated by Dr Karl-Henrik Robèrt of Karolinska Institute.

Figures and Tables are labelled conventionally, followed by 2-letter-unit code strings indicating the category of item: Background Information (BI), Field Research [*mine*] (FR), Research Report [*mine or others'*] (RR), Conceptual Exercise [*informed by UHSE² Model*] (CE), Contribution to Model (CM) and Eco-Strategy or Principles (ES). Unified Human Settlement Ecology tools are labelled "Tool". Volume II is arranged in the order of mention in the text, except for the Tools, Databases (DB) and longer, Background Papers (BP) and Declarations & Charters (D&C), so the reader is not constantly flipping back and forth. Statements I have personally verified are marked: "⁵" **Link: Volume II Appendix A: Writing Conventions.**

A constant difficulty with describing complex systems is that they are multi-scalar, cyclic and 'webby'. Everything leads to everything else. Where to start or finish is arbitrary and perplexing. No wonder scientists seek comfort in Reductionism. The main conceptual linkages throughout the text are marked thus: '**Link: (Topic, Table, Criterion or other item name)**'.

Wholistic models for implementation are now urgent. This work effectively describes an emerging discipline, that I have named 'Human Settlement Ecology'. When I speak of 'the Model' I refer to this broader field, for which the 'UHSE' Epistemology is an attempt to define a derivative framework for application. It could not be done in 2-300 pages, and I beg the examiner's forbearance. In another year, I could have shortened it further, but a line needs to be drawn.

This work is the outcome of an exploratory journey of considerable scale, taking steps towards defining a Theory of Scale, or to bringing hierarchical ecological concepts a step closer to the business of human settlement development. Cases are derived from overseas research as well as wider Australia, South Australia and the City of Adelaide. Another important aspect is its search for a working knowledge of the issue of Complexity, which is intrinsically embedded in new approaches to Ecology, indeed, in new approaches to most disciplines, whether or not recognised.

This dissertation in part reports the author's search for a better understanding of that relationship. It traces a path from the subatomic realm and its philosophical underpinnings of Sustainability, connecting them through an integrative Epistemology. It describes useable tools for formal (tertiary) Education and reinterprets 'best practice' in the Design, Planning, Engineering, Building and Development professions, hopefully contributing to a positive transitional outcome.

² Unified Human Settlement Ecology.

Australia at the turn of the century/millennium, along with the rest of the inhabited world, is experiencing a phase of rapid transition, a transition that has both positive and negative potential. Some are saying we have skipped through the 'Information Age' already, and are now entering the 'Biology Age', a period that will be dominated by things organic, including the critical bio-logical issues besetting the Biosphere, which will come to dominate all our decisions. Bio-logy is non-linear, so we must confront that and work with it.

Ever since its introduction through the World Commission on Environment and Development's 'Brundtland' Report in 1987, and the serious business of the following United Nations Conference on Environment and Development in Rio de Janeiro in 1992, the term 'Sustainable Development' has been much abused and contested. Urban Ecologists at the EcoCity II Conference in Adelaide in 1992 were substituting the term 'Ecologically Sustaining Development', and recommending that we align with Nature, acknowledging our part in it, in order to do ecologically responsible development. This implies an ongoing commitment to work with, restore and sustain the health of ecosystems as a first priority (and knowing what that implies). It contrasts with the common implication of 'Ecologically Sustainable Development' (ESD), which often seeks to push resource throughput to the maximum level an ecosystem is thought to be able to sustain, looking to efficiency gains in energy, resources and materials use, but engaging little with community or concern for ecosystems at bioregional or scales other than global (based on concern about global warming).

As participants in a world of accelerating change, we need new, more sensitive ways of attuning our decisions and policies to ecological function. To remain abreast of changing conditions, organisations have had to invent the concept of the 'learning organisation' (Senge 1990). In attempting to manage ourselves for sustainability, we need to prioritise ecological health and to be open to learning, to receiving and acting on feedback, to act to restore and preserve the healthy function of what I have called our 'Sustainability Space' - to behave as our bodies do to keep us in healthy balance (a dynamic equilibrium with sensitive feedbacks). A concerted effort will not be possible without widespread understanding of systems function and reason to act.

Designers are in the business of intervention. No matter what kind of environmental designer, whether a landscape architect, architect, urban designer, engineer or even many industrial designers (and householders, horticulturalists and farmers?)³ the results of their interventions are new environments. These new environments intervene, whether as a deliberate intention of the designer or not, in the operation of natural processes ... [and] become part of the natural world ... and are governed by the same controls and balances that operate in natural ecosystems ... the designer is ... in a unique position to influence natural processes in a profound way ... On a global ecosystem scale, and increasingly locally, it can be seen that the record of intervention is poor (Lamb 1991: 12).

³ [My comment]. Link: **Writing Conventions, Volume II.**

1.2 THE PROBLEM

On 5/4/2000 it was announced on the ABC National News that in 1998-9 136,000 Australians had asked for assistance for homelessness, 45,000 of these were children, with 40,000 families turned away. In NSW, Shelter NSW reports one turned away for every one helped. In Melbourne the figure for urgent housing assistance is one helped to three turned away. The market was incorrectly thought to be willing and able to provide the low cost housing needed (so public housing has been de-funded and substantially eroded). Large profits are not available, so housing is not being built.

Humans are creating major global and local problems, many of which have been defined as 'ecological', but 'social' and 'ecological' are irrevocably intertwined. An exponentially swelling literature, especially in the last decade, has documented and offered solutions to the crisis, even as many deny its reality. Ubiquitous threats include unprecedented acceleration of human population growth, unemployment, poverty, social breakdown, violence, national debt and bankruptcy, pollution, loss of habitats (biodiversity), loss of soils and productive potential of soils, salinisation, desertification, climate change with increasingly extreme events, new and recurring old diseases, conditions which appear ripe for a revisitation of another plague situation, and positive feedback exponentials in many of the above problems, including intra- and inter-national wealth-poverty disparities (1990;Boyden & Dovers 1997;Bracken 1989;1994;1998;Brown & Kane 1994;Diesendorf & Hamilton 1997;Forrester 1971;Gardner 1996;Garrett 1994;George 1995;George 1986;Hardin 1993;Harrison 1987;Hellyer 1999;McMichael 1993;Meadows,Meadows & Randers 1992;Platt 1996;Possingham 1993;Schucking & Anderson 1991;1991a;1991b;Shiva,Anderson,Schucking,Gray,Lohmann & Cooper 1991;Short 1994;Trainer 1985;1991;Tuxill 1998;United Nations 1992;Wiesner 1992;World Commission on Environment and Development 1990).⁴

International free trade and investment treaties, agreements such as GATT, NAFTA, ASEAN and MAI,⁵ Structural Adjustment and domestic Competition Policy, have invented new ways to allow large national, multi-national and non-local operators to continue to damage ecosystems and social structures, to capture local assets and import carrying capacity, with little national ability to resist as long as nations believe markets must have free rein. **Link: Criterion Feedbacks.**

⁴ See also CRES Fundamental Questions Papers, Australian National University; and ongoing WorldWatch Papers, WorldWatch Institute, Washington DC.

⁵ GATT: General Agreement on Tariffs and Trade, NAFTA: North American Free Trade Agreement, ASEAN: Association of South East Asian Nations, MAI: Multilateral Agreement on Investment (now diffused into World Trade Organisation – WTO - agenda).

The watershed publication "*Our Common Future*", the so called Brundtland Report from the World Commission on Environment and Development on "a global agenda for change"⁶ is widely quoted as both the source of the commonest definition of 'Sustainable Development' ("... development that meets the needs of the present without compromising the ability of future generations to meet their own needs"), and as the source of the term (World Commission on Environment and Development 1990: 87). Prior to 1987, the stated concern in the Australian literature was 'ecodevelopment', but the focus was extra-urban and more wildlife- targeted (rural and agricultural impacts on habitat), as in the World Conservation Strategy, 1980 and the National Conservation Strategy for Australia, 1983 (Commonwealth of Australia 1992b; Jones, Robertson, Forbes & Hollier 1990).

While a great deal of energy has been expended arguing about the differentiation between 'development' and 'growth' and whether 'Sustainable Development' is an oxymoron, it seems that development is presently inevitable. Thus the discovery of what may be meant by 'sustainable' and how this human settlement sustainability may be understood, supported, implemented through design and development, and evaluated, has been an agenda item internationally since the first Habitat Conference in Vancouver in 1976⁷ and tenuously in Australia since the Ecologically Sustainable Development workshop processes of 1990-'92. The almost complete omission of women on committees, women's work and women's concerns from these exercises (Switzer 1993: 4-5), and the bureaucratic castration of the output of the working groups (Diesendorf 1993: 5) were forerunners to increasing public criticism of Australia's environmental performance internationally (for instance Berlin UN meeting on Greenhouse strategies 3/1995 and Kyoto 12/1997).

As appears possible, the escalating problems may force us into post hoc activity, at greatly increased cost, if not too late. It is becoming increasingly urgent to come to terms with what we are doing, knowing that we have been procrastinating at least since the 1960s, and that change does take time. It took between 4 and 6 years just to get Local Agenda 21s off the ground in local government, and many, probably most, have talked reassuringly but assumed or feigned helpless (resourceless) positions under challenge and resistance.

⁶ Chairman's foreword, page xiii.

⁷ This conference still thought of environment in quality of life terms, so its focus was more on social sustainability than ecological. The main principles that emerged were equity, social justice, solidarity, human dignity, free choice and free movement. These themes have woven forward at international level through UN conferences in Rio de Janeiro (ecological issues, but integrating the social, 1992), Vienna (Human Rights, 1993), Cairo (population & development, 1994), Copenhagen (social development 1995), Beijing (women, 1995), to finally come together with ecological issues, this time urban, (*Habitat II: shelter and urban sustainability*) in Istanbul, 1996, the last conference of the series (de Vries & Keuzenkamp 1996: 6-9).

The Ecological Perspective has emerged to complement what we used to call 'environmental' thinking. It seeks to understand and work with ecological complexity, in order to achieve alignment with Nature and avoid its destruction. As Esty & Chertow argue, we are moving from a "pollution-based and law-driven" Environmentalism, which largely dealt with clearly visible point sources or phenomena such as smoking chimneys or toxic rivers.⁸ The regulatory approach has reached its unpoliced or confronting, polarising, compartmentalising and crisis-ridden limits. We are now moving towards a cooperative 'Eco-logic' which must acknowledge fundamental interconnectedness and deal with diffuse sources and a range of scales, ultimately dealing in values, the realignment of institutions and changes in roles: partnerships between academia, governments, NGOs and CBOs⁹ (representing 'civil society') and the private sector (Esty & Chertow 1997: 4, 1-7).

The one process now going on that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us (Wilson 1984: 121).

The Australian consumerist lifestyle and our growth-dependent economy, while less impactful in view of our smaller population, are still seriously significant ethically, with regard to the despoilation of our own ecosystems, with respect to our global ethical position, and especially in our association with Asia. It has been recognised that while the less developed countries intend to follow the more developed into modern Consumerism, Urban Footprint studies (Foran 1997; Wackernagel, McIntosh, Rees & Woollard 1993; White & Whitney 1992) suggest that the potential consequences of resource (including Carrying Capacity) over-consumption (and thus relative scarcity), constitute perhaps the greatest threat to global security ever known, especially in a context of population expansion.¹⁰ **Link: Criterion Ecocycles.**

Australian consultants work in Asia to assist in building new, 'modern' cities, and major engineering projects such as dams,¹¹ many of which repeat all the mistakes, local socio-economic damage and design for extravagant scarce resource consumption that are the mode at home. East Timor is the latest target of the unsustainable operators, who are presently hovering, positioning themselves for the usual international development bonanza, buying up land and

⁸ Even so, Queensland in 1999 approved the construction of three new coal-fired power stations.

⁹ Non-Government Organisations; Community-Based Organisations.

¹⁰ For instance recent rapid expansion of irrigated crop production for export (wine grapes, cotton, olives) is taxing already over-committed rivers in Australia. Eutrophication now regularly stimulates toxic algal blooms throughout the Murray-Darling River system, and regulators see a risk of a disastrous water crisis within 20 years under present conditions. The Murray River mouth is very close to closing completely. The concept of reserving a percentage of water 'for Nature' is unfortunately being greeted by growers as a vexatious imposition, to be resisted. Australian Broadcasting Corporation Radio National, News 17 March 2000.

¹¹ For instance see proposed hydro dam project in Laos by Transfield and many other major infrastructure projects proposed and initiated in Asia by BHP, Snowy Mountains Authority and other Australian organisations without local consultation and generating massive profits for themselves at the expense of local people and environments (ABC Radio National "Best of Indian Pacific" on Mekong River, repeated 4th February 1997).

ving for niches.¹² More fortunately, a number of Permaculture practitioners have also arrived there, to work for sustainability from the outset.⁵

The disastrously effective television marketing system is actively preparing the way for unsustainable levels of consumption in developing countries, notably China and India, and continuing to stimulate our own.¹³ While AIDAB¹⁴ had published manuals instructing how to respect third world rural ecosystems (Commonwealth of Australia 1991a;1991b;Ovington 1991), in corrupt, high privilege settings there are apparently few regulatory constraints.¹⁵

At the same time we resist taking responsibility for a Greenhouse gas emission per capita level which is second only to the United States,¹⁶ on the grounds that our population is so small as to be insignificant, while at the same time exporting large amounts of coal to Asian countries, whose emissions we do not add to our quota, and where environmental controls are largely absent. Survey of companies seeking work in these areas reveals poor competency in the areas of eco-social integration, and a heavy emphasis on technological and economic development for its own sake.¹⁷ Since Australians are apparently favoured as consultants by Asian countries, it would seem to make sense to export not our second hand polluting power generators,¹⁸ our population-displacing and socially devastating dams, our Greenhouse gas-producing coal, our potentially disastrous uranium, and our unecological, car-dependent and sprawling urban designs. Rather we could assist Asia in leapfrogging over our disasters and become twentieth century eco-social models for our own next attempts.¹⁹ Most of the 'Asian miracle', was ego-driven, not eco-sensitive, and abundantly demonstrated the inevitability of side effects from narrow economic foci in development. The 'Green Revolution' has proved devastating to both ecosystem and local community (Shiva 1991b;Shiva *et al.* 1991: 8-10).

The urban contribution to environmental problems, especially of the better- (or more accurately, over-) developed countries, is highly significant, in Australia as elsewhere. An ongoing issue worldwide is the economically driven problem of rural depopulation and its relationship to

¹² Observation of Manager of infrastructure company, presently working in East Timor (February 2000).

¹³ Reports are starting to emerge from the USA and Australia that the public is beginning to resist pressure to consume (Lecture ABC Robert Theobald, April 1998).

¹⁴ Australian International Development Assistance Bureau, now AusAID.

¹⁵ For instance the devastating tailings impacts from the OK Tedi Mine in Papua: Broken Hill Proprietary itself drafted the Papua-New Guinea law that made it illegal to sue the Company for damages.⁵

¹⁶ Actually exceeded in 1999.

¹⁷ Eleanor O'Brien, Network Broker for AusIndustry, personal communication, 1996.

¹⁸ South Australia recently negotiated to sell an obsolete power station to a rural area in China.

¹⁹ Moves to establish Emissions Trading under the Kyoto Protocol may change this, as credits may be earned from abatement projects in other countries, developed or undeveloped, and for joint implementation in economies in transition (Commonwealth of Australia 1999c: 9). This was signed by Australia but as at 8/2000, not ratified: for review at Conference of the Parties, The Hague, November 2000.

projected massive urban growth in a context of structural unemployment.²⁰ A society, which claims competition as a core value automatically, generates a neo-Darwinian type of *Scarcity Paradigm*. Authoritarian response to the behaviour of the disenfranchised ultimately sees significant increases in management by imprisonment. This is self-defeating and creates severe and expensive social ripple effects and long term problems, compared with proactive approaches that seek to honour and value the contribution of each individual - a widely claimed goal of modern intentional communities, which usually aspire to both ecological and social goals, even if they fall short in practice.

In our urban context, despite considerable available knowledge, and even despite the more recent Agenda 21²¹ efforts, which have improved the situation somewhat belatedly since this study was initiated, serious damage to biodiversity continues at the hands of planners who do know better, but seem to have them tied by the failure of visions, rhetoric and even policy, to find their way into Development Plans.^{22, 23} Those who try to implement radical experiments still meet such resistance that they are commonly forced into substantial compromise (a finding of my research journey). There has been a softening in this position over the last five years, and small-scale experimental arrangements are starting to appear.

A new momentum is just now developing through the appointment and funding of catchment water management boards, as their twin attentions to water issues and biodiversity, together with the availability of legislative backstopping, have put them in a better position to assist local governments in taking a bioregional (catchment) approach, and start to deal with larger-scale planning than has been the case to date. Local government is the major scale for attention, and integration of its visions, policies, Development Plans and protocols is arguably the most potent single intervention a community could make to biodiversity and ecosystem services.²⁴

There is no intention here to join the argument as to whether or to what extent there is an ecological crisis. This study starts from the assumption that there is an urgent need to attend to the relationships between humans, eco-systems and each other, and that EPPs (Ecological

²⁰ Transnational migration and ecological refugees are of course other strands of this efflux.

²¹ Agenda 21 was first introduced as a multi-functional global sustainability strategy at UNCED, 1992, and in Australia at least, did not get under way for at least another three years.

²² For example despite an excellent Council Vision and Biodiversity Policy, the City of Onkaparinga (SA - 2000) has quite separate Urban Form/Urban Development Policy that does not specify biodiversity, and the Development Plan is not linked. The City of Shoalhaven (NSW - 1993) had an exemplary, Best Practice demonstration SoER - one of the first in Australia - and specified protection areas, but it contained no urban biodiversity headings nor policy as such, and in practice, the urban development and environment departments did not communicate over land use (City of Onkaparinga 1998; Shoalhaven City Council 1993).

²³ This statement is based not on Local Government planners' rhetoric, but on the visible outcomes of planning decisions and evidence of deals between Local Government and developers which result in short-term profiteering and discounting of long-term eco-social sustainability. Even the 'world's best practice' MultiFunction Polis eliminated many innovative sustainability strategies well before the design stage.⁵ The rush to buy and build before the GST has seen

Paradigm Proponents - see below) are not a vexatious rabble, as portrayed by some industries writing off the Environment Movement; they have many answers to offer. We can not afford not to listen, especially in incremental matters like the design and use of our own habitats, and in alignment with the Precautionary Principle, to which the Australian Inter-governmental Agreement on Climate Change refers:

Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation (Heads of Government in Australia 1992).

There is increasing general support for environmental protection, second only to the economy in many surveys. But visionary leadership at all government scales is urgent and lacking. There seems to be little bipartisan will to espouse radical change, so practical experience in Australia, although growing, is still minimal, and experimental development is strongly resisted. It appears that to convince the public, designers, developers and planners that new concepts are feasible and desirable, truly radical demonstration projects need to be implemented,^{24,25} and careful evaluation of outcomes needs to be undertaken. But in what terms? And by whom? An expectation that a 'free' market can be relied on to drive the necessary changes is completely unfounded, but much potential exists for a principled market, one that takes account of human and ecological capital, not just financial and material/manufactured capital, as Rocky Mountain Institute associates have demonstrated (Hawken 1993; Hawken, Lovins & Lovins 1999: 3-9; Rocky Mountain Institute 1998; Van der Ryn & Calthorpe 1986; Von Weizsäcker, Lovins & Lovins 1997). Frankel would add a values-driven quality capital:

Classical economics, and conventional sustainable-development thinking, and scientism – in fact, just about all the conceptual frameworks that emerge from the modernist paradigm – suffer from the same shortcoming: they suppress what we may call the depth dimension of experience ... many aspects ... soulfulness ... the imaginal (archetypal) realm ... feelings/emotions ... the intuitive process ... feelings of relatedness ... without it, the experienced world becomes (relatively speaking) a flat and barren place ... "flatland" (as Wilber calls it) (Frankel 1998: 23-4).

Frankel uses 'value-added' and 'quality of life' to exemplify our culture's conceptual flattening through the use of 'hard numbers':

The point is that you can measure some aspects of quality, but ultimately quality is more than numerical, more than empirical. It is a tautology, but in our culture it needs saying: quality is quality, not quantity (Frankel 1998: 24). **Links: Complementarity Theory; Criterion Genius Loci.**

serious overworking of development assessment planners, and the approval of numerous eco-destructive developments.⁵ (architect & native tree propagator, 2000).

²⁴ David Van Vliet, of Simon Fraser University (1995), who has considerable expertise in eco-community design in Denmark, was in 1993 planning to investigate the effectiveness of demonstration projects in changing local building practice as a PhD research project.

²⁵ Based on this assumption, the Australian MultiFunction Polis initiated a 'step-up' project at New Haven, South Australia with the intention of introducing local developers and builders to new ways of building, and to test these new ideas. The resistance was reported to be considerable (SAHT engineer, personal communication 1997).

This dissertation takes the position that all humans have collective ethical responsibility for the outcomes of human impact on the planet, and so attempts to present a contemporary explanation of the type of thinking that needs to underlie approaches to reasonable practice, with the goals of high level ecological and human physical and psycho-social health in mind.

... The world's richest and most powerful producers had gone and left the consumers to their fate ... People knew that they were all to blame, not one single person was without guilt. The least anyone had done was to stand idly by. The best that could be said of a person was that they had done no more than close their eyes to the cost of the great global party ... '... why didn't we do something?'

... But they hadn't, back in '89, '90 and '91, the years when the decisions needed to be taken, nothing had been done. People had listened to the politicians' empty rhetoric at election time but nothing huge, nothing drastic, nothing real had actually been done. Too much money was involved, it simply wasn't economical. Nothing had been done and now the reckoning was upon them all (Elton 1989, "Stark": 450-1).

I can still hear them calling, but our groups have been cut from each other for some time now. Ever since the road was cut through our home, and more and more humans have come into the forest. We are only six on our side now and have retreated to the last quiet places ... Yesterday I went to the edge. Everything is destroyed there, and from all sides the wasteland is growing. Our forest is dying and there is no place we can go. When we woke this morning we couldn't hear calls from the other side any more. Across the road the forest is burning ... ' (Schucking & Anderson 1991: 13) Off East Brazil, black-faced lion tamarin *Leontopithecus caissara*.

1.3 ON EGOCITIES AND ECOCITIES: EXPLANATION OF THE TITLE

The hardest saying in the Bible is that of St. Paul, addressing the Galatians: "God is not mocked," and this saying applies to the relationship between man [*sic*] and his Ecology. It is of no use to plead that a particular sin of pollution or exploitation was only a little one or that it was unintentional or that it was committed with the best intentions. Or that "If I didn't, somebody else would have." The processes of Ecology are not mocked (Bateson 1972b: 504).

The core of human habitat is the human settlement, inhabited by a web of humans, other animals, plants and microbes, living together In Community in the ecological sense. The human settlement is a visible, tangible entity, emerging from a balance of tangible and intangible influences which this dissertation will eventually refer to as a 'complex interference field': the product of interference patterns of multiple fields of influence.

The title refers to the fact that the design and development of cities (and other human settlements) have much to do with the state of the ego and personal aspirations, and Ideologies of their builders and their customers - that the metaphoric structure behind such development tends to reflect deeply held beliefs about the nature of reality. The *Cultural Bias* (see Douglas' Group-Grid Analysis below)²⁶ is now '*Entrepreneur*' in full flight, with '*Bureaucracy*' in retreat.

The "from ... to" is a claim of transition, which is unlikely to be disputed in today's world, but the question 'to what?' is ever present. This dissertation attempts to clarify an emerging set of concepts about the nature of reality in the context of human habitat: that espoused by the eco-community movement (EPPs – Ecological Paradigm Proponents), and those of more scientific bent, who, perceiving the present achievement of an ecologically destructive '20:80'²⁷ society with growing disquiet, act from concern for the very survival of humankind. This is not just a statement about the city or the human settlement, but about the context, the system in which the human settlement finds itself at the turn of the century and millennium, and our struggles to understand that system. It reviews the many elements of a Theory of Hierarchy, and synthesises a practical approach to the problems of scale, because this slippery concept lies at the heart of an ecological understanding of our conditions. It does not leap directly to this theory, because a working knowledge of the steps between ordinary life and Complexity Theory is important.

In the modern Economic Fundamentalist climate, the worst (indeed most) examples of large scale development reflect short term ego-driven thinking, sweep all before them, have minimal

²⁶ **Links: Hypercyclic Systems Theory, Criterion Community.**

²⁷ 20% ('the haves') participating in and running the global economy; 80% ('the have nots'), the latter redundant and vulnerable to the self-indulgent and territorial behaviour of the 'haves', who must be kept supplied with adequate food and 'tittytainment' – various kinds of media and consumerist pap to keep them mindless and quiet (Martin & Schumann 1997: 1-11).

community input, savagely control their few biotic features and embody the often questionable taste of their proponents. They are frequently alienating and Community-repellent, supporting an unhealthy level of personal privacy, encouraging auto dependency and inappropriate levels of Consumerism. Many people do not know their neighbours. Natural surveillance and local community are replaced by car-accessed and distant communities-of-interest meeting on neutral ground (cafés for example), and the type of paranoid neighbourliness embodied by such organisations as 'Neighbourhood Watch' or such living arrangements as guarded (wealthy) enclaves or dangerous, feral ghettos (such as Sydney's Redfern). Most meeting places need money, excluding the poor, and treating adolescents as potential criminals. As Jane Jacobs said of 1950s New York's "cataclysmically financed renewal-clearance projects: It does not mean a 'conspiracy.' It is a logical outcome of logical men guided by nonsensical but conventional city planning beliefs" (Jacobs 1961: 303). Has this changed?

Modern Western Individualism benefits the well-off. Some 60% of people in an Adelaide study were car disadvantaged (elderly, children, poor, unemployed, students, disabled, sick, locationally disadvantaged), in a car-dependent society where owning car, ability to participate fully in society and one's personal freedom and safety walk hand in hand (Morgan 1992: A.6).²⁸ What can this mean? Another form of two-tiered society.

Sorry! This city is for adults, but you can play in these little parts of it. These areas of the city we have left for you. But if you want to get from here to here, then you'll have to go with an adult (Tranter 1993: 3).

Or "Sorry! You'll have to catch a bus (or three buses) – if there is a bus – if you can afford one – if it arrives by the time you need it - if you can cope with your shopping or the threat of mugging or the distance between stops - if the facilities you need are still there." Those without financial means are excluded from full participation. Those with modest means have real difficulty in finding time to participate if they subscribe to the usual standard of living.

The picture that emerges from these different perspectives is that progress - as currently defined in largely material terms and measured in terms of growth in GDP - has in the past delivered undoubted improvements in quality of life in the developed world. Progress may well still hold this promise for the developing world (although even there it is creating social and environmental strains). However, material progress now presents developed nations with diminishing benefits and escalating costs. It appears to be becoming increasingly irrelevant, even hostile, to well-being and quality of life through the impacts on both the natural environment (improvements in some areas notwithstanding) and social structures and relationships (Eckersley 1998: 29).

Even without particular satisfaction, most modern Westerners live at a level of self-indulgent consumption and comfort well above survival needs, only dimly aware of the suffering of others

²⁸ Loss of independent mobility of children has many associated potential problems, including economic, personal development and self-reliance, physical fitness, contact with Nature and workings of society, environmental health (pollution from extra transport), parental freedom, community indifference (Tranter 1993: 2-3).

less fortunate,²⁹ yet increasingly support national governments in reducing their already ungenerous levels of international aid and meanness towards the poor, fed by the catch-phrase 'the taxpayer's money'. We are told we must globalise, but this apparently does not refer to policies or proactive protection of people or the environment, only to the narrow behaviours and treaties related to capital and economic activity. Nor in 2000, does it apparently refer to our own obligations under international treaties. The situation makes a mockery of the UNCED definition of Sustainable Development and the Declaration on Human Rights (*inter alia*).

The Istanbul Declaration, developed at the UN Habitat II Conference in Istanbul, 1996, was supported by the attending countries, including Australia: **D&C 6.1: Istanbul Declaration**. It looks excellent, but was dishonestly used. In Istanbul, Australia formally committed itself, under the present Government, to recognise housing as a right,⁵ yet in July 2000 is releasing non-English-speaking refugees into the community with \$800 and no physical means of support, and the reduced funding for public housing begun by the previous Federal Government has accelerated in favour of dysfunctional privatised schemes. The following poem, received by the author at that Conference,³⁰ expresses the pain in this situation (transcribed verbatim):

I stumble to Istanbul

Here I stand in Istanbul.
trying to understand all this confusion
I was warned, but never thought it would be so evident.
Yes, I stumble over fallen shacks and houses
in Tibet, Atlanta and Turkey
as I mumble my housing rights
and my right to survive and exist.
I was warned, but never ever thought,
the gap between rich and poor was so wide.
the gap between the NGOs and govt. Was so wide.
and the understanding between NGOs and the poor was so poor.
How much of this information will reach
the homeless? Only god knows.
Why is it so hard to give me my
housing rights? Only they know.
Never the less I will continue
to mumble my housing rights.
and probably [*sic*] take them if they not [*sic*] recognised
From an empty stomach
maybe this time they will hear
because, here I stand in Istanbul.

By one of us whose home is called 'slum'.

Only in relationship can we meet our psychological needs (Erskine 1997: 13; Stewart & Joines 1987: 101-3, 118-23). In community we experience our full individuality, where we are each known for our personalities, observed in our behaviours and answerable to others over the long term. Yet suddenly, this is a frightening idea to many modern Westerners, who in the intrusive

²⁹ Especially in LDCs: Less Developed Countries.

world of electronic surveillance and massive, linked databases, unrealistically believe that their business is not known as long as their fences are high.³¹ This makes sense in terms of Hierarchy Theory's 'overconnectedness', where the yearning for privacy may not be shyness, self-sufficiency or social inadequacy, but a cry for solitude in an overconnected world. So many now can not even manage the community of two that has come to represent the individualist's ideal crowd size. A push has begun, to disconnect us from the last vestiges of social responsibility: 'exercise your free choice as a citizen, make voting non-compulsory'. Emotional illiteracy and loss of trust abound in our violent, overstimulated and virtual age. We hate so much of this, and are deeply fearful for our destiny as humans, yet we are too weary and impotent to act. Increasing numbers suffer from a new condition called 'chronic fatigue syndrome'. We have difficulty distinguishing between battle fatigue, post-traumatic stress, emotional deprivation and chronic low-grade toxicity, and pressed medical personnel have little patience with those who would discriminate amongst these when a drug or certificate is the easy answer.

Sense of Place and local uniqueness struggle against a pervasive homogeneity. The city centre and the suburbs are similarly affected. Everything is piped or trucked/flown/shipped in and out,³² sparing residents the consciousness of and responsibility for, their dependence on the natural world for survival and wellbeing, and interrupting natural cycles. Our supply lines become longer, our personal environmental awareness decreases, our self-sufficiency diminishes and environmental costs escalate. The ability to cook is a dying art. The sense of social alienation and loss of community involvement are compounded by a damaging loss of a caring and joyful daily relationship with Nature. For too many, the anonymous Internet provides intimacy; or Nature has become a pot-plant, the rain necessitating our clothes drier, or the virtual version chosen for us by our minders in the media, brought to us as 'infotainment'. The Aborigines, a small number of whom could still give us a real introduction to the land we inhabit, are presented to us as a threat: 'beware, they will steal 70% of Australia, your back yards are in danger!'

Since this study began, an hubristic acceleration of such trends has generated a diffuse disquiet. Urban ecologists feel the core needs of people and Nature are being poorly met in this marginally moral and anti-social climate of Individualism, and its special, selfish type of human

³⁰ Conference themes were 'shelter for all' and 'sustainability in an urbanising world'. This poem was given to Nick Hall, representing UK appropriate technology organisation ITDG, by an African delegate. Accepting the message, the odd combination of sophisticated & poor English does question the authorship.

³¹ An early interview with a prominent Adelaide tract developer responded to my invitation to look at McCamant & Durrett's book on Cohousing, responded "Why would anyone want more than their family around them? Our family all love each other and love being together. Why would we want to be involved with our neighbours?"⁵

people happily in the country? De-funding regional infrastructure (hospitals for instance) is an extraordinarily short-sighted economic strategy. This issue is particularly urgent in the less developed world, but is distressingly present here also.

Yet, as complex systems will, new things are emerging: alternative concepts of site design, planning, building, communication,³³ community-based banking,³⁴ land trust (CLTs) and economic systems (LETS³⁵) are emerging in response to some of the economic pressures, building local community (Institute for Community Economics 1982).^{36,5} The beginnings of a Social Movement, born of concern, psycho-social need and spiritual pain, are starting to emerge in response to these trends. Thousands of small, caring groups are springing up to take care of catchments, biodiversity, frogs, water, weeds, propagation and planting;⁵ CBOs (such as *Reworking Tomorrow*, *Australia Connects*, *The People's Forum*, *The Future of Work Foundation*, *Nature & Society Forum*, *Resilient Communities*, *Economic Reform Australia*, *Global EcoVillage Network*) are essentially in alignment.⁵ Local government is often in the background, supporting these types of events directly and indirectly, writing or supporting such documents as the **Newcastle Declaration (D&C 6.2)** and **The Earth Charter (D&C 6.3)**.³⁷ Such principles can act as guidelines for sustainable business and policy,³⁸ or feed into Local Agenda 21 (LA21) programmes.

There is yet hope of a new, more conscious civil society. The EcoCommunity Movement is gaining strength, the Global EcoVillage Network is growing⁵ and its premises are gradually being absorbed into mainstream methods. The general public is now so upset that new political emergencies are likely. Demonstration projects are starting to appear. EcoCommunity (including Cohousing) seeks modern ways to recognise the evolutionary human need for local communality and the civilised human need to relate to a broader civic responsibility, at the same time as remaining in sensitive, nurturing and reciprocal relationship with the natural world.

³³ An increasing number of elderly, often subsidised by their younger relatives, are learning to use the Internet in new ways. Once non-workforce women in particular overcome their technophobic concern about harming the computer by 'doing something stupid', they are finding great value in email in particular, but also information gathering (Females in Information Technology survey, Adelaide c 1997).⁵

³⁴ Rural community banking services are emerging in Australia in response to closure of rural branches of the major banks. Building societies, the Australian Local Government Association and the Bank of Bendigo have been involved with this in different parts of Australia.

³⁵ Local Economic Transfer Schemes invent local currencies which operate around a centralised bartering system (originated in Canada in 1980s). In Minnesota in 1988, the Lester Prairie community (population 1229) saved ± 600,000 miles of travel and prevented 200,000 lb of CO₂ pollution through an Energy Commission-stimulated, sustainability-oriented local economic system which traded in 'Prairie Bucks' (Roseland 1992: 236). Starting in intentional communities such as the Blue Mountains in NSW and Maleny in Queensland, most major cities now have several LETS communities, most of which have a general service and community building function as well as economic goals.

³⁶ See also "ICE Update" Institute for Community Economics, 57 School Street, Springfield MA 01105-1331.

³⁷ The Earth Charter is an international-scale bottom-up expression of a collective, global vision for values needed for fundamental change towards a just, caring and ecologically, socially and economically sustainable world. Further information and the latest full drafts can be found on the Internet: <http://eca.anu.edu>; www.earthcharter.org/.

³⁸ The Earth Charter is being used in this way by *Hassells*, a large planning and development company.

and the civilised human need to relate to a broader civic responsibility, at the same time as remaining in sensitive, nurturing and reciprocal relationship with the natural world.

The challenge, then, is to encourage a return to the concept of the eco- as a core part of the ego, much as indigenous people experience it, but in the modern context. The first step is to re-acquaint ourselves with the eco-, using modern Science and rethinking our everyday relatedness to Nature and each other. We need to experience deeply that damage to Nature is damage to ourselves; that respect for Nature includes respect for human beings and vice versa; that 'anthropocentric' and 'egocentric' are ultimately synonymous with 'ecocentric' and 'biocentric'.

An egocentric ethic is grounded in the self. It is based on an individual ought focused on individual good. In its applied form it involves the claim that what is good for the individual will benefit society (Merchant 1992: 63) .

An ecocentric ethic is grounded in the cosmos. The whole environment, including inanimate elements, rocks, and minerals along with animate plants and animals, is assigned intrinsic value. The eco-scientific form of this ethic draws its ought from the science of Ecology ... to solve ethical dilemmas ... Maintenance of the balance of nature and retention of the unity, stability, diversity and harmony of the ecosystem are its overarching goals. Of primary importance is the survival of all living and non-living things as components of healthy ecosystems (Merchant 1992: 74-5).

1.4 AUTHOR'S BACKGROUND

The author has a background in integrative disciplines: clinical third line medicine (Wholistic, Environmental, Complementary, Psychosomatic, Nutritional Medicine, Clinical Ecology); Psychotherapy, Communications and Social Psychiatry based on the Transactional Analysis (TA) conceptual system, developed in the 1960s by neo-Freudian psychiatrist Eric Berne; also Process Oriented Psychotherapy (POP) and 'World Work' (large group conflict resolution), based on the neo-Jungian work of Arnold and Amy Mindell and others, notably Max Schuepbach and Jytte Vikkelsoe, in the last two decades. Subsequent evolution of both these theories has demonstrated them to be systems based and applicable not only to inter- and intra-personal therapeutic work with neurotics and psychotics, but also to personal growth in psychological 'normals', community building in local government, Education, Organisational Development, Political Theory, Communication Studies, (including Conflict Resolution and national and international Communications), and to be 'values-neutral' metasystems based on multi-scalar Systems Theory, which successfully translate across cultures.³⁹

³⁹ A discussion (February 1999) on the Transactional Analysis listserver compared the differences in experience with particular therapeutic tools, of therapists working with Transactional Analysis in Westernised and indigenous cultures. This discussion centred around the Parent Ego State, the overlap of the concept with Jungian collective unconscious and with native ancestor relationships, and the need for sensitivity to the unwillingness of some indigenous people to act out

While no theoretical system is ever values neutral, these two generic, overlapping systems do not demand a particular set of cultural, parental or personal standards. In practice, both have strong, formal Ethics systems, in both cases aligning very comfortably with EPP positions such as the Maturana definition of 'love' as the proper basis for society (qv). They describe mechanisms by which personality is laid down, basic needs are met, people communicate and internal consistency is maintained, and take a contractual approach to therapy or community building whereby the work to be done is agreed in advance. TA has been very successful in organisations and Psychotherapy both in Asia and across Europe, having started in California USA. It is also widely used in advertising and local government, and the Australian National Training Authority has accredited a training course.

I have found broad applicability of these concepts, and correlation with other systems-based Psychotherapies, such as the post-modern Narrative Therapy⁴⁰ and similar but more limited theories in Sociology, Quantum Theory and Complexity Theory. These frameworks help to explain organising principles operating at cultural, social, personal and intrapersonal scales, together with inter-scale relations. Bridges are needed from theory to ecological practice, and to integrate the personal into meso and macro scales. The issues are essentially scale, communication and health: the health of people, biota and ecosystems. Another advantage in having a working knowledge of personal growth techniques is their application in Visionary Planning (for instance Rounsefell 1991a),⁴¹ in Health Education⁴² and community consultation.

Since 1990 I have studied tertiary subjects including Environmental Geography, Aboriginal Studies, and honours Urban, Population and Historical/Methodological Human Geography and a Masters Qualifying dissertation on Urban Planning (Adelaide 2020 Vision Planning Review & Local Government). I have audited full terms of Environmental Politics, Philosophy and Ethics, Environmental Policy, and attended part courses in Social Geography and Development Geography.

the Parent position in role-plays, 'Parent interviews' and '2-chair' techniques (therapeutic strategies commonly used in Transactional Analysis therapy in Western societies).

⁴⁰ Developed in Adelaide by family therapist Michael White and his colleagues.

⁴¹ Dr Wendy Sarkissian, a leading Australian social planner, has actively used a number of personal growth techniques in large scale planning and community development workshops, with powerful effect, and winning a number of awards.

⁴² Videos: '*Reclaiming Our Stories, Reclaiming Our Lives*', Camp Coorong 15-20 August, 1994, *Aboriginal Health Council of SA*; '*Mrs. Sugar*' limited edition tape from Ms. Barbara Wingard, Aboriginal Health Worker, *Community Health Service*, Murray Bridge, SA.

2 METHODOLOGY

2.1 DEVELOPMENT OF RESEARCH TOPIC

2.1.1 PROCESS OF CONCEPTUALISATION

The initial intention was to investigate environmental illness in depth, my having spent a decade working with people whose illness was related to their life conditions - to their inability to be well in their current eco-social context. Having attended the Royal Australian Planning Institute Congress 'Planning for Sustainable Development', Canberra in March 1992, and participated in March-April in the MFP-Australia Social Issues Team, which invited 16 urban professionals to design their ideal social city.¹ I then attended the EcoCity 2 Conference in Adelaide in May 1992. This demonstrated again that the nature of human settlements themselves and the structure of human community were deeply involved with the low level of wellness of society generally, and also with ongoing damage to the Earth's ecosystems.

Many speakers were struggling in a practical way with these big questions, and I made a decision to visit as many of them and their projects as possible. My idea was largely technical, as at that time most of the 'Sustainable Development' and 'sustainable community' concepts were unorthodox or 'alternative'.

In June 1992, I attended the Global Forum associated with UNCED, the United Nations Conference on Environment and Development in Rio de Janeiro and the EcoTech exhibition in São Paulo.² The influence of this and subsequent major United Nations Conferences on social issues (ending with Habitat 2 in Istanbul, 1996, which I also attended), had yet to be felt, and is still unfolding.

I collected definitions of sustainability and protocols for implementing it in a human settlement context, and started visiting local projects around Adelaide.

The need to take an 'ecological perspective' was mentioned frequently by Urban Ecology; ESD interviewees tended to refer to 'environmental' perspective. The former was usually presented as long lists of what should be done in order to be 'ecological', accompanied by orientating diagrams, or by lists of principles of considerable generality. ESD people more usually had three arenas to be balanced: economics, people and environment, in that order. **Link: Confluence:**

¹ My role was to deal with Environmental Health (broad spectrum) and new technologies. The task was to provide detailed lists of descriptors for developers.

² Generously funded by my mother (who also funded my attendance at Habitat II) as a fiftieth birthday present.

Content for the Framework – Pattern Repertoires. It was apparent that a distinctive body of knowledge was emerging.

The literature at that time dealt mainly with unifocal issues and projects, and was not reflecting a concerted effort to take an integrative, wholistic approach. Built examples were sporadic and imperfect: clearly there were barriers to implementation, but also problems of interpretation and integration.

The Australian suburban tract norm in 1992, even when labelled 'Sustainable Development', was profit-driven, short time horizon, self-serving 'ego-city' enterprise, with very few concessions to meaningful sustainability (which continues). For example I was disappointed by a visit to the 'energy village' in the Golden Grove tract in Adelaide. The Electricity Trust of South Australia (ETSA) had installed itself as the answer to sustainable practice in recommending all-electric houses so poorly designed that they relied on (albeit mildly energy efficient) air conditioning. Insulation of modest quality was introduced as an innovative feature,³ thermal mass and solar siting were ignored as strategies, and a 'solar pergola' was as 'optional extra', not integral to the design. There was no attempt at block orientation, because the developer had pre-determined the layouts on some other, probably economic basis, and the demonstration houses often faced or had major unprotected window structures or heavy masonry, facing West. Additionally, all-electric housing technology can only begin to earn a sustainable label by using sustainable energy generation sources, which is not the case on South Australian grid.⁴ ETSA, I later discovered was doing a long study comparing Greenhouse impacts of different fuels and appliances in South Australian Housing Trust (SAHT) Housing. **Link: Criterion Ecocycles.**

Another visit in 1993 was to Rosewood Village, hailed and promoted by the SAHT as a model for community participation and a 'popular', successful retrofit. Some tenants were given free paint in 'heritage' colours and the appearance of buildings was improved by adding finials and cute little neo-traditional fences. It transpired that the tenants of other Trust houses nearby being heavily renovated for sale had been displaced to indefinite destinations. Some welfare tenants may have done well by buying their homes (Peel 1996:108), but those unable to pay had quietly vanished. To where?

³ The use of fibreglass insulation is very wide-spread in Australia. It is explicitly dangerous to builders installing it, and since ceiling and wall spaces are not necessarily sealed off from indoor air or people, may well give cause for anguish in the long term. A similar comment applies to working with 'craft wood'. **Link: Criterion Ecocycles: Baubiologie.**

⁴ Coal with some gas.

When I asked our private developer⁵ host about functional improvement of the houses, for example insulation, he wondered if I were joking, since they had been "flat out getting them to deliver the right paint and materials, let *alone* worrying about things like insulation, and that would have cost too much anyway". It was clear that appearances were far more important than the preservation of community or the promotion of ecologically sustaining practices, rhetoric notwithstanding.

While the developer was proud that 'community consultation' had introduced neighbours of 20 years with no previous contact, he failed to mention the lot of the displaced. The 'consultation' was more in the vein of explaining to the subject residents what was about to happen to their area and enlisting their support, than actually seeking their serious input into any design process.

In mid 1993 I undertook a then radical search for implemented examples of best practice overseas, to find out what people meant when they claimed sustainability or an 'ecological approach' in human settlements, and to discover what they had ended up implementing, how they had gone about integrating multiple issues, and what obstacles they had encountered and overcome. I organised a four-month journey through nine developed countries.

On my return I took every opportunity to follow a similar path in Australia, visiting a smaller number of projects in Queensland, NSW, Victoria and South Australia.

In South Australia I initially identified the (MFP) MultiFunction Polis (ESD) and the Halifax Project (ECD),⁶ both in Adelaide, as suitable subjects for in-depth study, one top-down and the other bottom-up, and both claiming leading edge environmental sensitivity. I invested a considerable amount of time being involved in preparations and public processes for both, however each for its own reasons has been commercialised (to Mawson Lakes and an orthodox apartment development respectively), with eco-radical features mostly deleted.⁷ The MFP's New Haven 'step-up' project has been implemented, but it, too has been given over to commerce. Some useful learnings are available from this (see below), but the project is no longer radical.

In 1994 due to inaction in both projects, and finding that most of the overseas projects presented at the EcoCity 2 Conference were lingering in the planning stage, I decided to abandon this approach, and shifted my attention from description of cases to the synthesis of a conceptual model.

⁵ This was a joint venture between the South Australian Housing Trust and Delfin Property Group.

As the pace of understanding quickened and sustainable technologies themselves became less novel but remained poorly integrated, and as I recognised the lack of a coherent framework for conceptualising and teaching the basics of sustainability, it appeared that this had been an appropriate decision, but it greatly increased the time required to complete the work.

The Jerrabomberra Valley National Ideas Competition (JVNIC) was one of three Australian case studies on the principles for development of ecological cities, hosted by the National Capital Planning Authority, the ACT Government, ACTEW (the ACT electricity and water supply authority – now public company), the City of Queanbeyan and the State Government of NSW in 1994. I saw an opportunity to test my own knowledge and find out what the leading edge EcoCity thinkers in Australia were proposing (many through quite large teams). I put in an entry on behalf of a group of ecological consultants (ECOCO Global Ltd), which was selected as one of the best six (of 32). Because my report was regarded as the best theoretical analysis, I was asked by the National Capital Planning Authority⁶ to write the technical content for their report to the OECD, and do content reports on all entries, and analysis illustrated through 90 'information spiders' such as **Tool 3.3: Information Spider - Traffic Reduction through Urban Design** (Foulsham & Rounsefell 1994;Rounsefell 1994b).

The JVNIC brief specified discussion of the urban meaning of ESD and presentation of 'integrative strategies', a notion only moderately well grasped by participants. Entrants were asked for conceptual designs for an ecological settlement of approximately 2520ha straddling the border between the ACT and Queanbeyan, NSW (Commonwealth of Australia 1995d). This activity alerted me to the tentative emergence of Complexity and Systems Theories in the conceptualisation of Ecological Design. Several competitors made naïve attempts to apply different aspects to practical outcomes.

The Second Prize winners proposed Complexity Theory as the basis for their concept plan, but this was discounted as 'a distraction' by the judges, who nevertheless liked the outcome of this reasoning. An unplaced entrant took a 'fractal' approach, which referred to connectedness across two scales (macro/micro), but neglected myriad other characteristics of complex systems. The Third Prize winners proposed an integrated system of 'diversities' and 'ecologies', based on commercial clustering, which succeeded functionally. The First Prize winners made heavy use of the concept of self-organisation, without promoting that as a feature of complex systems, but

⁶ Ecologically Sustainable Development; EcoCommunity Development.

⁷ Especially compared with buildings reported by the Rocky Mountain Institute (Von Weizsäcker *et al* 1997: 10-28).

⁸ NCPA, Now National Capital Authority.

did provide an array of the best known strategies for ECD and ESD. It also devised a hypothetical story about governance, an area tackled by only two other entries. But it did no ground truthing (building in precious bushland and on some endangered species areas); it also advised low-density development on the grounds of market acceptability and food-growing potential.

Of the two 'Special Mentions' one proposed a Permaculture community (which itself actively promotes ecological systems emulation and natural pattern recognition), and the other offered (*inter alia*) seventy-six patterns for achieving sustainability, based on an extension of Christopher Alexander's 'Pattern Language (Alexander, Ishikawa, Silverstein & others 1977). **Links: Models & Mindscapes: Bridges from Theory to Practice: The Emerging Synthesis; Table 11: Entry 101 - Patterns of Sustainability.**

Indeed either Permaculture or the less comprehensive but related Yeomans system of urban forestry and geomorphological water management, was espoused by half the entrants (Rounsefell 1994e: 23-6). These priorities indicated that the leading edge of mainstream eco-development was tentatively shifting in this direction.

JVNIC represented the formal international (OECD) state of the ecological cities art at that time, and was followed by large, international, OECD-funded conferences on the subject the following year in Brisbane (Human Settlements) and Melbourne (Economics and Policy). It was supposed to have the potential to be a real project 10-15 years in the future. Follow-up in 2000 finds the site unlikely to be much developed at all in view of the large number of endangered species and newly-identified threatened vegetation associations and Aboriginal sites there: a circumstance not appreciated by the sponsors of the Competition, and only reported by my own entry and two others. Action Plans are in place, as required for threatened species by the new Conservation Act (ACT & Sub-Region Planning Strategy Steering Committee 1998). A gaol will soon be built, favoured because of its small, controllable footprint. The ACT Department of Planning and Land Management (PALM) is not impressed with the outcome of the Competition itself, because none of the winners had started design with the land and the local biodiversity.⁹

The City of Altona ran an international conference, 'Habitat' in July 1994, which emphasised partnerships between industry, local government and community. Partnerships were first mentioned at Rio, but the NGO and business 'Global Forum' was separated from the National Delegations by 30 km! At Istanbul (1996), Committee 2 of the United Nations for the first time,

⁹ Tony Adams, PALM, pers. comm., 7/2000.

welcomed presentations from a range of partners,¹⁰ acknowledging that no one sector can solve the world's problems alone.⁵

The above activities were followed by a long period of library research and conference/seminar attendance in a new range of topic areas including urban and environmental Computer Modelling, Planning, Ecology, non-probability Mathematics, Subatomic Theory, Physics, Fuzzy Logic, Psychology, Semiotics, Complexity Theory, Organisational Development, environmental indicators, Sociology, Human Geography, Human and Urban Ecology and Ecological Economics. The objective was to gain an understanding of how different disciplinary areas were going about dealing with the idea that we need to go beyond linear approaches to knowledge, learning and decision-making. This led to the conclusion that analogous processes were emerging across many disciplines, but that most were still dominated by traditions of linear thinking, Complexity Theory proponents having to form 'special interest' clubs. During this period I spent a lot of time collating and sorting this information, identifying concept constellations with a view to integrating ecological and complexity concepts into a framework for Human Settlement Ecology. This was stimulated by my appreciation of the training system we received as medical students: we were given a simple conceptual framework (actually a decision tree) which made it very difficult to miss a diagnosis. I felt that an appropriate conceptual framework could perform a similar function for human settlement professionals-in-training.

At this point I discovered Hierarchy Theory (O'Neill *et al* , Allen & Starr), and Unified Ecology (Allen & Hoekstra), which was an attempt to unify the dissonant fragments of Ecology. I recognised in it the type of conceptual model I was developing, and reasoned that if I used an extension of this for human settlements, it would open up a theoretical conduit between Ecology and development on the one hand, and Complexity Theory and development on the other. This eventually became the 'UHSE¹¹ Matrix'.

Shortly after this I noticed that when I explained my work as involving 'Hierarchy Theory' (HT), a common reaction was dismissive irritability. This turned out to be due to a deeply-ingrained perception that HT referred to power hierarchies, and an assumption that it therefore had no business being presented as a solution to ecological or social problems.

¹⁰ Local Authorities, civil society (NGOs and CBOs), Trade Unions, Academics, Business & Industry, International Foundations.

¹¹ Unified Human Settlement Ecology.

Engwicht, a prominent figure at EcoCity2, illustrates this well in "*Towards an EcoCity: Calming the Traffic*". He warns of the 'butterfly effect' and describes and extols the virtues of chaos and diversity, and 'eco-relational thinking':

Like nature this space [*Münich Square*] is constantly changing, moving, and surprising. Chaotic yet brimming with life and creative energy ... Mechanistic thinkers hate disorder and diversity; their mission in life is to bring 'order' ... chaos is absolutely essential for the emergence of new life forms (Engwicht 1992: 26).

But he is not apparently clear about the distinctions between temporal, functional, fractal, dominance and spatial hierarchies or their relationship to scale:

Fractal systems are not hierarchical. A tree does not go from trunk to major branches to minor branches to twigs to leaves. These are convenient labels for reductionist thinkers who want to reduce things to their base building blocks and draw hierarchical flow charts ... [*these words*] are only useful as a means of indicating at what scale the tree is being viewed (Engwicht 1992: 123).

He then goes on to describe "the fairly simplistic hierarchical models" that describe roads, the fractal designs that enable infinite space to fit into finite space, and planners' discounting of complexity in human settlements (Engwicht 1992: 123). Such contradictions led me to a much wider investigation of different types of concepts of hierarchy, and ultimately to a whole section on a Theory of Scale.

In June 1996 at Habitat 2 in Istanbul, I visited a large exhibition of 'sustainable' urban development designs and strategies, many presented by teams attached to national delegations. Many of these bore the culturally deadly imprint of high-rise designs from the 1960s (as did the massive, new building projects in East Berlin in 1993). I also had the 'opportunity' to lead a warring, multi-cultural team of writers to produce a document for the UN, on the NGO/CBO role in implementing shelter for all and urban sustainability, that represented some 8000 NGOs. By strange contrast I was able to visit Çatal Hüyük, a partly excavated underground, neolithic city dating from 10,000BC, and to visit a number of Turkish villages and high-rise apartment developments.

The Opposing City West Project (OCW) was a 12-week, three half days per week, final year Studio in Architectural Design, presented between March and June 1997 at the University of South Australia, by a teaching team (comprising the author and two architects) derived from two professional consultant networks, Energy Architecture and ECOCO Global Ltd. This provided a limited opportunity to use a UHSE matrix-based data management system. It enabled me to assess the requirements for teaching the model in a practical, collaborative design setting. It also demonstrated how an edge-of-chaos concept is helpful in guiding a design process.

By 1996, the language of sustainability was well-known, and the field was moving so rapidly that attendance at conferences and seminars became essential to leading edge knowledge. It has become difficult to attend even a third of relevant Australian meetings. let alone international ones. However this has been balanced more recently by an increase in publications with a more wholistic approach, but the emphasis on local interpretation is often still theoretical, coming from 'alternative' sources and/or imported (mainly from the USA). In June 1997 I attended the large 'Pathways to Sustainability' international conference in Newcastle NSW, which displayed the progress being made by local government in most aspects of sustainability.

My past experience in Organisational Development, and the literature on systems thinking in business, 'the learning organisation' and 'continuous improvement', alerted me to the strategic importance of indicator development in the quest to align our activities with the ecosphere. If we are to respect ecological constraints we need appropriate ongoing feedback on healthy system function, not just on the symptoms of collapse. Seminars on environmental indicators, Environmental Impact Assessment and environmental costing brought to my attention the symptom-focused, mechanistic approach of most environmental reporting. It reminded me of the analogous mainstream approach in orthodox Medicine. I therefore reviewed environmental indicators from an ecological complex systems perspective, which was eventually related to Criteria of Observation and an entity I have called a 'Fuzzy Sustainability Space'.

Overall, I have allowed the description to unfold as seamlessly as possible, but it has felt like wrestling a giant octopus with its own set of objectives: a personal experience of the *Edge of Chaos*. It seemed valuable to construct a map of the larger territory incorporating all its disparate scales and lenses on reality, integrating humans and their settlements with their ecosystemic contexts, and opening up the accessibility of data and research findings across disciplines.

I therefore decided that a conceptual model should be sought which would form a framework for describing case studies, especially those of large sites, which would if used for tertiary training, make it difficult not to incorporate 'ecological thinking' into educational, design and further research work.

My intention is to broaden or redefine and to orchestrate a range of tools available to educators and practitioners in the areas of human settlement theory, assessment, indicator development, modelling, design, housing development, redevelopment, policy and governance, not in the

detail, so much as in conceptualising the systems' underlying emergent outcomes, and to honour the scientific basis for my own interest area, human eco-community.

2.1.2 THE ECOLOGICAL PARADIGM PROPONENT ('EPP')

This thesis aims to present an accessible understanding of the scientific principles behind a paradigm shift in human habitat Planning and Design that is being promoted first by activists and committed professionals (especially natural resource managers and architects, and some hydrologists, landscape architects, civil engineers and planners) in many quarters, as a solution to global and local ecological and environmental problems.

The EPP group, seeking transcendence to a dramatically more collaborative Paradigm, is coming together to attempt healing and protection at the Local (Bioregional) Scale, attempting to short-circuit from the global scale, as many loops as possible . It has increasingly referred to the need for attitudinal, and an eco-spiritual reorientation as a prerequisite for long-term survival.

Systems thinking has general explanatory status, and Complexity Theory is advanced as a design approach (as in Permaculture). Proponents in Australia and overseas are often academics and working urban professionals, but include a wide range of non-professionals and a substantial proportion of low income 'green' activists.⁵ Communal housing arrangements are increasingly taking the form of ecocommunities (often 'EcoCommunities'), ecohousing, cooperatives or Cohousing or mixtures, often linked with Permaculture, and in one case (Aldinga Arts EcoVillage), the Arts.

The research was initially an enquiry into the so-called 'EcoCommunity' or 'EcoCity' Movement, its Science 'Urban Ecology' and its Philosophy and activities (represented by Halifax Project, Fuzzies Farm, Crystal Waters Permaculture Village, Aldinga Arts EcoVillage, Sun Village and others). A partly organised global network of individuals and groups has been attempting for some three decades to design, implement and model eco-social and sometimes spiritual strategies, in the hope that it may make a difference towards solving the on-going sustainability crisis. To some extent this group overlaps with the communalist movement peaking in the 1960s and 1970s; but there is emphasis more on appropriate technologies and a 'Green Theory of Value' (Goodin 1992: 24-41)¹² than on the social statements of the communes (Pepper 1991: 31-2);⁵ where communes emphasised freedom from control and laissez-faire, recent intentional communities emphasise extremely focused management, service to wider community and high

¹² Such values, unlike ordinary political positions, are fundamentally non-negotiable. They are only compromised with guilt.

levels of ecological efficiency (Meltzer 1997b: 315)⁵. The social objectives, especially in Cohousing, are founded on an attempt to reconstruct community rather than react against society as such, on the principle that many social and ecological problems are based on modern society's loss of community. **Link: Confluence: Process: Weaving the Backcloth.**

The research also approached the issue from the perspective of what could be termed 'the ESD Movement' (represented *inter alia* by MFP-Australia, Cities of Toronto, Almere, Milton Keynes and JVNIC), the effects of which have started to filter through to the scales of Local Government, tract housing, individual housing and individual lifestyle modification (such as recycling). This is a 'top down', control-driven movement motivated ultimately at the international scale, not by any thoroughgoing green consciousness, but by the perception of opportunity for green market niches and the coming 'onto the agenda' of economic and neo-Malthusian concerns for which scientific data on resource shortage and security, population increases, food production capacity, climate change and loss of biodiversity through habitat destruction, are lending increasingly ominous support. The significance of top-down projects lies in their large size (impact for good or ill).

2.2 RESEARCH QUESTIONS

These can be stated as follows:

Principal question:

- *What could an Ecological Approach to human settlements be?*

Subsidiary questions (What is Nature like, that we might align with it?):

- *How have people attempted to apply Ecological Principles to human settlement development?*
- *If linear thinking has let us down, what do we have instead?*
- *What are the New Sciences' of complexity and how do they relate to the Philosophy and Science of an 'Ecological Approach'?*
- *How is this different from 'Sustainable Development'?' (What is Ecologically Sustaining Development and how could it be evaluated through an ecological framework?)*
- *How can all this be applied as a non-linear approach to human settlement Policy, Assessment, Design and Development?*

2.3 BIASES AND CONVENTIONS

2.3.1 ASSUMPTIONS & BIASES

That the perception of ecological crisis on planet Earth is correct, and requires serious action in the next 5-10 years to avert catastrophic positive feedback effects over the next 50 years.

That EPPs and people identifying as 'green' are not essentially 'vexatious scaremongers'.

This work is driven by a strong desire to contribute to ecological understanding for the political purpose of catalysing effective action in healing the human relationship with the biosphere.

Attention has therefore been given to explaining and defending the EPP position, with writings derived from the orthodox science that underpins the theory explored.

2.3.2 CONVENTIONS

A list of editorial conventions used in this dissertation is found in Volume II.

2.4 METHODOLOGICAL ISSUES

2.4.1 STRATEGIES

The principal approaches were:

- Library research and data collection.
- Content analysis (document collections, national competition entries).
- Observant participation (research journey, conference attendance, conference presentation, participation in community consultation and project processes).
- Interviews, projects, site visits, public consultation, meetings, response to government documents, involvement with national design competition).
- Structured fact finding; documentation and recording by film (stills), notes and tape.
- Integrative thinking using conceptual aids such as mind mapping, large matrices, fuzzy cognitive mapping, AO paper, right brain techniques.

2.4.2 BIG PICTURE RESEARCH

I was warned not to take on too broad a brief in selecting my topic. I appreciated the motivation behind this, and came in time to suffer severely for my foolish ambition, but my perception was that one of the major causes of the ecological problems of the world today is precisely that a small, reductionist perspective is usually taken. This has resulted in a dangerous degree of fragmentation in approaches to human settlement problems, even in the activities of those concerned for biospheric health.

This was affirmed on my research journey, when I observed that wider knowledge notwithstanding, people were not implementing fully integrated projects. It was reaffirmed by working with final year Architecture students, many of whom would be managing large, complex projects in the near future, but who had no way previously taught to them of taking a large site and handling it with any integrated understanding of how to approach, evaluate or design for complexity, wholism and integration.

Since my natural thinking style is integrative and lateral rather than logical, I saw value in using this ability to do some difficult thinking work on behalf of those who are constrained by the inability to think other than logically. I have reserved logic for the structuring and weaving of my case and reductionism for the focusing and pruning required once the bulk of the argument was spelt out.

2.4.3 INTERNAL CONSISTENCY

The presentation of this work has the intention to trace theoretical ecological issues through from Philosophy, Ideology and Ontology to Epistemology, thence Methodology and Technology to Practice. It seeks to demonstrate the Principle of Complementarity by concerning itself with the integration of the theoretical and the practical, the empirical and the interpretive, the physical and the metaphysical. **Link: The Subatomic Scale: Bohr's Complementarity Principle.**

2.4.4 ACCURACY OF INFORMATION (RESEARCH JOURNEY)

In the early stages of this study, I gave considerable thought to the methods whereby my data was to be collected. I was concerned that my research may not be 'scientific'. I soon realised that there was no possibility of collecting the required information by the normal Social Science methods, so did what I needed to do to find out what I needed to know. It is commonly stated by EPPs that implementation of a strategy anywhere in the world implies the possibility of repetition elsewhere. Both MFP-Australia and the Halifax Project originally claimed to be about to implement the most comprehensive collection of sustainable strategies so far assembled. The MFP paid a consultant to amass such a database (since 'vanished'), and it is the business of Urban Ecology Australia¹³ to be well versed on this subject and to teach and demonstrate solutions.

Thus I searched for suitable subjects through telephoning colleagues, interviewing personal contacts and contacts of contacts, searching the Internet, bookshops and libraries, networking at

¹³ Initial proponents of the Halifax EcoCity Proposal.

conferences, listening to word of mouth and radio broadcasts, and writing letters to experts, companies, activists, embassies and governments.

It is a valid criticism that the short duration of my stay (overseas and Australian interstate journeys) often minimised the depth of collectable knowledge. I attempted to counter this in a number of ways. One was to become involved in longer-term in projects in and around Adelaide, so that I became aware of the issues and knew what to look for. I designed questionnaire sheets so as not to miss important information: **Figure 1: FRBI: Master Questionnaire.**

Most of the information I collected was of a process reporting or system description type, rather than being subject to misinterpretation. I tested this in a local community, got feedback, and practised going into a community, making fast connections with people, asking fairly searching questions, participating in their day-to-day life if possible, and staying 1-3 nights if I could. I relied on my ability (derived from years of medical practice and psychotherapy group work) to get to a fairly deep level of communication with people quite fast. I prepared for my visits by writing and phoning the subjects well in advance and again near the time, making preliminary relationship by phone especially. I read anything available before the visit, and collected large amounts of literature for later reading. I took notes and dictated comments, and in some cases made follow-up phone calls or otherwise kept in touch. I did other types of follow-up or library research in a number of cases.

The selection of persons for interview tended to be somewhat random, in that in communities, sometimes the 'best' people to speak to were absent on holiday or other business. This is essentially an anthropological problem, inherent in the types of study where the community is the subject rather than individuals, however the difference here lay in the need to take a 'grab-and-run', short term approach to information gathering. I attempted to speak with as many people as possible in each place, so as to compare notes and gauge possible dissonance, especially in the area of statements about issues of community function. Other selections involved prior appointments with specific people, selected for particular knowledge or reputation, or role in government.

It should be noted that lack of assessment time is a common issue in the ordinary planning world, and some of the strategies referred to above could be repackaged as necessary consultation skills for community work and Environmental or Social Impact Assessment.

Had finances allowed it, I would have preferred to return for a less rushed journey, concentrating on the best examples identified by the first. In the end, the detail of this work has not been the principal focus for the dissertation, but rather, has served as a conceptual backdrop to development approaches and technologies at different scales and in diverse settings.

2.4.5 RECORDING SYSTEM (PRELIMINARY WORK)

I recorded my visits on questionnaires, in notes, on tape and where possible, on slide film. This was essentially an anthropo-sociological study in its field research aspects, and completely unquantifiable, notwithstanding the fact that naïve interpretation of high level mathematics has played a key role in the integration of the Theory.

2.4.6 OBSERVANT PARTICIPATION IN ACTION RESEARCH

My participation in community life, community consultation, planning competition and teaching processes was designed to give me first hand knowledge of internal community dynamics, the workings of public political processes, the state of the eco-design art and the application of complexity principles to group dynamics, respectively. My participation in conferences was aimed at remaining aware of leading edge knowledge in the areas of concern.

My experience with large government or private organisations, was that friendly, participatory approaches generated open information sharing and candid political comment which simply would not be available in situations without such trust, and especially where political motivation or adverse judgement is suspected. My identity as 'student' opened doors; an identity as a potential consultant creates a completely different (cagey, competitive) response. The present climate of political paranoia and the tendency to hide real issues under 'commercial-in-confidence' blankets is of considerable concern to academic research, and tends to block the ability of outsiders to make accurate assessments, while insiders can be relied on to present a biased view. In Adelaide alone, I found multiple layers of political and power- or territory-driven intrigue in private and public sectors, surrounding attempts to deliver sustainable solutions, both in 'top-down' and in 'bottom-up' organisations. There is then an ethical and indeed a long-term professional issue as to the use of the information gathered.

I made a choice: between following a 'community intrigue' path in this study, which would have resulted in a sociological type of outcome, but which could have had explosive and difficult repercussions politically, and later professionally, for myself in a small city. The course eventually adopted, was to stay with the theoretical and didactic aspects, which potentially have longer

term and broader community benefit. The first option would have obliged me to restrict access to some content of the thesis, which would then have limited its usefulness.

2.4.7 REPORTING OF CASES

I have had to choose again between in-depth reporting of a small number of cases and superficial reporting of many. Ultimately, I focus instead on what I, as an informed observer, found useful or learned from in each case. This then made the cases available as a type of internal citation for illustrative purposes.

2.5 RESEARCH STAGING

The research was done in several stages. Conference, seminar and presentation activity continued throughout:

- Stage I: Preparatory literature review, interviews and project visits
- Stage II: Overseas field work
- Stage III: Australian field work
- Stage IV: Theory development
- Stage V: Application through trial; framework updates; write-up.

2.5.1 OVERVIEW OF RESEARCH STAGES

2.5.2 STAGE I: ECO-COMMUNITY AND SUSTAINABILITY PRINCIPLES

This stage continued throughout, but started in 1992 with literature search, sustainability strategy list collection, and early visits to Adelaide projects, all preceded by EcoCity II, Global Forum and ACT Sustainability Conference (RAPI).¹⁴

Activities included visiting Canberra twice (JVNIC), and numerous conferences, seminars, public consultations associated with Halifax and MFP developments.

2.5.3 STAGE II: JOURNEY 1: OVERSEAS FIELD WORK

The field research involved a four-month journey through MDC communities in June-September 1993, and a follow-up period in Australia in 1994, and resulted in a 'jigsaw' and 'snowball' sampling of what could be possible, collected in ten countries (United States of America, Canada, United Kingdom, France, Germany, The Netherlands, Denmark, Sweden, Finland and Australia).

These were funded by the Department of Geography, University of Adelaide, privately, and a small grant for a supplementary report on sustainability strategies and technopoles from MFP-Australia. **Database 4.1: Research Journey - Places and Learnings** outlines most activities, locations and what I learned from them.

I visited the sites of projected large, integrated eco-community projects such as Bamberton (Canada, 12,000 residents) and Ahmanson Ranch (California, 3000 households), and collected much material about their plans, but did not have the opportunity of seeing any functioning consciously sustainable ecocommunities above the size of s or Village Homes (Scotland, approximately 200; Davis CA, 240 households respectively). **Links: Confluence: Models for Post-Industrial Community: Plate 13 & 14: Findhorn Collages A & B.**

My preparatory action was to write seeking information and assistance in locating contacts and example of best sustainable practice to a wide range of Embassies and Consulates for North American and European countries. Then followed four generations of letters to these contacts , plus letters to other people or institutions recommended by colleagues, and another series of letters and phone/fax calls to participants of the EcoCity 2 Conference. Finally, I phoned Professor Peter Newman and Dr. Jeff Kenworthy of Murdoch University (Institute for Science and Technology Policy, special interest area car dependence and transit-oriented urban design), and asked for recommendations as to the best examples of sustainable, transport-related city practices.

They recommended a number of destinations, all of which I managed to visit: Granville Island Vancouver Canada; Toronto, Ontario Canada; Almere, The Netherlands; Der Seepark, Freiburg im Breisgau, Germany and Arabella Park, München, Germany.

Because it was uncertain what would have been accomplished by people overseas who were supposed to have implemented interesting 'ecological' strategies, the original search letter contained a broad spectrum of suggestions as to items of potential interest: **Figure 2: FRBI: Form Letter Extract.**

Destinations were then chosen according to perceived likelihood of learning something new on the basis that if an event has occurred at least once with good results, then it may well be an option for replication. By far the most helpful response came from the EcoCity 2 presenters, and a policy was followed of visiting (if humanly possible) the people who had expressed most

¹⁴Royal Australian Planning Institute.

warmth or helpfulness, as well as having something to demonstrate and being relatively accessible.

I learned early that most Western embassies had very little idea of what is going on in their own countries in the sustainability area, and while many were very helpful, sending general policy or strategy literature, their suggested contacts were very orthodox, such as ordinary departments of housing, planning or environment. While significantly ahead of Australian departments in ESD knowledge and activities, these tended not to be familiar with Ecological or Landscape Planning, nor with the efforts of intentional communities, with some notable exceptions such as The Netherlands, Sweden and Denmark. In many countries (USA, UK, Australia) these are apparently regarded as alternative, unscientific and irrelevant to 'real' planning, a bind similar to that of environmentalists, who have consistently and in the face of discounting and denial, provided the vanguard for and alerted scientists to, ecological issues, which have now become accepted and 'owned' by 'real' science. Only Canada referred me to human settlement ecologists (Universities of Calgary and British Columbia), others being found by word of mouth and personal contact.

The Dutch Housing Department and the German Department of the Environment sent me literature in quantity, much of it not in English, and the Dutch indicated many innovative, experimental projects, largely in the energy housing area, some of which I visited (Almere). The Swedish Government had a special department devoted to assisting foreign researchers in finding the contacts they need, several of which I was able to follow up. Finland, France and the United States sent lists of environmental organisations, and Norway did not respond at all. Morten Elle of the Technical University of Denmark, organised a detailed and coordinated ten-day tour of relevant projects and contacts in five areas of Denmark.

I initially developed research questionnaires by a process of 'brainstorming' elaborate checklists from my own knowledge of Urban Ecology and from my collections of ecological and sustainability principles. Soon after this I discovered the framework described by Boyden under the title "*Integrated Holistic Research*", (IHR) (Boyden 1984). Boyden's checklist approach affirmed the questionnaire I had just designed, and was seen to be valuable in the circumstances and also in practice, however IHR was primarily designed as a research tool for the Man and Biosphere Programme (MAB), and for studying matter and energy input/output patterns, and human living conditions (evaluating and comparing) single cities as resource processing entities rather than being attuned to design. There would be a need to expand it considerably to take account of the data likely to be collected at the micro scale (Boyden's full checklists are not

published in available references, and he expressed an intention to apply his framework to Australian cities himself, when I enquired). Also, since data gathering was made at many scales (individual, household, neighbourhood, housing tract, region, small city, large city, nation), a model for interpretation of my case studies clearly needed less generality.

I also developed a short, single sheet, eligibility-as-ecological-project questionnaire, more a thinking discipline than for data recording: **Figure 3: FRBI: EcoCommunity Short Assessment Sheet.**

Both questionnaires were taken to Fuzzies Farm, an small intentional community in the Adelaide hills, committed to bringing benefit by working on eco-social projects with the local community. The community members agreed to take me as an ordinary paying guest to work with them for three days, during which time I would interview them, and test out my questionnaires. The goal was to practise going into a strange community, participating in the ordinary work there (in order to establish trust while optimising penetration into their system), gleaning maximum information rapidly. The foundation residents of this community are a social planner/psychologist and an anthropologist, who are very self-aware and insightful, and they were most helpful in perusing my questions and making suggestions as to how to approach communities, what questions could and could not expect reliable answers when the time available is limited. On my return I was invited to attend community meetings weekly with the goal of assisting the process designed to implement their (considerable and well-developed¹⁵) theoretical principles in daily practice. This allowed me to build a deeper understanding of the inner functioning of this community, and to appreciate many of the forces operating in communities of this type and potential lessons they may have for wider society.

While overseas I visited many communities, including Cohousing in the USA, UK, Denmark and Sweden, and three neighbouring rural communities in Oregon USA (Cerro Gordo, Lost Valley, Alpha Farm); I attended or participated in a number of conferences, courses, Local Agenda 21 meetings (Southern California Region) and seminars. I also conducted interviews with an assortment of academics, authors, local government environment managers, soil and sewerage engineers and planners, Lord Mayors, civil engineers, policy planners and other professionals, architects, engineers and others in private practice.

¹⁵ The Fuzzies Farm Philosophy, while initially based on Findhorn (Scotland) was the most thoroughly evolved and debated of all the communities I visited, except Alpha Farm (Oregon USA) which was very similar: a radical, common purse arrangement, with a minimal personal belongings policy and an ethic of community service.

2.5.4 STAGE III: JOURNEY 2: AUSTRALIAN FIELD WORK

On my return from Europe I visited a number of Australian projects, including Robina, Gold Coast hinterland South East Queensland, a number of demonstration villages in the Brisbane area; Werribee sewage treatment farm West of Melbourne, again, Fuzzies Farm North of Adelaide, Sun Village (design stage), Queanbeyan, NSW, the Permaculture community of Crystal Waters (Conandale) and the nearby township Maleny, North of Brisbane, Queensland; Fraser Island Kingfisher Bay 'ecotourist' development¹⁶ off Maryborough Queensland; and in Adelaide, Golden Grove tract development, Rosewood Village, interview with Alan Hickenbotham (developer), the Northern Adelaide wetlands areas and Bowden-Brompton gravel pit stormwater management in medium density housing, amongst others.

In Adelaide I participated as an observer/participant in a number of projects such as the Halifax Project 1993-2000 (Cohousing group), the full set of public consultations on The Halifax, run by the City of Adelaide, and most of the public meetings run by the MultiFunction Polis from early 1992 until mid 1995, including meetings and follow-up of the New Haven project at Osborne in 1993-6. The Jerrabomberra Valley National Ideas Competition and subsequent activities took up a number of months in 1994 and 1995, including a work-in-progress major public seminar/workshop/consultation in Canberra at which I presented an initial content analysis, and an international conference in Brisbane on the Ecological City. I have also been peripherally involved with the Aldinga Arts EcoVillage, which is selling land in 2000 after 15-20 years of quiet struggle (150 households, semi-rural Permaculture farm, arts, shop front, community centre).

As described above, the Jerrabomberra Valley National Ideas Competition (ACT), the MultiFunction Polis (Adelaide) and The Halifax Project (Adelaide) represented three major areas of focus for background research for this dissertation.

2.5.5 STAGE IV: THEORY DEVELOPMENT

As a result of recognising that ecological approaches were inherently also approaches to complexity, and that to align with Nature one should have a working knowledge of how Nature actually works, further library research was done in these areas, the result of which forms the theoretical sections below. This work sought to link the philosophical underpinnings of eco-theoretical thought, an explication of the scientific concepts to which they and increasingly, planning professionals, often refer in vague terms ([Link: JVNIC description above](#)).

¹⁶ Enabled through winning a door prize at a Municipal Conservation Association Conference in Melbourne, 1994!

At the same time it sought to provide a credible explanatory framework that explains the efforts of ESD proponents in their 'alignment with Nature' behaviour.

The main tools for application of this work are a 'Fuzzy Sustainability Space', 'Traffic Light' indicator reporting diagram', the Unified Human Settlement Ecology Matrix, a Self-Referential Matrix and Questions for Designers by Criteria, and a Scale Scoper.

2.5.6 STAGE V: APPLICATIONS

The Opposing City West student project in 1997 was an opportunity both to test the Unified Human Settlement Ecology approach, and to work as a team leader with two architects well known for their creative and ecologically sound approaches. The process used was effectively a systems approach, and the Unified Human Settlement Ecology Matrix proved 'invaluable'¹⁷ for generating the data required for collection, and for later organising it into a document. A number of refinements to the model resulted, and it is recognised that this process is likely to continue with use in different settings.

Having developed and refined the Unified Human Settlement Ecology Matrix and other supporting tools, and having described their use and application, a selected set of sustainability and eco-development principles and strategies was collated, and sorted under the headings provided by the Criteria of Observation from UHSE. The selection sought a balance of emphases, as different institutions, individuals and groups tend to recommend the solutions with which they are most familiar.

The work was rounded off by briefly reviewing the collated strategies, and returning to the concept of transition, asking what do EPP heroes and euhemeri think is going to make a difference?

¹⁷ According to my co-leaders' and students' response to a questionnaire.

3 EARLY FINDINGS

3.1 JOURNEYS 1 & 2: PRINCIPAL FINDINGS (AT 10/1993)

- a. Implementers tended to specialise in one or two aspects of sustainability.
- b. Solutions were not wholistic or well integrated locally or were incomplete or of minimal impact in most cases. Most wholistic, integrated projects were still in the design stage, and those that were implemented tended to be small scale. Large projects were often retarded by politics, inadequate public involvement and unhelpful and secretive official responses to environmentalist questioning.
- c. There were formidable structural barriers to implementation of appropriate ecologically sustaining strategies; these urgently needed the assistance of public education and participation, highly prioritised, shared environmental goals, new institutions and enlightened government (all scales, especially local) intervention, especially in the areas of technical support and finance, effectively designed policy levers and planning regulations that can be seen to support espoused values directly.
- d. Countries where social capital (community scale), experimental housing and alternative energy were actively supported by government, especially national and local government, tended to display a wider range of projects and be further advanced in the implementation of ecological principles in human settlement development, and in public awareness of the need for this (Denmark, Canada, Germany).
- e. While flexibility in planning is desirable, and sustainability rhetoric sounds convincing, changes in plans often or usually represented a watering-down of Sustainability aspirations.
- f. A comprehensive model for research and education was lacking, and in a practical context, where site analysis and design were involved, a multi-scale, multiple parameter model could help: several models I saw were too generic or not wholistic or excluded biota.
- g. There was a significant difference between 'Sustainable Development' and 'EcoCommunity Development' (**Link: Table: ESD vs. ECD**), the main difference consisting in the long-term involvement of a community (with attention to the Complementarity Principle as described below – without so naming it), in the latter.
- h. The style of 'top-down' integrated development tends to be efficient but to my perception, 'soulless' (**Links: Plates 3, 5, 6, 17, 18 (Collages) MFP, Der Seepark, Arabella Park**). 'Bottom up' tends to have a more 'organic' ambience of **Plates 9, 13, 14, 15, 16: Soul, Findhorn, Overdrevet, Permaculture**).
- i. The central theme in EcoCommunity development was to demonstrate through intentional community building, that humans could accept their place within and dependence on Nature, and could attempt to 'live lightly on the planet', aligning with Nature and providing technical demonstrations of alternative approaches for wider application.
- j. A large project was likely to fail if the timing were not right, if some level of visible results were not rapidly apparent, if it received no government assistance, if it became a political fighting ground or did not have multi-partisan support or a powerful champion (a 'fire soul') (ild-sjæle), if its processes were not transparent to or were misunderstood by the public, and especially if it were perceived to be dishonest, economically wasteful, or if the media did not support it.
- k. We all need education on the linkage between long-term thinking, Surprise, multi-scale effects, multi-functional design, (negative) Incrementalism and achievement of 'Sustainability'; in particular, the economic (full cost) comparisons of sustainable and unsustainable practices, and the eco-impacts of different design choices: we all know what to do, but we need to convince ourselves that it matters enough.

3.2 COMMENTS ON SELECTED FINDINGS

3.2.1 LIMITATION OF SCOPE OF DEVELOPMENTS

In most communities, although a broad spectrum sustainability concept often underlay group aspirations, in practice there was a tendency to implement social or environmental strategies, but often not both.

In the more orthodox ESD area, apparently because sustainability was seen in resource conservation terms, there was a tendency to focus either on energy (for instance experimental housing in Milton Keynes UK [± 600 energy houses], Almere Netherlands, Village Homes [*first energy village*] and experimental developments in Davis California, Portland Oregon, Tübingen Germany, Vancouver and Waterloo Canada); materials (again, experimental housing using new or recycled materials or special resource-conserving design [*such as 'The Green Home' Waterloo, emphasising recycled'*], Canada); advanced insulation materials (Innovative Housing Conference: demonstration houses in Vancouver, 'The Healthy House' and 'The Energy House' Vancouver [*latter part of a series of demonstration houses supported by the Canada Mortgage & Housing Corporation*]); or transport (Almere The Netherlands, Freiburg im Breisgau Germany, San Diego California USA, Arabella Park München). Larger scale efforts, while multi-functional, such as those of Toronto, Almere or Calgary, tended to concentrate on the centre and major arteries (strategies such as dedicated expressways, multi-occupant lanes, transit interchanges, close public transport stops, park-and-drive, integrated light rail, and comprehensive covered or underground pedestrian systems, especially for Winter. Calgary, Berkeley and Davis had recognised urban ecological connections through the water management system, through the 'Yellow Fish Road' project, the 'Creek Critters' program and drain marking respectively.

Toronto's Strategic Plan is exceptional (1993), in being wide ranging, bioregionally based, strong on community consultation and quality of life indicator development, and addressing (*inter alia*) transport integration and passenger service, emphasising the underground city, decontaminating harbour-front soils, opting to be a WHO Healthy City, planning for biodiversity, commuter bicycle network, investigating a deep lake water urban cooling system and setting up an extensive network of wildlife corridors, and recreational and commuter bicycle paths to complement the public transport strategies.⁵ All this being said, it is still a sprawling city with

⁵ Including Tyres → pavers, car bodies → roof tiles, polyethylene for example bread packets → carpet; also passive solar features, argon windows, heat sensitive glass, closed system gas stove, state-of-the-art insulation sandwiches, computer chip for light sockets (auto turn-off); advanced, computerised temperature regulation, heat pump & furnace system; Swedish experimental washing machine and refrigeration technologies, water-conserving appliances & infrastructure.

many potential improvements (also see Canada Mortgage & Housing Corporation 1993; Houston & Ferguson 1991; Kenworthy 1991; The Municipality of Metropolitan Toronto 1992).⁵

Almere has a number of 'sustainable' features (multi-mode transport, energy and experimental housing, residential above shops, human scale, pedestrian mall, public art), but these all arose from the work of "three or four planners" (one doing a higher degree on the design of Canberra), with little or no community participation. Outside the exemplary centre, the housing is low-density. Conversations with locals indicated low public 'ownership' of the system, inadequate transport frequency and increasing levels of commuting by car.⁵

The less orthodox, intentional communities, had much higher integrative aspirations, including the social, but tended to be severely limited in scale and in the number of things they could implement at once, usually for financial or planning reasons (resistance to change of planning departments or local communities), or simply lack of available time. They often delayed implementation of significant aspirations, or were forced by local governments to implement ecologically or socially inappropriate elements (Crystal Waters). **Links: Criterion Community: The Formal Regulatory Sector; Confluence: A New Style of Development.**

3.2.2 DEVIATION FROM ORIGINAL PLANS

Structural barriers to reaching community goals long term are often externally imposed. For instance Crystal Waters Permaculture Village was forced into unsustainable subdivision by local government² (1964), with a 4km road through the property servicing residential blocks of 1 hectare. This caused dispersal of housing instead of the preferred clustering, ensured a much higher level of car use, made collective Permaculture gardens and site conservation planning a problem, and created an ambience of 'up-market rural blocks' as an initial condition, which detracted from community values and attracted people with retirement goals as much as communitarian.⁵

In addition, the Sociology of the likely buyers was ignored. Follow-up in 2000³ indicates amongst 83 block buyers, a population of 47 singles, with a number of lonely commuters stuck on the periphery of what amounts to a dispersed estate, belying the name 'village'. Building as at Findhorn EcoVillage designed for singles, in a tight, village setting but an easy walk to the

² Informant (the late) Stewart Sherwin, original resident (1964) and first inhabitant of the CW cemetery. Contradicted by 15-year resident, who attributes this to original Permaculture planner; comments on disastrous legacy in alienation ("like living on an estate") and undesirable need for motor vehicles (6/2000).

³ Régine Ruppelt, Permaculture Consultant, resident at Crystal Waters.

Community House, could reorient dispersal, promote community and save land. **Links:**

Confluence: Models for Post-Industrial Community: Plate 7, 14: Collages Metaphor, Findhorn B.

The overall description of the property as a Permaculture settlement was not in general borne out in actuality (courses are run there and two Permaculture consultancies). While these things were mentioned as disappointing aspects, a wide range of sustainable strategies was evident. A number of extraordinary, beautiful, often self-built, some cobb, or Alexander-patterned,⁴ weird (rarely uninteresting) houses had been built, some 150 home-based occupations were supported (1996). The communal atmosphere and the level of community participation at Crystal Waters were still manifestly more organised and committed than in the orthodox rural acreage, and individual residents in a few cases do make good, Permaculture-based use of their private patches. **Link: Plate 16: Collage: Permaculture.**

The Overdrevet community in Århus, Denmark, told a familiar story of the staging of intentional communities, with change of community drivers over time. The original group (15 years previously, now over 20) had intended to work half time outside and spend the rest of their time developing and maintaining their community resources, including food production and buildings. The financially-driven reality saw a second generation of residents working full time outside, and also for financial reasons, not being able to control who bought into the community, the market being limited. This had resulted in an influx of people who were interested in the social and communal aspects of the lifestyle, but who did not really care so much about the environmental. Thus, although the community had started with an exemplary and balanced spread of environmental and social strategies implemented, including self sufficiency in energy and most food, newer elements of the current group were not in favour of replacing the ageing windmill, but wanted to connect to the power grid instead, causing considerable debate. The residents were, however, very confident that they would reach a democratic (non necessarily consensual) solution, and were willing to accept whatever decision the community thus reached. **Link: Confluence: Cohousing: Plate 15: Collage: Overdrevet.**

Change of intentions is also often internally driven, as communards adjust to the reality they find. Danish academic cohousers told me they had had 'wall-to-wall' meetings in the early years, but ended up being driven crazy by them, so they had gratefully opted for a committee system once everything was bedded down.⁵ A group of planners, architects and others in Stockholm decided 1987 to design an EcoVillage to live in. **Table 1: FRES: Swedish EcoVillage:**

⁴ See below.

Adjustment of Strategies over Time spells out their discovery of a need for flexibility and to design for both social and ecological evolution.

3.2.3 FIRE SOULS AND 'BOTTOM UP' PARTNERSHIPS

The Danes at the Technical University of Denmark said that what was needed was a 'fire soul' (ild-sjæle, a word which appears across the Scandinavian language family) - a local leader with a 'fire in the belly', often, but not necessarily an activist with charisma, but someone who holds the fire of enthusiasm and persistence, having a determined mission to make a difference.⁵ This parallels the North American finding in management that 'visionary leadership' is critical to social evolution (Westley 1995: 401). One of Morten Elle's colleagues, Jeppe Læssøe, was conducting a study on social structures for sustainability, including the characteristics of 'Green Families' and fire souls, finding four main fire soul personality types, and defining the essential ingredients for social movements (including volunteer fire soul and followers).⁶ Green Families (a project organised by the Our Common Future Committee) can be seen as 'symptoms' of a green city.⁷

Elle himself⁸ is clearly in the fire soul mould, inducing major behavioural change in communities by integrating the work of the University, local communities and municipalities, using as a driver the circumstance that the Government had decreed that everything possible would be recycled by the end of 1994. Thus he, a civil (transport) engineer,⁹ was quietly moving across the Danish community housing landscape, awakening and enlightening volunteers, implementing integrated environmental initiatives and using recycling as a catalyst. In his spare time he was helping to write an encyclopedia! Checking back with him in June 1999 I found him Head of Department and supervising some 82 projects.

A nice example of Elle's work was at a 900-apartment low-income high-medium density estate (Blå Kilde Gårde), built in the bleak style of the 1960s. Elle introduced the community to recycling (metals, glass, paper, containers), helping them set up a comprehensive recycling centre on site, saving on municipal rates. Residents managed it, and brought their wastes and surplus goods twice weekly. Social opportunities escalated, the unemployable learned confidence, tending to move on to paid work, allowing room for others. Exchange areas were established

⁵ Morten Elle, & colleagues 1993, also (Elle 1995: 6).

⁶ This work was unfortunately not available in English.

⁷ Perhaps a suitable eco-social indicator.

⁸ Now Associate Professor, Institute of Roads, Transport & Town Planning, Technical University of Denmark, Lyngby, Denmark.

for unwanted white goods, furniture, domestic appliances and toys. Enthusiasm extended to the whole community as tangible results followed the new surplus funding. Drab buildings were painted; fifty percent of the unused car park area was reclaimed for childrens' play areas. A highly effective water saving competition was initiated, with small, community-building prizes such as group trips to the Tivoli Gardens, and big prizes such as trips to the United Kingdom, all paid for out of savings in water rates. A row of unused studio apartments was taken over for community use as a crafts outlet, a café, a book exchange and a clothing exchange. This was only one of several such projects Morten sent or took me to see at first hand (see **Plate 2: Collage: Blå Kilde Gårde**).

Another of Elle's colleagues, Birgitte Hoffman, was doing a PhD on project-oriented teaching she had set up in 1990, which compared environmental initiatives in schools in four dissimilar communes (regional government areas). These were designed, developed and implemented by the children under the guidance of teachers, using significant timetable space over a long period, and conducted under the combined auspices of the schools themselves, the local municipalities and the Technical University of Denmark, Lyngby: **Table 2: FRRRES: Danish Research (A): Framework**. Hoffman emphasised the political, non-authoritarian intent of the Danish education system - that the goal was not Individualism but to produce cooperative, collaborative individuals with a high level of social conscience, critical thinking ability and training in participatory democracy.

The diversity of outcomes was reflecting the local differences in response to the same instruction set. All were designed to offer service in the understanding and implementation of good conservation and recycling practices, of real benefit to their communities. Interaction through schools was seen as a gentle and pleasant way to involve people who really need help to participate in municipal activities. Goals included education, community development, local self-sufficiency, and community and personal capacity building. It formed the basis for the "*Quark*¹⁰ *Cooperative Programmes*" which aim for long-term change, reintegration of the excluded, elderly and children in community, the establishment of processes for public consultation which transcend top-down and bottom-up. The use of Ecology as a unifying theme was timely, and excellent since it affects everybody ("everyone has garbage").¹¹

⁹ Elle's own area of interest was the interface between technology and local community, the breakdown of community networks through supplanting their roles by government action, and the rebuilding of community through self-sufficient tasking involving intermediate technologies.

¹⁰ A small mythical character known to Danish children.

¹¹ The PhD Dissertation is entitled "*Garbage is Not Something We Talk About*" ("*Affald er jo ikke noget vi taler om*"): Rapport 2, 1997, Department of Planning, Technical University of Denmark.

Hoffman's findings (**Table 3: FRRRES: Danish Research (B): Outcomes**) included the conclusion that even local government is not local enough - environmental solutions need to be step-by-step (too much at once overwhelms people), and much more local (neighbourhood scale) - local government has only general knowledge. Schools are excellent community centres which can support integrated community-building projects. The community focus of ordinary Danish activities is very noticeable to an Australian, with the Municipality being traditionally much more involved in the provision of services such as education, health clinics, (gymnasias), and traditional bottom-up governance, implies a high level of citizen-Municipality interaction.

A large proportion of residents lives in apartment accommodation, and the existence of a community house or suite is common, along with the expectation of management of the property by resident committees, similar to the South Australian Co-operatives Program (SACHA¹²). The actual use of the communal facilities varies widely. Taxes on motor vehicles are extraordinarily high, so few Danes drive a lot or own cars, and public transport is excellent and well supported, including comprehensive arrangements for bicycles to interchange with bus and rail travel. A statement by a Dane that something is "ten minutes away" refers to a pedestrian journey, causing confusion and initial tardiness in Danes visiting Australia.

In the Australian setting the fire soul phenomenon is also apparent, with these committed leaders often working together as a couple or small group, supported by communities of various sizes, for instance Sun Village 2: 15, Crystal Waters (2-6): 200, Halifax Project 2: ±100+, Fuzzies Farm 3: (variable).

Time given voluntarily by intentional communities and the organised poor is impressive, and can potentially be catalysed (harnessed) through subsidised self-build systems or cooperatives extended to those of all incomes, as South Australia did until recently.¹³ This can make the difference between economic participation and alienation. Examples are *Habitat for Humanity* (as in Toronto)⁵, self-builds for LDCs (Ianto Evans, Cerro Gordo)⁵, LETS, cobb, strawbale and other self-build techniques available in Australia (for instance Anne McMahon SA, Christie Walk Adelaide and Buddhist Temple Whyalla, Ecopolis Pty Ltd).⁵

Community development, personal mastery and growth, self-confidence, food production, personal assets and employability are common spin-offs from such undertakings, a fact well

¹² South Australian Community Housing Authority.

¹³ Prof. Emeritus Hugh Stretton in the GT Sambal Oration 19/08/96 on Economic rationalism "The Poor Laws of 1834 and 1996" argued for a return to the housing arrangements under Premier Playford (SA), started during WW2: legal minimum wages were adjusted for local cost of living; housing was bought and sold without profit, under general price control; the bottom half of the housing market was profoundly affected, but not the private sector; workers had 30%

demonstrated by Danish examples and the large American Community Land Trust movement (see Institute for Community Economics 1982).

3.2.4 BARRIERS TO IMPLEMENTATION

The visits to EcoCity 2 authors revealed that many of the inspiring projects boasted of at the conference were having tremendous difficulty in being implemented, usually for structural, path dependent reasons as mentioned under 'Limitation of Scope', but also economic constraints, environmental issues or community attitudes, both within and outside the developer group. It was clear that the most effective implementation was in regions that widely supported the concept of sustainability (for example Denmark, Sweden), basing this on acceptance that there was a serious environmental-social problem to be addressed. Trying to act against the tide of public policy and business-as-usual, is difficult.

Many of the people I visited spoke of their efforts to implement demonstration projects, with a view to explaining to the public how to go about living lightly on the land, and spelling out ways to nurture the Biosphere by healing activities, good design, active caring and community development. They sought to show that it was not necessary to suffer massive losses in terms of income, lifestyle and convenience, as is often feared.

Very large projects like MFP-Australia, have path-dependent troubles too, but are also vulnerable to political manipulation. If large projects are not multilaterally supported, and especially if they are slow to materialise, they are very often lost, along with their potential lessons for us all, positive and negative. The MFP suffered this fate, being announced as a 30-year project, but was constantly criticised: "we have spent all this money and there's nothing to show for it." This, despite many far-seeing activities, and significant successes, as listed in **Figure 4: FRRR: The Good News – Noteworthy MFP-Australia Projects. Links: Project Failure (below); BP 5.1 Helsinki Paper: 'Other Points if Time'**. The MFP concept was seriously misunderstood, and tainted by politics.^y

I noticed in a number of cases in Denmark (Elle, Andersen in Lyngby, Marling and Olsen at University of Ålborg Institute for Development and Planning), a strong, practical and problem-solving approach to the implementation of sustainability which one could describe as 'barrier thinking'. Goals are clarified, then research is done to discover the 'why not?' aspects of solutions. Thus Morten Elle and his team had conducted a comprehensive series of 'Scenario

more disposable income; personal security was found to be aligned to worker productivity; the industrial peace record far surpassed that of the eastern states.

Workshops' with a wide range of citizens and decision makers, for the specific purpose of identifying barriers. The principal identified barriers to Urban Ecology were: existing infrastructure (sunk capital); lack of knowledge about ecological alternatives at all levels (technicians, contractors, craftspeople, residents); lack of communication between relevant authorities and exclusion of residents from development process by authorities; existing planning law, taxation and subsidy structures which provide economic and structural disincentives to ecological behaviour (Elle, Andersen, Drewes & Danielsen 1992: 8).

Table 4: RRES: Barriers to Urban Ecology lists these findings and amalgamates them with content from JVNIC entries. Potential problems and solutions for dealing with planners and developers in Australia, are discussed in later chapters. Links: Confluence: A New Approach to Development; Criterion Community: Formal Regulatory Sphere.

Many planners recognise real needs for training in Multi-Scale Planning and Landscape Ecology, especially if they are to keen conserve biodiversity (Peck 1998: 1-6, 21-2), and wish to attend training sessions if time allows. They particularly need support from their Development Plans, and proactive collaboration on urban development with their environment departments and strategic planning departments (Rounsefell 2000).⁵ Interviews with developers (Hickinbotham, Delfin¹⁴) in 1993 demonstrated great confidence in the commercially driven decisions they were making, including confidence that anything they were not implementing (including most

¹⁴ Golden Grove, Mawson Lakes.⁵

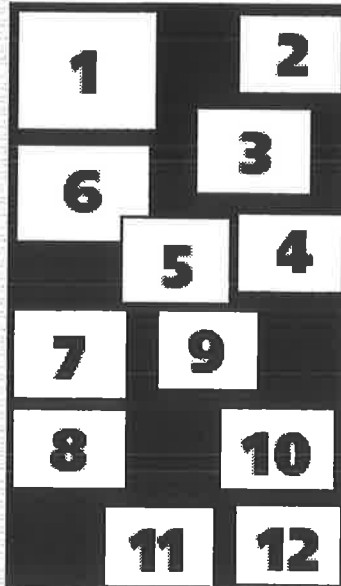


Plate 2: Collage: Blå Kilde Gärde - Key

Community Building Through Mutually Beneficial Activities in Established, 800-Resident, Low-Income Apartment Housing

1 Morten Elle in community recycling centre
Sundays and Thursdays, residents bring domestic recyclables to their centre, sorting into crates and onto shelves. The centre is a cheery meeting place and an opportunity for unemployed residents to gain experience running something real. They often move on to paid work. Self-management of waste has captured substantial funding from council rates, enabling many community projects. DK80,000 has been saved in water charges through demand management competitions with DK50,000 in prizes (eg trips to UK, Tivoli Gardens).

2 Reject white goods

Are either repaired and reused by others who need them, or sold as scrap.

3 Superseded kitchenware, household appliances & furniture

These are left on the shelving for others who may find them useful.

4 A child rummages in a box

Looking for a new toy.

5 Children's playground in an internal courtyard

Significant savings on municipal rates from managing their own recycling, are spent for the good of the community. This and the next photograph show areas formerly hard-surfaced and unfriendly, now converted into more amenable, child-friendly play areas.

6 Carpark reclamation

Few people in Denmark can afford cars, due to enormous Government taxes. Cars are well beyond the pocket of low income people. The municipal regulations stipulating a ratio of car parks to apartments therefore just result in large areas of wasted space. At Blå Kilde Gärde, 50% of these car parks have been reclaimed for the benefit of the children.

7 & 8 Atelier apartments with commercial outlet

Some of the unused apartments have been taken over as studios producing arts and crafts for sale.

9 Clothing exchange

Cast-off clothing finds a new life in the community clothing exchange. These exchange locations are fitted out by community effort, run by voluntary roster and the items are free to community members.

10 Book exchange and café

The central community meeting place is the café. The book exchange has a wide, ever-changing range of titles for adults and children, all free.

11 A new coat of paint

Some of the spare funding has been used to give the drab, 1960s buildings a face-lift.

12 Graffiti remnant

One small patch of graffiti has been preserved on an internal wall to remind the community of the angry mess that used to dominate their space in unhappier times.

Sources: Interviews, Field Visit, Author's photos. Background: Image 12.



effective¹⁵ eco-strategies and new social concepts like Cohousing) would not sell. It was clear that without specific educational and promotional effort by (and to) such gatekeepers, the buying public would not be aware of wider options. The Adelaide 2020 Vision (Strategic Planning Review in 1991, despite its significant 'public consultation', was little more than an issues-collecting exercise, changing nothing except to improve conditions for developers (Rounsefell 1991a: 83-4).¹⁵

Personal and institutional resistance are experienced by those attempting to implement well-referenced, eco-social strategies in human settlement practice. Even the MultiFunction Polis found it necessary to design a 'step-up project' (the New Haven development), partly to trial new environmental technologies,¹⁶ but also and more importantly, to expose the development industry to new ideas.⁵ See **Plate 3: Collage: New Haven: The MFP 'Step-Up' Project.** Managers reported tremendous resistance from the development industry.⁵ Their entrainment is definitely a key to sustainability.

The MFP handed over control of New Haven early, to the SA Housing Trust. Private estate agents, were engaged, who really had only marginal interest in the eco-social aspects. Osborne is not an area where sustainability would be expected to be a household word. Their concern was justified, as the last 50 of sixty-two planned buildings at New Haven are only now being constructed, the original dozen having sold slowly and having been promoted without noticeable enthusiasm for sustainability by the agents, except in their having been built to a price. The houses being built now have few of the sustainable features originally envisaged. None of the buyers (1997) had taken up the Green Mortgages option, which was too conditional, requiring 'geothermal' heating/cooling, solar HWS, integration into the site stormwater system and pre-wiring for computer access.¹⁷

From early 1999 Mawson Lakes housing packages have been advertised, with no mention of their (reduced but still present) ecologically sustainable features. A commercial decision was made that if these features were advertised the houses would not sell.⁵ Builders are assisting householders at Mawson Lakes in cheating on their energy rating scores.⁵¹⁸ Public ignorance is unlikely to be dispelled if sustainability is a 'shameful secret' or people feel coerced, and nobody is educated. **Links: MFP Plates (3,5,6); Criterion Indicators: Indicators & Benchmarks in Practice.**

¹⁵ Effective in the sense that an aggregate ecological improvement would be likely from the degree of change from current destructive practice..

¹⁶ New Haven was designed to test the level and type of such resistance, and to trial new energy, water management, social and financial strategies in preparation for a more radical development of larger scale (now Mawson Lakes Project).

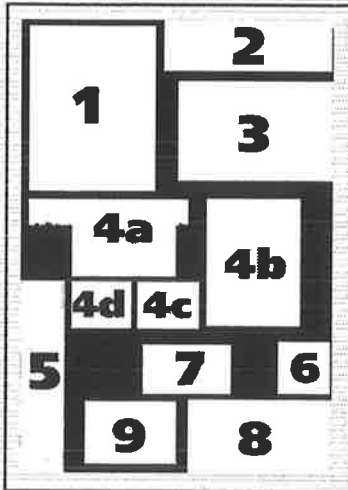


Plate 3: Collage: MFP New Haven - Key

1 A National Housing & Urban Design Competition

The brief asked for environmental sensitivity and innovative urban design. It was sponsored by MFP-Australia, BHP Steel (whose products designers were asked to use – not a very sustainable option), SA Housing Trust, City of Port Adelaide and Green Street.

2 Sketch from Winning Entry

1 and 2 both feature conceptual sketches by Woods Bagot, the winning team.

3 Educational Signage Announcing Project on Roadside

The innovative, mostly underground storm and grey water management and recycling system relies on the presence of an adjacent oval (also see (1)).

4a-d Illustrated Technical Papers were Produced for

Public Information

Energy and water consumption were to be reduced about 35% (4a) by the use of solar water heaters, passive solar design and in-ground heat exchange enabled by Green Mortgages negotiated with the State Bank (4b)(none was taken up). An underground, 40,000 litre stormwater system with overflow trench, delivers water to the treatment plant at night when sewerage demand is low; a revolutionary 'Sinkair' aeration system processes the contaminated effluent in batches (4c). On-site treatment combines grey and storm water and treated sewage effluent, ultimately using a gas-locked syphon decanter system (4d) and ultraviolet sterilisation, and is delivered through underground drip-irrigation to the oval and gardens, remotely monitored and managed by the City of Port Adelaide.

5 Self-Promotion of Project by MFP-Australia

The project, like the MFP itself, was largely ignored by the media, despite active promotion, press releases and a high-powered team of four PR people.

6 MFP-Australia Logo

The design is supposed to represent disks occupying a three-dimensional space.

7 Roadways as Stormwater Collectors

Roads (shared use, slow-ways), are gently sloped to the centre to collect all stormwater into the recycling system. Roads also have common trenching of utilities, which use shared and remote metering to save resources.

8 Streetscape

The houses are small, but built to a maximum price (\$120,000). Many are more or less solar oriented, but they are not world's best practice passive solar design. A ridiculous 'phallic symbol' houses mailboxes and dominates a small, brick-paved 'square' without shelter or seating. Agents sought to remove this 'community-building device', but residents opted to keep it when surveyed.

9 Communal Mail Housing: a resource-wasteful 'phallic symbol'

Design is poor, with no provision for parcels or winter conditions.

Comment: This project improves on several aspects of orthodox tract development, but its reliance on steel frames and air conditioning (inter alia) makes it far from sustainable, and the social planning was not at resident scale. Nor were the promised railway station elements implemented. Even this compromise was difficult to achieve, and resisted by the building/development industry.

Sources: Promotional material; MFP TODAY April 1994: 5; MFP TODAY August 1994: 5. New Haven Information Sheets: 2.1 "Site Sewage Treatment and Effluent Re-Use"; 2.2 "Sub-Surface Irrigation"; 3.1 "In-Ground Heat Exchange".

Background: Aerial Map of Le Fevre Peninsula (source MFP-Australia).

¹⁷ Information from Sue Oliver, Administration Manager, Business Development, Bank SA: letter to author dated 30/9/1997.

¹⁸ Confidential internal source.



Lifting the Vision

A NATIONAL HOUSING AND URBAN DESIGN COMPETITION DEMONSTRATING ENVIRONMENTAL SENSITIVITY AND INNOVATIVE URBAN DESIGN

Logos for MFP Australia, BHP Steel, and other sponsors.

NEW HAVEN VILLAGE

Key features and energy savings:

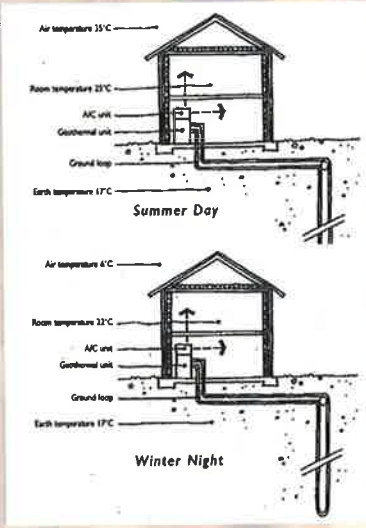
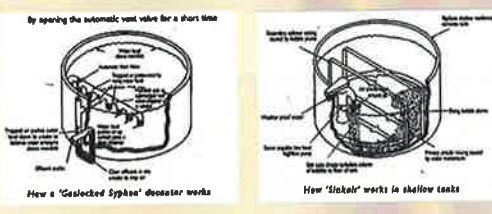
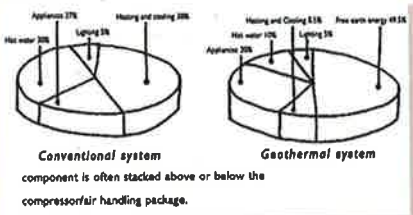
- Roofing energy:** Energy efficient solar panels... (saves up to \$800 a year)
- Water, power friendly exterior:** Low cost steel... (saves up to \$1000)
- Small use of water:** Waterless flush toilet... (saves up to 2000 litres)
- Use of the space:** Workability for the owner... (flexible design)
- Lowest energy footprint:** Reduced energy use... (saves up to 50%)
- Environmentally friendly:** Choice of everything... (green building)

THIS INNOVATIVE VILLAGE IS THE RESULT OF THE MFP AUSTRALIA BHP NATIONAL HOUSING DESIGN COMPETITION

MEPTODAY

New homes slash energy costs

Fourteen new models will be open for viewing at New Haven Village, a pilot project designed to exhibit MFP's innovative concepts in a marketable package.



New Haven homes of the future

MFP Australia inspired homes will be open for public viewing by the end of this year. The 12 display homes will be part of the showcase New Haven Village, a pilot project designed to exhibit MFP's innovative concepts in a marketable package.

The village, on Le Ferre Peninsula, the opposite side of the Port River from the MFP's Gillman site will be the first glimpse of the kind of surroundings in which Australians are likely to live in beyond the year 2050.

Geothermal heating, solar water heaters and provision for new information technology for home shopping, learning and similar activities are all part of the revolutionary new houses which will be situated in quiet, pedestrian-friendly streets.

Award winner

The village, to be developed by the land owner, the South Australian Housing Trust, will be based on a design by local architectural firm Woods Bagot which won the BHP/MFP National Housing and Design Competition.

New Haven's 65 low-rise dwellings are to be built by Alpine Constructions, Lin Wood Homes and Harding Homes.

Most houses and land packages are expected to sell for under \$120,000 with the energy-efficient homes being considerably cheaper to run than conventional dwellings.

The MFPs also negotiating special "environmental mortgages" through local financial institutions to encourage prospective buyers to move into the future.



3.2.5 THE NEED FOR AN INTEGRATIVE MODEL

The Urban Ecology theoreticians and practitioners I visited worked from eclectic lists of 'shoulds'.

Link: Confluence: Content: Pattern Repertoires. Although many items of new information had been collected and a working knowledge of the 'state of the art' of eco-social practice had been gained, with the exception of Permaculturalists¹⁹ it could still not be said that there was any coherent model which tied together all the collected knowledge people were using: a 'big picture' was required, at least for teaching and research purposes. Not all implementers hold and practice 'deep green' values (Bennett 1990: 6), or if they do, may be pragmatic in practice; often, like 'brown' environmental resource managers, they are forced to compromise by financial, community or institutional constraints.

The clarification of a model of an ecological approach to human settlement research and design thus became a priority, for education and application. A working definition for an ecological development perspective can be stated as:

An approach to human habitat development that takes a biocentric, wholistic, complex systems view of Society-within-Nature, and actively pursues and celebrates eco-social integrity, linking mechanism and meaning, at all scales from subatomic to biospheric, through all conceptualisation, communication, design, decision-making and action.

This is expressed somewhat more poetically by & Manning in "*The Ecology of Place*":

The vision of sustainable places or sustainable communities ... is explicitly human. Just as it seeks to protect, sustain, and restore the environment, it also strives to create livable, inspiring, enduring, and equitable places – regions, cities and towns where the quality of life and the long-term quality of human existence will be enhanced rather than degraded. Hence there is a unity of purpose in the vision of sustainable places that is at once environmental and ecological, as well as social and human in its orientation (Beatley & Manning 1997: 2).

Integrative strategies were flagged by the OECD as key requirements for their Ecological Cities Project Case Study, in 1994 (JVNIC). Recognition and proactive training of integrative generalists is a recommended notion (Yanitsky 1984: 35). **Link: Criterion Connectivity: Integrative Strategies: Synergy.**

3.2.6 ESD VS ECD

On reflection as to the difference between the top-down and the bottom-up in development, I came to the view that while they often overlap, and certainly differ politically (**Link: Hierarchy Theory**), and while ECD also includes much of ESD, the main difference in outcome lay in the

¹⁹ This, too, is an integrative, eclectic model.

emphasis on resources by the former, and on community (including fire souls) by the latter. I thus started to use the terms 'ESD' (meaning RSD/RCD/Resource, or Environmentally Sustaining or Conserving Development) and 'ECD' (Ecological Community/EcoCommunity Development) to distinguish them.

Few intentional communities or urban ecologists referred to their activities as 'Ecologically Sustainable Development', feeling the term had long been tainted and devalued by its use as a misleading marketing ploy by the development industry. 'Sustainable Development' in this context often means 'resource-sparing' or 'economically' when it says 'ecologically'. In practice, top down development thinks in terms of resource efficiency, from an economic or Market Capitalist perspective, with environmental and social considerations being interpreted and affirmed or denied in these terms: "In an ideal world this would be nice, BUT ..." "Who's going to pay for it? ... "There's no demand for it" (Delfin Lend Lease Consortium and MFP Australia 1997: 4;MFP Development Corporation 1993;MFP Services Company 1992;MFP-Adelaide Management Board 1991a). Projects such as MFP-Australia have access to the best theoretical information, and the intention to model leading edge strategies, but most of this material remains behind the scenes, only marketable strategies emerging into implementation.⁵ **Links: Criterion Community; Confluence: New Approach to Development.**

The differences (which are tendencies rather than exclusive categories) are summarised in **Table 5: CM: ESD vs ECD.**²⁰

3.2.7 PERMACULTURE, COHOUSING, ORGANICS & MIXED USE

The Australian system of Permaculture was familiar to interviewees all over the world (for instance Crystal Waters, Maleny and Fuzzies Farm Australia; Olympia Washington; many locations in California and Europe), often imperfectly implemented, and in practice often indistinguishable from the overlapping principles of organic gardening²¹ and elements of community gardening and urban/city farming and urban forestry (Ceres Environmental Education Centre Brunswick and Brunswick Community Gardens Melbourne; Gildea Resource Centre Santa Barbara, LA EcoVillage Los Angeles, California; Village Homes Davis CA, Der Seepark Freiburg im Breisgau, Swannsholm Community, Odense and Hundsted experimental housing communities in Denmark, Findhorn UK, Ålborg and Lyngby Denmark, Block 6 Project Berlin).

²⁰ A local government LA21 Committee found this OHP offensive, but the same committee was not taking a whole-of-city nor Bioregional approach to local sustainability, and ignoring both biotic and human communities in its planning.

Der Seepark was unusual in being a large, top-down development with strong community features, a community-built 'Ökostation', and educational/experimental 'Biogarten' and a substantial organic garden. Permaculture and organic methods are also often combined with Cohousing (Milton Keynes Rainbow Cooperative UK; Muir Commons Davis CA, Overdrevet Århus Denmark, Sun Village Queanbeyan) or 'sustainable intentional community' (Cerro Gordo, Lost Valley and Alpha Farm, OR). Permaculture and Cohousing embody wholistic, ecological principles, with different emphases (the former on self-sufficiency and aligning with Nature, the latter on community and socio-economic sustainability). Thus the concepts 'EcoDevelopment', 'EcoCity', 'EcoVillage' and 'EcoCommunity' can be understood to subsume both Permaculture and Cohousing, as well as local economic systems such as 'LETS'.²² **Links: Criterion: Landscape: Imitating Nature by Design in Landscape Planning: Permaculture; Confluence: Process: Cohousing, Permaculture.**

3.2.8 PROVIDING DEMONSTRATIONS

Every community I visited expressed a wish to demonstrate alternative lifestyles which at the same time met human needs appropriately and modelled respect for ecosystems in the design and development of their patches. Many (for instance Lost Valley, Alpha Farm, Cerro Gordo, Findhorn, Fuzzies Farm, Crystal Waters) were pursuing active educational and social service strategies in the wider community, by inviting visitors, supporting commercial outlets, often for their own produce combined with hospitality facilities, running workshops or holding cultural events in their facilities.

This is of interest, as David Pepper²³ told me that in his 12-commune environmentalist study in 1988, Thatcherism had taken its hold and fragmented the communards away from politically active, evangelising collectives, into frank Individualism: following profit-seeking models and aligning with mainstream society rather than seeking to demonstrate alternatives (Pepper 1991: 191-3 and personal communication). Pepper seemed to think that his communards had de-energised their demonstration role by slipping into the comforts of corporatised materialism.

Link: Criterion Feedbacks: Design & Implementation Issues.

I found in common-purse intentional community (as distinct from Cohousing) in 1993, that considerable effort went into generating income in the extra-community world, and this

²¹ *Bio-dynamics* is a subset of organics, based on the Theory and Methods of Austrian philosopher and healer Rudolph Steiner's *Anthroposophy*; Bio-dynamic Agriculture was introduced in 1924.

²² Local Economic Transfer System.

²³ Senior Lecturer in Geography, Oxford Brookes University; author of "Communes and the Green Vision", "Eco-Socialism: From Deep Ecology to Social Justice" and "Roots of Modern Environmentalism" (Pepper 1984;1991;1993).

certainly had a commercial basis, but for survival reasons, not self-indulgence or exploitation. Alpha Farm, for example, was running five local businesses including a café, craft-making, seminar and ceremony facilitation, local labour-intensive tasking and a postal run, in addition to being nearly self-sufficient in food. However they continued to live on a common purse, with severe limits on personal possessions, and were definitely in the business of demonstrating an alternative, ecologically responsible lifestyle. Cerro Gordo had similar aspirations without the common purse, but were a lot less organised and experienced a lot of community tension going back to its initial conditions 15 years before. Nevertheless they were very successful at promoting an educational message, and had idealistic non-resident members providing financial support through shares. They held regular open days and tours on site, explaining sustainable forestry and the Community Philosophy, and harvested trees at about \$US800 each. Other businesses were Bed & Breakfast, bicycle trailer manufacture and cobb house construction training.

Findhorn, also one of Pepper's subjects, had found it necessary to democratically elect representatives who could reach majority decisions quickly enough to represent the community in the business world, as the consensual decision model used in community meetings was too slow and inflexible. Findhorn makes a common purse income from hosting conferences at Findhorn and in Forres, selling food, gifts, clothing, jewellery, crafts, books and music at Findhorn and by overseas catalogue, and selling its knowledge in a range of areas including the ecological and personal growth, cultural (music: hosts regional symphony concerts), educational, spiritual and conference markets. Its most recent efforts in building a demonstration EcoVillage have become the centrepiece of regular, large conferences on this subject. The community eats together (vegetarian) and visitors may pay to join them or pay to live in and work for the community for short periods. **Link: Confluence: Plates 7, 13, 14: Collages Metaphor, Findhorn A & B.**

In other words, it is quite possible to be actively managerial and corporatised, and at the same time demonstrate quite radical forms of sustainable eco-social practice.

An important aspect of the Danish projects was the attitude of experimentation, supported by government and housing associations (for instance through startup funding or building the housing through a complex type of hire purchase). Perfection was not expected prematurely, and completed projects were publicised, while the Ministry of Housing and Planning ran a comprehensive building research and publication programme which (*inter alia*) undertook research into Urban Ecology and sustainability (for instance see Dansk Byplanlaboratorium 1992).

3.2.9 PROJECT FAILURE: MFP-AUSTRALIA AND THE HALIFAX

It is perhaps a testament to the difficulty of overcoming the path dependence of the existing system, and the persistence time required for implementation of non-orthodox developments, that the originally envisaged 'sustainable' urban developments associated with both projects will not materialise. The official dissolution of the MFP was announced in August 1997 and the Halifax Project became an orthodox, unSustainable Development in 1998.

3.2.9.1 The Halifax

Nearly a decade of dedicated collective work and negotiation with the City of Adelaide came to an untimely end when Ecopolis Pty Ltd,²⁴ the Halifax 'preferred developer', called in an apparently 'green' home builder (the same as had built New Haven), who then argued for the inclusion of a large group of orthodox engineer-builders to assist with the large-scale, urban nature of the project.

These people took over preparation of the final documentation on the grounds of having superior production technology, and Ecopolis had prepared the earlier submission. But they marginalised Ecopolis to an advisory role, wrote out many of the key ecological features and all the carefully-designed social strategies, and did not show the documents to Ecopolis before submission.²⁵ Another, unknowable dimension lay in some (not all) City of Adelaide planners who were not in favour of an innovative eco-social solution to the tender. The Council "could not in all conscience" give the project to such a non-compliant tender,²⁶ so awarded it to a developer prepared to put a few sustainable strategies into its relatively orthodox development. Ecopolis was subsequently invited to be 'advisers' to this group.

But in the 17 November 1999 week, the City of Adelaide held its first public 'consultations' on the Halifax Project for eighteen months, a sharp contrast with the early inclusive approach. The long-term, intensive input, and potential resident community were being squandered. A number of advanced but 'safe' sustainability strategies were presented, but most of the community, transport, materials, urban form, urban-rural and energy strategies had been compromised, notwithstanding vigorous community input at that time and the impression of an open ear given by developers and Council.

Only 10% of houses would have solar photovoltaic lighting, there would be air conditioners in all buildings (the developer does not believe it is possible to have buildings without air

²⁴ Architectural Company of Paul Downton, Co-founder of Urban Ecology Australia and designer of concept plans.

²⁵ Information from Paul Downton, Ecopolis Pty Ltd, fire soul.

conditioners, despite their non-necessity in places like New York, the UK and outback Australia²⁷); roads would transect the site; underground parking would be limited (despite remediation activities requiring soil removal to a great (many metres) depth across the site), ensuring that cars would have to be accommodated on site; brick veneer would be used, ensuring high embodied energy masonry; there would be no child-friendly attributes; no indigenous native plantings, no roof gardens; no meeting house, no educational facilities, one small public café for 250 households; no commercial premises under residential; no community scale recycling or other cost and energy saving activities; only one small cooperative of public housing. These compromises from the Ecopolis Plan were justified by the Lord Mayor (a former ardent supporter) on the grounds of local availability ("we already have a café in a nearby street"). Council had decided it wanted to receive normal commercial returns on the site, needing to cover the \$6million remediation. Ecopolis was disenfranchised, along with its community of 400 prospective buyers: a far cry from the radical, demonstration, Community-Titled ownership they had envisaged and promoted globally.²⁸

The last news report early in 2000, indicated that the developers and Council had abandoned the concept of EcoCity altogether, and The Australian national newspaper business section expressed relief that business could now finally proceed as usual:

The long-awaited development will be the city's largest residential project and is the brainchild of Pentroth, a local company with big plans ... was once earmarked as an "ecological city" ... high profile marketing agent Bernard Booth is marketing the first 28 of some 240 terrace homes, townhouses and apartments ... prices start at \$205,000 and go as high as \$450,000 (Dunlevy 2000: 40).

Pentroth, the project winner, originally claimed to be interested in conforming to Sustainability (ESD) goals, appointing an energy/ecology expert to the team, but not communicating with him again, sidelining him in favour of announcing a working relationship with Ecopolis Pty Ltd, and then dropping all pretence of Sustainable objectives. The City of Adelaide, writing it off, has learned very little from this project; Ecopolis and its supporters have learned a great deal. **Link: Confluence: A New Approach to Development.**

Downton is writing a PhD through the University of Adelaide entitled "*Ecopolis: Towards a Theory for the Design, Development and Maintenance of Ecological Cities*", near complete in 2/2001. Asked what his main learnings were from the last decade, his chief observations were:

- It is urgent to reinvent the processes we use for development.

²⁶ All the tenders at that stage were said to be 'non-compliant, some less than others.

²⁷ For instance the new wing on the Prairie Hotel Parachilna by Energy Architecture, Adelaide). Other buildings referred to in the Rocky Mountains Institute book '*Green Development*' (Rocky Mountain Institute 1998: 164-70).

²⁸ Winning considerable praise, recognition and several awards.

- The barriers we have found have not been funding, nor approvals; it is all about community: building and maintaining a functional community that will not accept the existing frameworks, defining its own conventions, getting things done together and keeping at it.
- One of the key strengths needed is persistence: commitment, resilience, keeping on working together for the long term for shared goals.

The related entities Urban Ecology Australia, Ecopolis Pty Ltd, Wirranendi Inc and EcoCity Development Pty Ltd, have moved on to smaller projects in the city, particularly the Whitmore Square Project, which is attracting a good deal of positive attention from Environment Australia and international experts (for instance Professor Herbert Giradet). Owner-builder construction is supervised by enthusiasts, mostly for love or LETS, including straw bale trainees. Christie Walk building is subcontracted to compatible tradespeople. See **Plate 4: Collage: Urban Ecology Australia**.

Ecopolis was also involved with the rural 'EcoCity Whyalla' project, which had very exciting EcoCity prospects initially, but was not maintaining appropriate support in 1999: the Local Government continued to miss opportunities to insist on sustainable features in planning approvals, even on the core site.⁵ The City of Whyalla put aside this 'EcoCity Core Site' next to a supermarket, which latter had already damagingly diverted business from the main town area. Despite \$330,000 to date (9/2000), including community consultation and education through a specially established display centre set up by UEA, the Council had no concept of 'EcoCity Whyalla' as a whole-of-city affair,²⁹ but a mild commitment limited to the core site only, and equivocally supported by the Mayor,³⁰ the city planners and the city's Economic Development Board.³¹ The Council spent \$18,000 on a landscape plan that ignores Landscape Ecology and contains only 30% indigenous native plants (a total of 61% exotics, mostly natives from Western Australia).⁵ The whole project has been shrouded in commercial-in-confidence embargoes, even to LG Councillors, in the last two years.

On followup 9/2000, the Mayor is bemused about how to progress the project, with a community angry about the money already spent. An unconfirmed report from a community proponent claims that the Community Title on the land has been secretly changed to orthodox residential and commercial titles. The EcoCity Information Centre has been de-funded and closed, and a recent 'Commercialisation Report' recommends worrying about ESD later, and getting on with filling the site with ordinary residential and commercial building.

²⁹ As I learned to my bemusement when asked to present ecological concepts to their LA21 Environment Plan Committee.⁵

³⁰ The Mayor told me (1999) he had no time for 'weird activities like public consultation' or 'weird-looking buildings'. A project he liked was a memorial to the 'silly old bugger' (a previous Australian Prime Minister, Bob Hawke famously

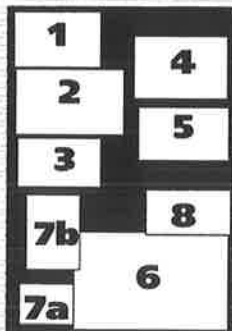


Plate 4: Collage: Urban Ecology Australia - Key

THE HALIFAX ECOCITY PROJECT

1 The Halifax Site, Central Adelaide

Now ready for its unsustainable future after the \$6m remediation used by the City of Adelaide to rationalise abandonment of the EcoCity concept. The chimney is the last vestige of the old Works Depot, the incinerator used for disposing of dead animals and Council wastes.

2 The Halifax Project Concept

Downton's concept drawing for 'A Piece of EcoCity', is well known globally amongst EPPs, in academic and special interest literature. The project was awarded the first international EcoCity Prize by EcoCity Builders in 1994. Its features included urban-rural linkage, 'earthcrete' construction, a Village square surrounded by housing, community and educational facilities; solar and gas power, native vegetation, self-build opportunities ('barefoot architecture' programme), Cohousing and Cooperatives, ecocommerce, rooftop and wall gardens, inter-building bridges, verandahs, balconies, decks, terraces and grey/storm water reuse. Work with potential residents began in 12/1993, soon after the proposal was mooted.

3 Part of Concept Model for Ecopolis/UEA Halifax Project

WHYALLA

4 EcoCity Core Site Whyalla

Sign promising environmentally friendly urban development, with energy, water and technological innovation and mixed use zoning. The background photo shows the core site terrain, with the Buddhist Temple in the distance: the first site building.

5 Straw bale Buddhist Temple in Progress

This typical, organic Downton design 'look' has been a problem in the 'red-neck' rural community of Whyalla. The Anglican Church concept design Downton did for the site is also very radical. The Mayor told me there was community anger at 'wasting so much money on the EcoCity', that he didn't know where to take the project, but he certainly didn't want any more of that 'airy fairy community consultation nonsense'. While easily identified by EPPs as a brilliant and feasible answer to reinventing the dying City economy, the importance of having a local champion in a position of influence, and of carrying the community with you, is underlined by this experience. The former Manager of the Arid Lands Centre for Urban Ecology could not have been more energetic and knowledgeable, but having local activist status, has tended to polarise rather than be accorded due respect from the local 'élite', even though she has now been elected to Council.

WHITMORE SQUARE ECOCITY PROJECT

6 Sketch Design for Whitmore Square Project (Successor to Halifax)

Across top-left, from left to right: Community House (for shared laundry, meals, meetings - later Stage); community gardens; Roman's Hut (tinted, straw bale building); Christie Walk (apartments). The tinted buildings are Stage I. From mid centre to bottom right, Stage II apartments; future Urban Ecology Centre. Plans have changed periodically as Backcloth conditions changed.

7a, 7b Roman's Hut

This building still lacks pergola and other finishing features, and is to house a man named Roman and his son. It was build mostly by volunteers, and the focus of a strawbale workshop. It has been found by other communities (eg Sun Village NSW, Andelsanfund, Hjortshøj, Denmark) that the construction of something small is a wise preliminary to going ahead with larger, more complex buildings: not a publically stated aim here, but the Halifax loss may be a disguised blessing.

8 Foundations for Christie Walk

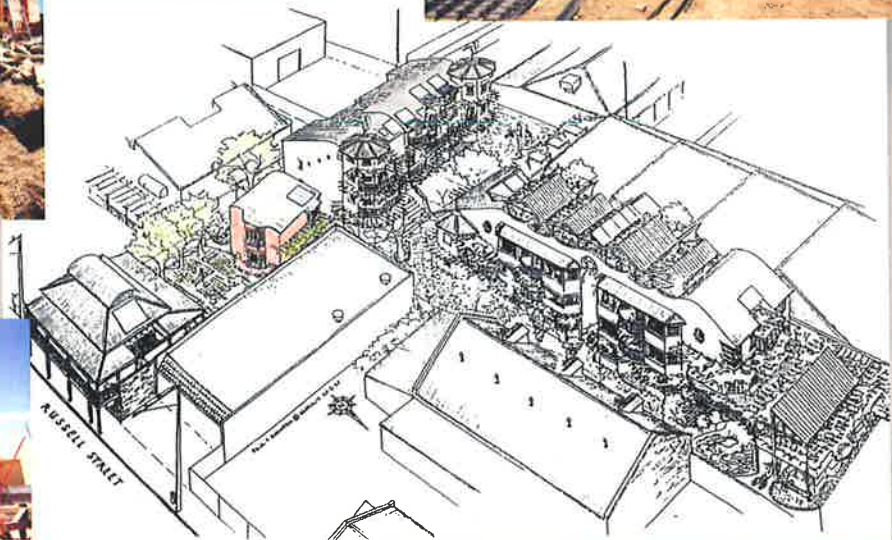
This site was dedicated by Kaurna Aboriginal elders in December 2000. It is owned by Wirranendi, a private Cooperative., and enabled by private investment and the Community Aid Abroad Ethical Investments Trust.

Sources: Interviews, Field Visits; Images 2 & 3 Downton; 6: Urban Ecology Australia literature; Author's photos.

Sources: Field Research, interviews & Project Newsletters 1993-2000.

addressed a heckler there on a public occasion some years ago.) This idea was canned, justifiably as the Mayor now agreed.

³¹ Statutory planner, City of Whyalla, and Mayor John Smith, 1999.



This level of enthusiasm will not draw tourists or help reinvent a dying city (population drop from 40,000 to 25,000 since BHP started rationalising its structure.⁵ Meanwhile, the globally unique cuttlefish breeding frenzy, another potential ecotourist event of international standing, supported by Tourism SA, is under threat from commercial fishermen, who successfully demanded that the emergency embargo on commercial cuttlefish netting, not be renewed, despite a population crash two years ago. Links: Confluence: Content: Pattern Repertoires.

3.2.9.2 MFP-Australia

The MFP aspirations are encompassed by the paper I delivered to the IFHP International Conference in Helsinki in 1993: **BP 5.1: MFP Australia: Helsinki Paper** illustrates visual aspects of the original urban development concept. See also **Plate 5: Collage: MFP Aspirations**. A glance at the headings and lists in this paper indicates the complexity and size of the project. It began in 1987 as a joint venture between Australia and Japan: a 100,000 population technopole in the Japanese style was the first concept mooted. It was to combine economic and leading edge, sustainable urban development, and hoped to implement both by preempting the economic activities of the 21st Century, taking a leadership role, and setting up a major clearing house for environmental information, also housing the Commonwealth EPA. Australia hoped for technology transfer from Japan. Japan was said to want to tap into Australian innovation, but some claimed a Gold Coast location was sought as a recreation hub (golf and sunshine), and there was a marked loss of Japanese interest once the project was reduced to 50,000 and located in Adelaide (Commonwealth of Australia 1990: 71-79; MFP-Adelaide Management Board 1991b: 2). There were many other factors, including the difficult, contaminated site of 2343 ha near Port Adelaide.³²⁵ The sad saga of its demise is illustrated through an annotated table of press clippings: **Table 6: FR: MFP Newsclips: the Bad News**. (Links: **Figure 4: The Good News – Noteworthy MFP-Australia Projects; BP 5.1: Helsinki Paper; Criterion Indicators: Benchmarking**).

The MFP had many failings, but its achievements were and are resolutely ignored (and apparently boycotted)³³ by the local media). It was as much about economic development as urban development (never publically explained or understood). It's disaffection was triggered by its being high-handed with the public consultation process, for which it was never forgiven.

³² It was claimed in the press that a visiting Japanese delegation was presented with an unfortunately amateur document in 'Japanese' that erroneously described the core site as a 'nuclear waste ground'.

³³ For Instance a three-week, self-funded visit by a group of 36 from the Shanghai Environmental Protection Bureau to fact-find about MFP catchment and trade waste management, had daily for three weeks MFP press releases ignored, apparently by Adelaide Advertiser editorial policy, while the event was widely reported in interstate newspapers (internal information, pers. comm.).

The project was subjected to negative political propaganda from all sides (for instance see Scott 1992; Smith c.1990;c.1991), focussing on economic matters (using too many consultants – it was actually structured small in order to use consultants and be more flexible) and perceived (and some actual) waste. It was publically executed, and nobody now dares speak well of it. Far more waste eventuated from the following, than from the appointment of corporate high-fliers on which the media focussed: politicising and reciprocal ‘white-anting’ between rival political leaders in SA; the risk-aversion of an early CEO related to a double-binding due to a dual-scale reporting structure (State, Federal); months of politically-inspired delays by the SA Parliamentary Works Committee; the replacement of the one (acting) CEO who had facilitated good progress (appointment over him of a good person but less productive, being unfamiliar with the project and slow to act, so the former resigned); high staff turnover, absence of positive feedback on efforts made (media blackout).

The MFP knew very little about Ecology initially, but *inter alia*, was engaged in modelling one of the first Total Catchment Management approaches,³⁴ and significant preparatory work at local scale. It was also one of the first to claim to use a ‘triple bottom line’ objective **Link: Helsinki Paper**. It intended to learn by cleaning up the contaminated core site, selling the intellectual capital. The intellectual capital that was developed by the MFP has been dispersed, its library archived and many of its files shredded.⁵ I can not discover the location of its Sustainability Strategy Database. The conflict between its urban development site and the presence of ecologically and commercially important mangroves, was resolved by shifting location. It was always a political football at State level (inter- and intra-party rivalry), semi-abandoned by its Japanese partners, and eschewed by activists for its inappropriate location and capitalist origins, especially its links with the defence industry (signal processing).

It spent a fortune on PR and media consultants, who consistently had a strongly ‘blokey’ approach to marketing. But rarely were the press releases reported.⁵ Most of its unsustainable promotional material, on glossy, clay-coated papers, were replete with interested-looking, carefully multi-cultural people in white coats or hard hats, pretending to be ‘doing things’, Asian women graduating from places of learning or peering intently down microscopes, and significant people hand-shaking each other and smiling excitedly. This type of presentation

³⁴ General Manager, Urban Development, Rod Keller, attempted to obtain the assistance of the Halifax Project fire souls, but were rejected disdainfully: Paul Downton has been consistently critical of the MFP as an insincere, ‘technofixing’, top-down concern, with low credibility and commercial aims. My observation was of a long trail of well-qualified, often idealistic professionals, who would invest energy and enthusiasm for about two years, but then move on, many in disappointment about lack of progress, lack of community recognition, political issues or incremental loss of Principle.

evokes derision in EPPs, who can only see phoney ESD aspirations, high-level support for Consumerism, even with a green face, and terminal hypocrisy.

The MFP reinvented itself with each new CEO, but especially in 1994 when it shifted from the Gillman core site, to its North-East extremity, around Technology Park and The Levels Campus of the University of South Australia. **Plate 6: Collage: MFP Reincarnation 1994** (following) maps this, and illustrates the type of promotion used. In the end it became the waste it was accused of being, because much of its considerable expertise and its innovative intentions were and are still being, thrown away.⁵ A well-kept secret in Adelaide is that parts of the MFP survive, unsung, under State Government joint venture, under the guise of Mawson Lakes, the now rather exclusive water-related development, and as New Haven Village. (**Link: Criterion Ecocycles: Benchmarking; Confluence: Content for the Framework: Pattern Repertoires: Plate: Mawson Lakes**).

3.2.9.3 Appraisal

For major MFP-scale projects, one would have to conclude that a dual-level control and reporting system is a bad idea, and that such developments must be protected from political and private (see Indicators below) interference, especially if they are trying to implement bold, new ideas and pioneer new types of economic activity. The fact of the project's cancellation, just as many of its investments in new-era businesses and technologies were coming to fruition.⁵

On the other hand, a genuine EcoDevelopment must involve the community in non-token ways. The Halifax community paused, licked its wounds, regrouped and moved on to similar but smaller things. The MFP was carved up for 'dinosaur food'. **Link: Criterion Indicators**. The Halifax project also went to dinosaur food. The community grew in persistence and resilience, if not in numbers. The Halifax Project and the MFP shared the objective of providing demonstration sites on the ground, to provide models alternative to conventional development projects.^{5,35} Both emphasised economic development, but at completely different scales. Both were learning opportunities, but both represented a massive waste of human resources, especially the MFP, not because of what it cost, but because of what was thrown away when decision-makers got cold feet or lost their vision or their influence. If a MFP-scale development could have achieved radical sustainability, it should theoretically have had a much greater ability to catalyse general change by virtue of its size and its greater exposure to the development industry, but there is no accounting for butterflies' wings.

³⁵ Paul Downton, interview May 1993.

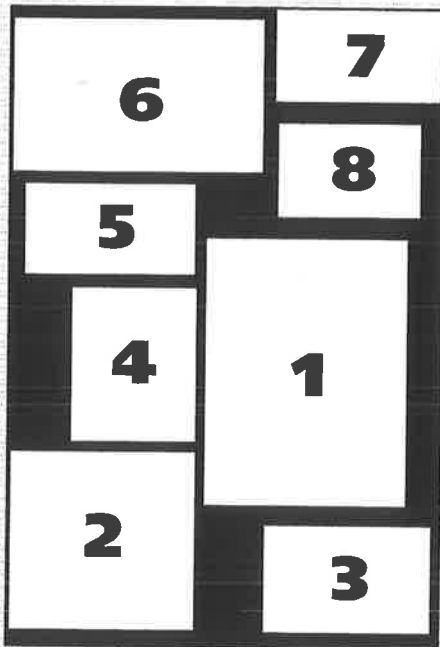


Plate: 5: MFP Aspirations - Key

Initial MFP concept sketches for the Adelaide site were done by an architectural firm in Sydney. A visit to their office did not reveal any new information. The sketches bore little relationship to the actual site.

1 Relationship of MFP Core Site to Adelaide

Note 'visual axes': source of derision and accusations of unreality: was a typical top-down attempt at intellectual Placemaking with no reference to community. (See Plate s 8 & 9). Note Technology Park & University of SA to East of MFP villages. Mawson Lakes is near this area (see Plate 6). Existing mangroves are dark green. Torrens Island is the location of Adelaide's main power supply. It causes thermal pollution of the local ecosystem.

2 Aerial Detail of Port Adelaide Area

Note swampy character & mangrove areas, of great concern to fishing industry and conservationists; many damaged already by levée building, industry & other activities. 1/3 of Adelaide's stormwater runs across the core site, stimulating an MFP TCM programme with all upstream Councils. Note curving Port River (New Haven located approx. at southern edge of subtended circle); Penrice salt pans on East.

3 Core Site: Levée & Samphire Character

4 Healthy Mangroves Port Adelaide Area

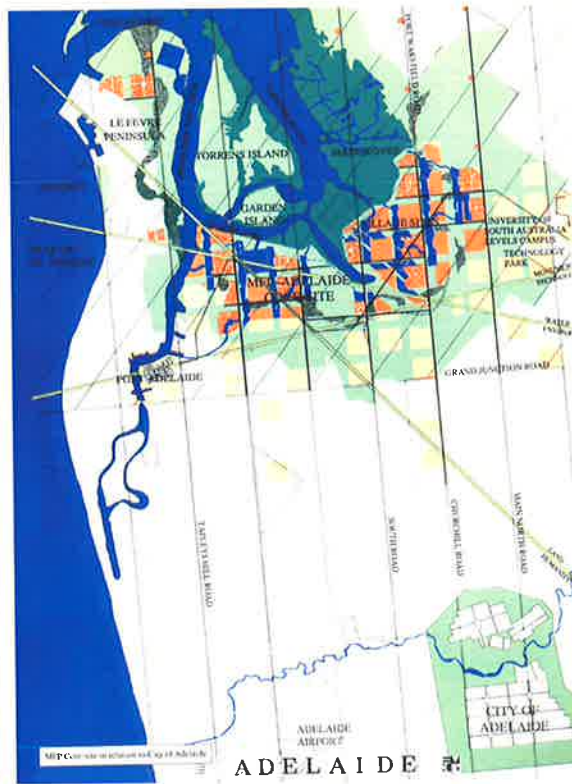
5 Concept Site Plan

Essentially a canal development: Downton was approached by MFP-Australia to assist with the 'ecological urban development': he disdainfully declined to be involved with a 'technofix' project. **Link: Plate 12: Collage: Site Plans.**

6-8 Concept Sketches

Demonstrate a neotraditional, 'New Urbanism' ambience; MFP-Australia supplied me with the Charter for the New Urbanism summarised in D&C 6.4).

Sources: MFP briefings, slides from MFP-Australia; Map: 1991 Feasibility Study: 2, NCPA Concept Development Report 1990 (quote).



The Halifax Community did not apparently involve the developer to a level of understanding and ownership that could have carried it forward. Finding a 'green enough' developer is no easy task. Part of the problem appeared to be that the developer did not have enough confidence to go against business-as-usual. Or if the outcome is viewed from above, it could be concluded that there were ulterior motives (for grasping control of the valuable city block for development), all along. It emerged early in the process that such blocks were normally allocated to developers in secret deals, and the local magnate was not pleased to have such upstarts intruding, creating considerable turmoil in Council in his efforts to reassert control. This provides a sad, cautionary tale for would-be EcoCity builders: the need for project fire souls to keep control of their projects while still engaging in unorthodox partnerships (top down + bottom up), and to be very, very careful and pre-emptive with politics and vested interests.

Plate 6: Collage: MFP Reincarnation 1994

The MFP had a an unenviable relationship with the South Australian media (see also Figure 4 & Table 6). Its attempts to market itself were sustained and comprehensive. Press statements were regularly released, but rarely printed. It sent speakers to many communities. It spent a small fortune on marketing, putting out its own newspaper (MFP Today), and co-opting a sympathetic journalist. None of this worked.

The article "*This was to be a city* " (Adelaide Advertiser 1998: 4) marked the end of the period initiated in 1994, when the MFP 'core site' at Gilman (diagonal stripes on map), was abandoned for a site further East (dark area), nearer Technology Park and the University of South Australia's Salisbury Campus. At the time of reorganising in 1994, there was very little discussion in the local media, all of it critical and certainly failing to discuss the environmental and urban development aspirations, and the reasons for their espousal by the original MFP Board. There was widely understood to be a media campaign of resistance to the project (politically motivated), and the fate of the project also became embroiled in the leadership struggle between Liberal leaders Dean Brown and John Olsen.⁵ In the absence of helpful media coverage, the MFP did its best to promote itself through its MFP Today publications, six examples of which make up the rest of the Collage.

MFP TODAY

A NEW MFP - THE PRESS REACTION

Firmer future for MFP plan

Japanese in 'praise' for our MFP plan

Fed, State agree on MFP plan

The science of cooperation Governments seal MFP deal

Government deal boosts MFP work

New-look MFP in relaunch

Bold new direction...

From page one
The MFP's new focus remains consistent with the project's overall objectives which are to:
• Develop national and inter-

US pioneer for conference

From page one
An interactive EXPO with
Commonwealth Minister for Schools, Vocational Education and Training

Expanded core site signals early start on housing

WHAT THE MINISTERS SAID

Senator Chris Schacht, Federal Minister for the MFP:

AUSTRALIA'S city of the future - the MFP - should begin being built within two years, following a major reappraisal of the project.

A joint statement last month by project which targeted the

use urban development as a private enterprise. *APRIL 10, 1994*

BETTER CITIES FUNDING FOR PROJECTS

Two major MFP projects, a \$40 million pipeline to supply recycled wastewater can be a catalyst for major urban development in Adelaide, the South Australian Premier, Peter Rasmussen, said today. The project involves the capture and treatment of stormwater from 74 hectares of Adelaide's

1
9
9
4



DEVELOPERS SOUGHT WORLD-WIDE WELCOME

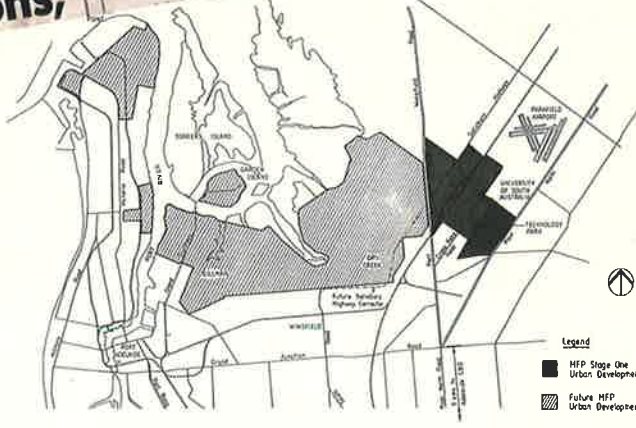
Significant response to MFP call

MFP Australia's worldwide call for a private enterprise partner to help develop its first stage urban development has attracted registrations of interest from more than 40 companies.

MFP Australia's chief executive, Ross Kennan, said the registrations, which include major international and national corporations, would now be assessed and potential partners invited to participate in a competition planned for the development commission for the

would be mixed use - the successful coexistence of commercial, residential and community facilities.

"Residents will live close to their work in technologically advanced industries and enjoy the best practice in all forms of urban living. It will be a world-class, multi-faceted development."



MFP CORE SITE
ADELAIDE, SOUTH AUSTRALIA

MFP TODAY

AN INVESTMENT IN THE FUTURE

BOLD NEW DIRECTION FOR MFP

"It's happening" - MFP Chief

"Suddenly there's an air of excitement about the MFP," says MFP Australia's Chief Executive, Ross Kennan. "The first projects are well under way and the whole concept is gaining prominence and greater public acceptance."

"Controversy has been defused by the successful MFP and the excitement is being fuelled by our innovative approach to both urban development and environmental clean-up projects."

Mr Kennan said business, community groups and the media had responded well to MFP Australia's new down-to-earth approach and concu-

Information industry employment opportunities at the heart of the first stage of the MFP, Mr Kennan said.

Mr Kennan said a start had been made on New Haven, a small scale village near the core site to trial some of the technologies for the first stage MFP.

International Inquiries
The leading-edge design and technology of the 172 lecture



4 MODELS AND MINDSCAPES

4.1 HUMAN (SETTLEMENT) ECOLOGY

4.1.1 WHAT DISCIPLINE IS THIS?

The challenge of a cross-disciplinary, 'big picture' dissertation is actually to struggle with the mass of information to the point where it can be presented in a useful form. If it is to be big picture, it must accommodate small pictures. If cross-disciplinary, it must translate in an internally consistent way across disciplines. Should it allow for an ecological approach it must also accommodate non-ecological approaches in order to discuss and interface with them, and because they exist (and in fact are still the dominant paradigm). It must deal with multiple scales in subject and context.

There is confusion about the nomenclature of this field, and it would seem that there is a certain amount of competition for territory in a new domain, but the confusion is not new. Certainly the term 'Ecology' can mean almost anything one wants it to mean, although its root, shared with Economics, from the Greek *oikos* a house,¹ is well known. The drift to this complex area is fed by graduates from an array of backgrounds ranging from the integrative disciplines of Human Geography, Planning and Environmental Sciences, through to such as Architecture, Sociology, Anthropology and Engineering. Similar subject matter (human settlement design and development) seems to be approached under the banners of 'Urban Ecology', 'Human Ecology', 'Social Ecology', 'Political Ecology', 'Transport Engineering', 'Civil Engineering', 'Strategic Planning', 'Project Planning', 'Applied Urban Geography', 'Ekistics', 'Landscape Ecology', 'Landscape Architecture',² 'Environmental Management' and 'Architecture (Ecological or Environmental Design)'.

'Urban Ecology', while recognising the urban-rural connection, risks limitation to the urban, but its meaning and intention come closest to the ecological approach referred to in this dissertation. The term 'urban ecologist' (according to Danish academics),³ includes two broad groups: those who practise intentional ecological community involvement, and academics who study 'ecological' human settlements (and are often also involved practically).

¹ Concise Oxford Dictionary.

² For instance the OCW Project we did with Architecture students from the University of South Australia was nearly identical to a project by the students of Landscape Architecture at the University of Adelaide, largely overlapped the work of the Community Arts Masters students who helped us, and was being dealt with in the real world by large firms of Civil Engineers and Planners (separately planning adjacent areas).

³ Prof. Gitte Marling, University of Ålborg 1993, personal communication.

Elle, referring to work in Danish by Andersen *et al*, 1993, and to earlier discussions by Agger, Gade and others starting in 1987-8, describes the general subject matter of Urban Ecology as "the natural and the human generated flows of energy and matter in human settlements", but identifies the difference between ecological and other solutions to environmental problems as "taking all relevant aspects into consideration" (integrated, coherent, comprehensive, holistic – 'helhedsorienteret') (Elle 1995: 1). A key point emphasised by the Danish Ministry of Environment's Consultative Committee on Urban Ecology, was that "the basis of Urban Ecology must be a specific place and its residents" (Elle quoting Miljøministeriet, 1994), and quoting another paper by himself and Jensen (1994), the difference between Urban Ecology and other environmental strategies is that the former is an integrated solution solving all eco-social problems in a specific place, while the latter solves one environmental problem in any or all places.

Elle goes on to describe a three-dimensional model which defines the "aspects of relevance". His model is a tool for assessing the sustainability of Urban Ecology projects, and his approach insists that Sustainable Development and retrofit involve awareness of both specific technical information and general education, adding information flows to those of matter and energy (:2). His 'scales' are single element, local-central interface and the 'inter-elements' of connectivity between them. His impact-oriented criteria embrace social, locational, process and structural elements (:3-5).

'Human Ecology' was a distinctive branch of Human Geography (Sociology) in the Chicago of the 1920s and '30s, and was combined with systems theory and presented as Anthro-Geography in the mid-1970s to 'mid '80s in small scale subsistence systems (Ellen 1982). This term has more recently implied the scientific study of humans participating in ecosystems (as in the ANU Department of Human Ecology), or setting up pathological pseudo-ecosystems at city scale, but has been hijacked by a Brisbane university to name courses in Domestic Science. It is still used in a number of centres overseas, although bearing little resemblance to its original meaning.

'Social Ecology' does not necessarily imply ecosystems. Applied Urban Geography is inherently (supposedly) of narrower focus (buildings, landscapes, transport systems, planning, engineering, sociology). 'Political Ecology' has been used by geographers "to elaborate multi-level, multi-sectoral, diachronic models in the past two decades ... as a way of differentiating their work".⁴

⁴ Personal communication Craig K. Harris, Dept. of Sociology, Michigan State University, June 1998.

Bramwell describes Ecology ('Ecologism') as a new political movement emerging from Energy Economics and anti-mechanistic (wholistic) approaches to Biology; a science-based, anti-democratic⁵ movement, but not inherently social-Darwinistic (Bramwell 1989: 3-4):

The ecology movement represents a new political consciousness and direction. It has been struggling to see the light of day since the third quarter of the nineteenth century ... came from the educated Western classes; thinkers and intelligentsia ... ecological ideas borrowed different political labels from time to time ... the two key shifts in mentality ... [were] ... in the biological and the physical sciences (Bramwell 1989: 3).

By definition⁶ 'Ekistics' is the most accurate term, including nature, humans, society, structures ('shells') and networks (Doxiadis, 1968: 21). However while it appears in current dictionaries of English, the name implies the structure and strategies which were specified by Doxiadis, and continue to inform the presentation of articles in the journal of the same name. The term does not appear to have caught on in Scandinavia or the orthodox planning communities of North America, Australia or the European Community generally, but is more widely referred to in the eco-city movement, particularly in Germany,⁷ (and perhaps in Greece?).

Ultimately, having discovered and appreciated the integrative work of Unified Ecology, and borrowing the settlement term from international jargon, I have rather tentatively come to call the field of my work Human Settlement Ecology, with or without the 'settlement', since 'human settlement' is a term commonly used in United Nations circles, but often refers to the large settlements of less developed countries rather than developed ones, and in any case, is not a term commonly used in Australia, and has a transient, 'tent city' character.⁸

The following section briefly overviews the development of Human Ecology.

4.1.2 HUMAN ECOLOGY: A BRIEF HISTORY

The human-environment interface has traditionally been the province of Geography, reaching its best known form as the Regional Geography of the first part of this Century. Modern American Human Geography emerged from Geology in the first two decades, although the unique work of Élisé Reclus, Lord Peter Kropotkin and George P. Marsh in the previous century in Europe, Britain, Ireland and the Americas (Breitbart 1981; Marsh 1864; Rounsefell 1991b) preceded this by decades. In 1923, University of Chicago professor Harlan H. Barrows, in a Presidential Address to

⁵ My experience with Urban Ecology and EcoCommunity proponents is that while these people would largely agree with Bramwell, they seek to specialise in Deep Democracy, and are definitely not anti-democratic. Their distress lies in the perceived disaster that has become of a once democratic system that has recently succumbed to Corporatism. They would have a cutoff around bio-lethal behaviours, though, regardless of democratic 'choice', resonating with Gould's "To allow, to forbid but not to require" of data (Gould 1981;1986).

⁶ Ekistics: The science of human settlements. Coined by CA Doxiadis, 1913-1975, Greek architect and planner. Greek *oikizein* to settle, colonise; from *oikos* a house (Macquarie Dictionary).

⁷ WZB Science Centre, Berlin, Prof. Udo Simonis, German Council on Global Change.

the Association of American Geographers, advocated a less physical Geography, which addressed adjustment of 'man' [*sic*] to 'his' natural surroundings, combining the virtues of Economics, Historiography, Sociology and Anthropology (Barrows 1923: 1-14). Ellen Churchill Semple, a geologist from the same department, taught a strongly physically deterministic Human Geography (human behaviour explained by geology, climate, height above sea level) which was known as 'Environmentalism' from the 1930s to 1950s.⁹ In the inter-war period, the same cauldron produced the 'Chicago School' of urban sociologists such as Park, Burgess, Adams, Evans and McKenzie (McKenzie 1967). A number of geographers such as Sauer, Barrows, Talbot and Aschmann did similar studies at the time. These workers developed the new discipline of Human Ecology from about 1915 to the late thirties, when Ecology as an organising principle, was abandoned for atheoretical 'Community Studies'.

Saunders describes a fundamental tension from the outset, between Human Ecology as a sociological discipline focusing on the city as an object, and Human Ecology as a study of process - a competitive, survival struggle between biotic elements. He refers to a 1938 critique by Alihan which argued for the obligatory inclusion of cultural processes along with the biotic in urban description, or alternatively, for regarding Human Ecology as the study of environmental adaptation at different scales - a general concept, not unique to cities (Saunders 1985: 71).

Subsequent work in Environmental Geography and Ecology has tended to overlap, the emphasis changing to ecosystem analysis, comparative primary biological productivity and Island Biogeography. Systems Analysis was applied in Land Use Planning, water resource management and Geomorphology from the mid 1950s. McLoughlin in "*Urban and Regional Planning: A Systems Approach*", used the language of complex systems and information theory, but his model was not user-friendly. He devoted his first chapter to the ecological metaphor, and particularly used the processes of evolution with adaptation to and of space to define a system, and competition as the driver central to change, :

One thing is becoming very clear: that man's [*sic*] life is intricately woven into the whole web of life on earth (:21, paraphrasing Wagner, 1960).

His astonishing powers have not enabled him to 'control' nature in any categorical sense; merely to administer much more profound shocks or disturbances than ever before ... the interlocked nature of earthly relationships ensures at least the possibility of more profound repercussions - often coming from unexpected quarters and with long delays. (:21)

... we are part of the planet's Ecology and we ignore this fact at our peril. (:22)

⁸ Sadly, having described my new business as 'Human Ecology', I find people assuming it was "something to do with bowels"! My next business cards will say 'Human Settlement Ecology' after all.

⁹Listserver.comm. Bryan H. Farrell, Dept. Env. Studies, University of California: sustainability-1@uts.edu.au.

This book is concerned with the aspect of understanding the complex systems of man's activities in the whole context of the planet's ecological systems ... there is an astonishing lack of detailed knowledge of the interdependence of living systems, or of the impact of human activity on established systems. (:22-3)

(McLoughlin 1969: 21-9)

The Chicago School of Human Ecology proved unsatisfactory because it attempted to generalise from local examples, trying unsuccessfully to predict for other cities on the basis of findings of patterns in others. The reasons for eventual dissatisfaction appear to have been a lack of scientific rigour, excessive use of complex and esoteric formulae, poor predictive capacity, limitation to philosophical and general applications, and a shift from Classicism in Ecology itself (and also in Geography) into Systems Analysis, just before ecosystems were conceptualised (Stoddart 1967: 521-523). At that time ecological entities were not seen as systems, so an opportunity was lost to integrate the two approaches. Others mention the tendency to law seeking and writing of complex formulae, inaccessible to the everyday planner & poor for prediction (Chadwick 1971: 183).

That the essence of complex dynamic far from equilibrium systems is indeed their unpredictability, had still not penetrated the Social Sciences, nor the concept of dynamic, rather than static equilibrium. The more recent understanding that prediction is (frequency) scale-dependent, and is only reliable when a system is up against reliable constraints (Allen & Hoekstra 1992: 34-5, 63-6, 114-5), suggests that developing 'constraint consciousness' would be a valuable activity, especially in the service of ecological indicator development. **Link: Hierarchy & Scale.**

The EcoCommunity Paradigm is different because it seeks CDS themata and interprets them through a local place filter. It does not try to generalise from one place to another, but emphasises knowledge of diversity and uniqueness, celebrating differences in people and place. It does not say that humans behave like ecosystems. It says that humans and their cities ARE ecosystems with all the patterns present in other ecosystems and special characteristics due to the local nature of human entities and groups.⁵

Some Chicago concepts are helpful if not fashionable, such as pioneer species, invasion and predator-prey relationships in the marketplace. As the conscious life of animals and the animal nature of humans have been revealed recently and affirmed through genetics, society may become more willing to consider its obligatory participation in the natural world (Birch 1995: 37-67).

Modern 'Urban Ecology' has tended to locate itself on the social democrat rather than the ultra-conservative side of Party Politics, and in particular is pitting its energies against Globalisation

and Economic Fundamentalism, at the same time as it is forced to participate in the real world of Development Economics and idealistic compromise. Its present incarnation as mentioned above, is consciously wholistic, having a rich mixture of sources including the social, ecological, environmental and economic, and of disciplines, especially including Architecture and Planning, Philosophy, Policy, Community Development, Conservationism, Ecology, Landscape Ecology, Intermediate/ Appropriate Technology, the healing arts, creativity; and sustainable food production (urban and rural), Agriculture and Forestry.

The 'ecological' view recognises the interdependence of all living systems, and acts accordingly; an 'environmental' view merely seeks to recognise the context of an entity: its environment, and (at best), the connections between the two.

4.2 CONCEPTS AND QUESTIONS

4.2.1 INTRODUCTION

This section speaks to the understanding that what goes on in the human mind must ultimately be the key that makes the difference. It addresses the need for and potential identity of an ecological model. Review of the literature on the modelling of complexity in human settlement and ecological situations led to an exploration of the nature of Quantum Theory, Complexity Theory, Hierarchy Theory, Evolution Theory, Fuzzy Logic, Q-analysis, Far-From-Equilibrium Thermodynamics, Catastrophe Theory, Ecological Economics and Unified Ecology, as relevant bodies of theory. As mentioned above, the language of these epistemologies is creeping into the vernacular of urban and community design, and these literatures themselves frequently refer to their relevance to ecological and social systems. There were many references in the literature to the inadequacy of linear approaches in a strategic, design and long-term planning context, but little offered to assist a comprehensive approach to complexity as such.

This section justifies the development of a conceptual model, sketches the general characteristics of such a model, and introduces the theoretical 'backcloth'¹⁰ from which later chapters will emerge.

4.2.2 THE NEED FOR AN ECOLOGICAL MODEL

I watched green spaces turn into malls, the smell
of orange blossoms turn into exhaust fumes ... we have to ask ourselves,
are we beneficiaries of progress or the victims? There's no point in being asked to
read my lips if the lips are not saying anything. That's called lip service ...
How do we best dispose of nuclear waste? By not creating any ...
I came because I care about the environment ...
It may sound square, and I guess I'm old-fashioned but
I want to put something back into my own society -
and right now, it needs all the help it can get.

"Remarks of an ecomaniac", quoting Robert Redford, The National Press Club, Washington DC, October 1 1990, edited by Gustav Berle in "The Green Entrepreneur".

Content of the Jerrabomberra Valley National Ideas Competition entries demonstrated professional familiarity with design for energy conservation and transit and walking oriented urban form, but most were poor in site truthing¹¹ and only five enquired the local endangered species question. General knowledge of ESD principles was very uneven and mostly poor, especially in the areas of energy generation, transport energy, policy, administration, land

¹⁰ **Link: Background Paper: Working with Vague Information: q-analysis.**

¹¹ Interpretation of design concepts to a specific site.

tenure, finance, employment and public participation. All but three ignored the (required) responses to other ecological issues like Total Catchment Management, and governance and social strategies were very poorly conceptualised beyond an almost universal level of concern for the encouragement of local participatory democracy (Rounsefell 1994c: 43-4;1994e: 23-4).

'Ecology' as used in the context of human settlements in this dissertation, always includes and assumes humans and their concerns as functioning parts of ecosystems. On reviewing works and manuals in current use for courses on site planning for Landscape Architecture and Architecture, it was evident that environmental concepts were normally present in Landscape Architecture, but not systematically organised, were scale restricted, and thin in social criteria (even though public consultation may be included in the design process).

Direct studio work with final year students at the University of South Australia in 1997, indicated that only those who had taken Urban Ecology as an elective had any real idea of sustainability principles beyond minimal energy considerations, and although keen to learn, most had no training in large site assessment and contextual relationships.

Planners often feel powerless (*vis à vis* engineers), may be 'confused by all the new Acts', or be 'far too busy' to push for change, where Development Plans are inadequate or developers need on-site education. Yet under this exterior, many have real needs for training in multi-scale planning and Landscape Ecology, especially if they are to conserve biodiversity (Peck 1998: 1-6, 21-2).^{5x} The Adelaide 2020 Vision Planning Review in 1991, despite its significant public consultation, was little more than an issues-collecting exercise, despite the production of some (invisible) background papers (Cole 1990;Crafter 1990;Rounsefell 1991a: 83-4).⁵

With Architecture, the use of the word 'environment' often implied 'built environment', and did not necessarily consider ecological issues at all, often referring to environmental management in a highly selective, incomplete, reductionist or engineering-oriented manner, with a strong bias towards a resource-valuing ethic and environmental¹² management, and largely avoiding user input.

The examples given under Table 4: Barriers to Urban Ecology, evidenced a general unwillingness to confront path dependence in the development industry, but beyond that, a lack of appreciation both of ecological connectivity, and once having achieved that, of both a structure for integrating ecological sustainability principles, and a set of strategies which attempt to align

with these principles. This dissertation attempts to redress this situation by clarifying a structure for such integration, and by exploring or describing many of these strategies through examples from field work or comparative listing of principles from the literature.

Fundamentally, we seek an ecologicalism that recognizes the inherent interdependence of all life systems. This demands, on the one hand, an expanded view of human impacts on the natural environment going beyond pollution to address more subtle, unpredictable, and harder-to-value problems such as habitat destruction, loss of biodiversity, and climate change. On the other hand, it requires an appreciation of the connectedness of all life systems, including human advancement. This focus on linkages and an ecological perspective leads to a more benevolent view of human activities and a belief in the possibility of Sustainable Development (Esty & Chertow 1997: 4).

The boundary between what is and what is not considered as relevant to a model, is the principal area of dissonance between the reductionist and systems paradigms, a struggle reflected in that between modern atomist/economic fundamentalists and pluralist/holists. While 'garbage pail' models are despised by ecologists (Allen & Hoekstra 1992: 292), and systems can often be represented by carefully selected key indicators (for instance the well-being of a keystone species), the emergence of severe social and ecological consequences from economic activities indicates the need to include these areas as relevant to any model of economic activity.

Bohm calls for awareness of the crises in every area of civil society and the biosphere resulting from the fragmentation wrought by atomism (Bohm 1980: 16-17) which has far-reaching implications in our search for underlying principles and their review:

... it is not an accident that our fragmentary form of thought is leading to such a widespread range of crises, social, political, economic, ecological, psychological, etc., in the individual and in society as a whole ... it is important and indeed extremely urgent to clear up this deep and pervasive kind of confusion ... in which [*the mind*] is generally differentiating what is not different and identifying what is not identical ... (Bohm 1980: 17).

However it is not good enough merely to make collections of separate entities and call it holistic. As will be seen below, interpretations of Quantum and Complexity Theories such as those of Bohr, Bohm, Chew and Prigogine attempt in different ways to explain reality through ordering principles, which reach out to make sense of apparent atomism at human scale, with universal connectedness as a fundamental truth, and spacetime being an emergent phenomenon rather than a fundamental condition. An affirmation of human community is embodied in the concept of human relationship as the core driver for a satisfying existence. The Ecological Paradigm invites us to be conscious of our ties and our metaphors, and invites designers to participate actively: not just to respect limits, but to celebrate the relationships with Nature and with each other.

¹² Environmental, not ecological. This claim is evidenced by the outcome of most human settlement projects, which in fact have very little or no input from the user, so that how the users will live and use the built environment is determined by the constraints and designs produced for them by decision-makers who apparently know best.

Mankind [*sic*] during the last nine thousand years has conducted itself like a pioneer invading species. These species are individualistic, aggressive and hustling. They attempt to exterminate or suppress other species. They discover new ways to live under unfavourable external conditions – admirable! – but they are ultimately self-destructive. They are replaced by other species which are better suited to restabilise and mature the ecosystem. If mankind is to avoid being replaced then the struggle against nature must cease ... With increasing understanding, increasing sensitivity towards internal relations, humans can live with moderate material means and reach a fabulous richness of ends (Naess 1989: 182-3).¹³

4.2.3 CHARACTERISTICS REQUIRED OF AN ECOLOGICAL MODEL

Having resolved that a better reference model was needed for organising the collected material, it was determined that an ecological model was required, informed by the three interwoven theoretical strands, eco-system, human system and complex system. Preliminary consideration¹⁴ of the characteristics required of an ecological model for apprehending, designing, developing, healing and sustaining human settlements or habitats, indicated the needs listed in **Table 7: CM: Characteristics Required of an Ecological Model**. From the table it is clear that what is required is a holistic, ecological systems model, which is also a general model as defined below.

Costanza *et al*, reporting earlier work by Holling and Levins, classify modelling approaches according to project aims, likening them to maps in their usefulness to navigation, while at best being a crude representation of a complex landscape (Costanza, Wainger, Folke & Maler 1993: 546-8). They emphasise that models should be used to inform, never legitimise policy decisions. Trade-offs must be made between the criteria of realism, precision and generality, and the assumptions behind many existing indicators have not been critically tested for these. **Table 8: CM: Purposes of Models** summarises these concepts.

The intended model is thus a general, conceptual, ecological model. A substantial proportion of this dissertation is concerned with the iteration, explanation and human settlement application of such a model.

4.2.4 THE APPLICATION OF ECOLOGICAL AND SYSTEMS CONSTRUCTS TO HUMAN SYSTEMS

... surely the mountain lion when he kills the deer is not acting to protect the grass from overgrazing. In fact, the problem of how to transmit our ecological reasoning to those whom we wish to influence in what seems to us to be an ecologically "good" direction is itself an ecological problem. We are not outside the Ecology for which we plan - we are always and inevitably a part of it. Herein lies the charm and the terror of Ecology - that the ideas of this science are irreversibly becoming part of our own ecosocial system. (Bateson 1972b: 504)

Over time there have been shifts between intuitive use of an Ecological Metaphor, objection to the drawing of analogy between human and ecological systems, and the acceptance of human

¹³ Founder of Deep Ecology.

¹⁴ Conclusions reached after reflection on my 1993 research journey.

systems as ecosystems themselves, nested in larger ecosystems within the biosphere - a key premise on which the Ecological Paradigm is founded.

Human communities and their settlements are now identifiable as being essentially biologically and ecologically based, complex adaptive systems, and as such, behave in ways similar to other complex self-organising systems. The literature demonstrates that there are characteristics of such systems that may be traced across the disciplines from organisms to the physical, social, ecological and economic. A description of such system dynamics is constructed in later sections on Subatomic Theory, Complexity Theory and Unified Ecology, and examples are given in support of this approach.

Nevertheless, the application of such constructs has in the past been questioned, sometimes apparently because human society is accorded special status above Nature, and sometimes on the grounds that naïve use of outdated science brings discredit to Environmentalism. For instance Goodin, arguing for a 'Green Theory of Value', and Lewis, claiming to support the environmental cause, both criticise environmentalists for undermining their case by recommending untenable or misguided lifestyle or belief systems (Goodin referring to New Age communality, hippie type dress or belief in tree spirits) (Goodin 1992: 82-3; Lewis 1992: 57).

Lewis invokes the tendency of 'eco-radicals' to use Ecological Theory to 'justify misguided social programmes', based on outdated ecological concepts such as stability, climax vegetation, preservation, the 'green lung' thesis, cooperation as Nature's standard mode, and misunderstandings of Geochemistry:

To analyse what is, in fact, a political and economic phenomenon in terms of an ecological construct - which even in its original context verges on a tautology - is to obscure the conflictive, interest-based nature of the interactions that perpetuate it. Workers are not species, and we can never hope to understand the complex social origins of a problem like unemployment by resorting to the lexicon of ecosystem dynamics. (Lewis 1992: 57-9) (criticising Catton's 1980 analysis of unemployment as 'niche saturation').

Lewis does not distinguish ecosystem analogy (the Catton analysis), from Ecosystem Science, nor come to terms with the ultimately ecological nature of human systems. While Politics and Economics carry a human stamp, they are by no means unique to human systems, where the key theme is relationship. Relations of dominance, flocking and competition for scarce resources, but also reciprocity, cooperation and nurturing, are ubiquitous throughout the natural world, including human society. Workers can indeed be considered as functional species, to the extent that they have identifiable patterns of needs, wants, beliefs, locations, habits, niches, habitats and identities differing from other groups. Again, humans' ability to manipulate their support systems does not excuse them from the reality of being subject to the processes of an indifferent

Nature. Nor do the human capacities for abstract thought and self-conscious choice mean these are the main drivers of their behaviour (**Link: Metaphor**).

Humans and animals individually have policies, energy budgets, needs, emotions, preferences and power relations. Some birds at least, have gift-giving rituals and collective arrangements, sharing various sorts of capital (such as body heat in the spectacled snow goose, structural and thermal capital in the shared dwellings of the sociable weaver of Namibia).¹⁵ Animals make decisions at many scales (**Link: Hypercyclic Systems: Decision Hierarchy**). Just applying the terms 'political' and 'economic' to problems does not automatically make them sacrosanct nor imply transcendence above the physical or biotic realms. Both are subject to systems of constraint and feedback and the general rules of complex system behaviour, and both employ ranges of strategies for implementing their particular purposes, including dominance and competition, and also cooperation and collaboration.

Furthermore, in claiming tautology, Lewis is paradoxically affirming that ecological description of the political and economic is saying the same thing in different words (justifying by self-reference), thus suggesting the compatibility and interchangeability of both descriptions. The dynamics, and not just the lexicon, surely apply to us, who share the biosphere with other entities. And tautology, in its guise of 'isness' and meaning, is shown below (Quantum Theory: Complementarity) to be the essential complement of every perceptual equation.

The denunciation of deep ecologists as clinging to old-fashioned scientific concepts is a point of greater merit, but these are not the core of Deep Ecology (an ecocentric Philosophy is). Deep Ecology is not static either (see evolution to Transpersonal Ecology, Fox 1995 648), and many of the 'old fashioned' concepts have been advanced or affirmed by later research (for instance static climax vegetation has become the 'mature' version of a dynamic equilibrium - but see work of Holling below), and the 'green lung thesis' has not been debunked, but elaborated and extended without the metaphoric name; cooperation as Nature's standard mode is not actually stated as an absolute, but as a desirable state for the human approach to Nature, and the Gaia Hypothesis has become scientifically accepted as Gaia Theory or Geophysiology, as long as the Scientism¹⁶ 'Geophysiology' is used in scientific contexts (Lovelock 1988: 11).

Problems will not arise from conceptualising human systems in their ecological identity, so much as from rigidly proclaiming and labelling ecological structures instead of using the Metaphor in

¹⁵ David Attenborough series on The Life of Birds ABC Channel 2, 17/1/1999: Episode 8, "*The Demands of the Egg*".

¹⁶ Scientists evidence an apparent terror of being associated with a 'New Age', mystical label. Interview with Lovelock, 5RN 1996.

partnership with the Science to obtain a grasp on how the whole system may function in practice.

... the conceptual language of biology. For some this was acquired via the analogical human Ecology of the Chicago School ... A few ... were beginning to absorb biological ideas independently and proved more flexible ... [Bates, 1953] ... managed to eschew both a crude functionalism and the superorganic by viewing Ecology less as a theory than as a perspective through which the organism could be regarded as functioning in an environmental context. Rather than adopting Ecology as an unanalysed slogan, using its concepts in a vague and generalised analogical fashion, some were beginning to experiment with explicit concepts as a means of extending the explanatory repertoire of Anthropology (Ellen 1982: 73-4).

Ellen, having been involved with Human Ecology in studying (small) indigenous communities in the 1960s-to-1980s time period, discusses objections and limitations to biological concepts. He lists the characteristic focal points of an ecological approach to Anthropology, taking the overall position that such a model has great importance and many merits (Ellen 1982: 75-9). His points include Monism (single system functioning), complexity (de-reification of culture, web model of causation), connectivity and mutual causality, process (interaction, relationship, multiple variables), populations as analytical units (identified by niche occupied), frameworks for description & analysis (new approaches; allows alignment of analysis of environment with culture) (Ellen 1982: 75-9). These are detailed in **Table 9: CM: Ellen's Ecosystem Approach to Anthropology**.

We need to integrate Economics, Psychology, Political Science and many other approaches, to study of human motivation in detail, but things are becoming urgent. Human ecologists claim we now need as never before, to be willing to face actively and work with our participation in ecological processes and their functions (on a daily basis, not just as unimplemented ideals). We are no longer talking luxury, but survival.

Problems need concrete solutions, in this sense they are always unique. We are not interested in probability distributions of environmental hazards, but in avoiding particular hazards. Ultimately we want to maintain conditions favourable for human life and wellbeing on the only planet we know This ... creates tensions with our accepted ways of thinking ... The recognition of site specificity is not an argument against theoretical generalization; this would be a misuse both of the heterogeneity of nature and of theory. The heterogeneity of nature is itself a major theoretical point, the starting point for understanding adaptation, diversity, distributions of organisms and strategies of production. (Haila & Levins 1992: 235).

Civil society will not respond appropriately unless it believes a problem exists (and the situation must thus be accurately and persistently reported by the mass media).¹⁷ We are wondrously creative at rising to occasions, if only we are aware that an occasion exists. Consumerism, destructive cross-subsidy and 'Growth-ism' must be confronted, or nothing will change. The use of systems thinking or 'synergistic thinking' in human community has many proponents, and is

¹⁷ For instance humans were recently reported to have destroyed more than 30 per cent of the natural world since 1970 with serious depletion of the forest, freshwater and marine systems on which life depends. Consumption pressure from increasing affluence has doubled in the past 25 years and continues to accelerate, according to a report from the *World*

believed by EPPs to be the *sine qua non* of effective action on sustainability. But it is important to distinguish between different types of systems approaches. For instance Giddens warns that, while accepting the functionalist interpretation of social interdependence as analogous to homeostatic or self-regulatory processes in organisms, this is relatively 'mechanised' as social reproduction goes, and that societies are so loosely structured as to make organic parallels a remote and far from unique description (Giddens 1984: 27-8). He distinguishes between homeostatic causal loops which govern social reproduction through the recursive effect of unintended consequences of action (that is, negative or constraining feedback), and reflexive self-regulation, whereby 'strategically placed actors' seek to control the overall conditions through selective information filtering (either through system preservation or by initiating change);¹⁸ that is, social engineering by information control, which would include present power politics, media concentration and the marketing industry. This is system Constraint, nevertheless. **Links: Organising Principles; Hierarchy Theory: Constraint.** A more important distinction lies in differences between low-parameter, predictable systems and chaotic systems. **Link: Chaos Theory.**

Giddens also mentions social and system integration as complementing these two entities in system reproduction. By this he means reciprocity in interaction (autonomy and dependence) between actors face-to-face, and between actors and collectives (where integration is across space and time in an integrated society).¹⁹ These distinctions are reminiscent of the individual-collective relationship of Zohar's social interpretation of Quantum Theory (Zohar 1990: 95 - see below), the individual-collective relations described by anthropologist Mary Douglas in her Group-Grid Analysis (Douglas 1982), and the basic psychological position in the systems-based communications Social Psychiatry model Transactional Analysis²⁰ (Berne 1972: 85-8; Rounsefell 1993a). Such approaches are compatible with an ecological systems framework for social and collective relationships, and in themselves represent examples of systems thinking. See **BP 5.2: Transactional Analysis as a Multi-Scale Model for the Social Sciences.**

The need to extend Systems Theory to include humans in the normative aspects of systems is emphasised by Wright,²¹ who reiterates a multi-dimensional conceptual space wherein the

Wide Fund for Nature, the New Economics Foundation, and the World Conservation Monitoring Centre at Cambridge (Paul Brown, "The Guardian" London, Friday October 2, 1998).

¹⁸ As facilitated by recent media concentration and threats to public broadcasting across Western countries.

¹⁹ 'Social Integration: Reciprocity between actors in contexts of co-presence.

System Integration: Reciprocity between actors or collectivities across extended time-space' (Giddens 1984: 28.).

²⁰ The Basic Position describes a person's concept of self with respect to self and others: I with myself, then I-you; this can be extended a cascade of nested positions, ...us (our small group), ...they (other groups), ...them (wider society), ...it (nature) (Rounsefell 1993a).

²¹ Then PhD candidate, Department of Architecture, University of Melbourne.

notion of sustainability is delimited (Wright 1995: 408-10). As Wright emphasises (after Loye & Eisler, 1987) in his 'Evolutionary Framework for Sustainable Settlement Management And Design', these qualities must extend to human settlement to support human well-being (Wright 1995: 408). **Links: Criteria Feedbacks, Indicators; Tool 3.7.**

But architects very often mean 'built environment', not 'ecosystem' when they say 'environment'. All too often, goals for simultaneous ecological and social well-being have been in competition.²² The essence of an ecological approach is to seek strategies to express a cooperative eco-social paradigm. For example Permaculture attempts to construct productive ecosystems by working with complex and known beneficial plant, plant-animal and human-biotic associations, and allowing for longer-term evolution and the emergence of new natural forms, the whole system being thought out simultaneously on ecological, biophysical, geophysical, social and economic bases (Mollison 1988).

Wright's definition of sustainability, adapted from Slocombe, 1990, is:

Sustainability is avoiding catastrophic change at the systemic level and sub systemic level while retaining the capacity for creative [*and purposful*] self organizing evolution without affecting the capacity of other similar, external, systems for self organizing evolution. [*Wright's insertion*] (Slocombe 1993a; Wright 1995: 408).

The elements of Complex Systems Theory are therefore spelled out below in some detail below. The systems analysis and 'cybernetic' approach associated with the *Club of Rome* and their associates at Harvard Business School (Forrester 1969;1971;1975;1994;1995;Meadows & Meadows 1973;Meadows *et al* 1992;Meadows,Meadows,Randers & Behrens III 1972) do not explicitly build thresholds, transitions or Catastrophe Theory into their models, although their software does allow their systems to 'crash'.^{23 5}

It is possible to argue indefinitely as to the congruence of detailed mappings between disciplines. These details do not constitute the appropriate realm of appraisal. What relates ecological, social, economic, climatic and other proto-living systems is that they all fall into the category of complex, multi-scalar, dynamic, far from equilibrium system, subject to self-organising principles that modify outcomes in reciprocity with environmental conditions. The key to the understanding, and ultimately to our response, is to comprehend the nature of these dynamics, to allow its webby, creative, evolutionary and chaotic metaphor to permeate our

²² It is commonplace in ordinary, bureaucratic, planning and industrial circles to hear the statement "it would be nice to take care of the environment BUT we can't afford to." It is becoming increasingly apparent that we can not afford NOT to.

²³ STELLA.

thinking and be represented in a re-written metaphoric structure. This dissertation can not do all these things, but does attempt a first step in that direction.

The advent of computers provides an opportunity to model human settlements more successfully in eco-systemic terms. While human settlements are inevitably eco-systems, Science is unarguably a tool of the associated values system. It is unlikely that more Science is really needed for the profound changes required of us humans in the looming eco-social crisis. Many now recognise that we are dealing with a crisis in values, not in our marketing.²⁴ As Bennett says, "When all or many of our modifications of nature fail, it is time to read the instruction" (Bennett 1990: 2).

4.2.5 HIERARCHY AND SCALE IN COMPLEX ECOLOGICAL SYSTEMS

According to Yeakley & Cale, Hierarchy Theory emerged from General Systems Theory in the 1950s and '60s, with Simon's 1962 description of space-time interdependency in complex system organisation being followed in 1963 by Ando *et al*'s mathematical modelling of the property of 'near decomposability'. This refers to the organisation of complex systems such that system components have similar frequencies or process rates at different system levels and so by frequency measurement, different levels are distinguishable. Many other workers, but particularly Koestler (1967-8) and Weiss (1968) laid the foundations for hierarchy in Complex Systems Theory, and Watt (1947) worked with ecosystems with a space-time frame of reference (Yeakley & Cale 1991: 204).

Hierarchy Theory was specifically adapted to Ecology by Allen & Starr in 1982 (O'Neill, De Angelis, Waide & Allen 1986: 75), and Yeakley & Cale ascribe theoretical development of 'this new paradigm' to O'Neill, Webster, Allen & Starr, Delcourt *et al* and Urban *et al*, and experimental development to Allen *et al*, Allen & Wyleto and Waterhouse, all in the range 1977-1985.

Ecologists have not been alone in their interest in time Hierarchy and Systems Theories. Coincidentally²⁵ an international group of geographers initiated a project in 1974 with the intention of exploring the application of time and the interface between the concepts of space and time in the Social Sciences, especially Geography, Urban Studies, Planning, Sociology,

²⁴ The recent groundswell of political reactivity in Australia, captured by the Pauline Hanson phenomenon with the cry 'you are not listening to us', has not resulted in a listening response, but a new political rhetoric of 'we ARE listening to you, and since we're right about everything, it must be you don't understand the great benefits to you of (globalisation, economic rationalism), why it's important for you to keep making sacrifices. We obviously haven't sold you our message properly, so here's the message again, and here are some offers you can't refuse that will persuade you to buy it'.

Economics, Psychology, Mathematics and Architecture. The output from this project took the form of a three-volume publication entitled 'Timing Space and Spacing Time' in 1978. The work of Hägerstrand and the Lund School were prominent in this very broad effort (especially time-space prisms, time allocation and 'time-space packing'). Holly in particular presented an analysis of the problem of scale in time-space research, describing a four-level hierarchy of space-time entities (Political economy - environmental structure [*social & built environment, not natural environment*]²⁶ - activity patterns [*behaviour*] - socio-psychological [*attitudes*], which he saw as nested ('each one a cover set for the one below') (Holly 1978: 14).

Again, in 1982, a small conference at Lake Como sought common ground between the disparate branches of the eclectic discipline of Geography, especially seeking to integrate the structural/functional and scientific/social aspects better, and subsequently published a book of related papers (Gould 1982c: 1,5). In her essay on 'Philosophy in the Construction of Geographic Reality', Couclelis described a rate-dependent hierarchy of reality levels and introduced the q-analysis approach, both expressing concepts similar to those of ecologists (Couclelis 1982).

Forman and Godron, whose work in Landscape Ecology bridges Ecology and Geography, refer to the pioneering C. Troll (c.1950). He claimed for Landscape Ecology a jurisdiction encompassing the horizontal and vertical physio-biological relationships of a region. Forman & Godron acknowledge that modern Ecology has taken over the vertical in spatial terms (plants, animals, air, water, soil within a spatial unit of relative homogeneity), leaving the horizontal relationships of spatial units for Landscape Ecology (Forman & Godron 1986: 7). They use the counterposition of a hierarchy of rate-characterised rhythms (geological time, centuries, decades, years, seasons, days, minutes) with a combination of natural and human-generated disturbances as the driver for heterogeneity and dynamic balance across single landscapes (Forman & Godron 1986: 274-286). They use a resolutely spatial approach to classification of a number of attributes, including levels of organisation, zonal climates, forests, vegetation and geomorphology, which seem to be understood as parallel hierarchies (Forman & Godron 1986: 477-84).

Systems engineers, General Climate (GCM) and systems modellers, ecological economists and most recently, political scientists and economists studying global change, have come to appreciate the importance of hierarchy and scale in dealing with global environmental issues (Gibson, Ostrom & Anh 1998; Gibson, Ostrom & Anh 2000). In Planning, 'fractal design' was

²⁵ Hierarchy theory would ascribe this inter-disciplinary synchronicity to being due to changes in higher level systems causing conditions conducive to the appearance of such knowledge. Q-analysis (see below) refers to this as a 'supportive backcloth'.

mentioned above in relation to JVNIC, and Peck has adapted Landscape Ecology principles to a multi-scalar land use planning approach and biodiversity conservation (Peck 1998).

The theoretical descriptions of Hierarchy Theory and Unified Ecology below, are largely distilled from three combined sources (Allen & Hoekstra 1992; Allen & Starr 1982; O'Neill *et al* 1986).

These three books, together with ancillary papers, most of which have Professor TFH Allen²⁷ as common denominator, are methodically and prolifically referenced and in small part refer to human and social systems as examples of many of the principles described. I shall refer to this constellation of authors as 'TFH Allen *et al*'. The work of C.S. Holling²⁸ and of Robert Costanza²⁹ have also been very influential.

Costanza and several of his co-authors have been associated with the Beijer International Institute of Ecological Economics of the Royal Swedish Academy of Sciences, The University of Stockholm, the Stockholm School of Economics, the IIASA,³⁰ ISEE³¹ and Biosphere Project ecologists such as Holling (for instance see Clark 1986; Clark & Munn 1986; Costanza *et al* 1993; Holling 1986; Thompson 1986; Timmerman 1986). Holling has also proposed that his ecological flow model ('Infinity Loop') can provide a theoretical basis for socio-economic and governance situations (Holling 1995: 20). **Link: CDS: Infinity Loop.** Costanza has historical linkages with The Natural Step (systems approach to sustainability). **Link: Criterion Indicators.**

4.2.6 CONTRIBUTIONS FROM THE 'NEW PHYSICS', PSYCHOLOGY, PHILOSOPHY AND METAPHYSICS

As consciousness of momentous social and environmental change widens, space research provides more answers and computers become ever more powerful, there has been a renewed search for answers to the big questions, perhaps to guide and comfort us in our instability: What is life? What are we all doing here? What is God? Do we need a Cosmology after Science or is Science a Cosmology? How did the universe start and how will it end? How old is it? Are there others? How does it all work? What is time? Can time run backwards? What is the universe made of? What is evolution? Is there a Theory Of Everything (TOE)? How do humans fit in? The theories mentioned herein are informed by this heroic quest: no less than the definition of a

²⁶ Note that in this list the economy is seen to contain the environment, not vice versa, and looking closer, the biosphere is excluded altogether.

²⁷ Professor of Botany, University of Wisconsin. O'Neill and De Angelis are Senior Ecologists at Oak Ridge National Laboratory, Oak Ridge, Tennessee; Waide is Research Ecologist at Coweeta Hydrologic Laboratory, Otto, North Carolina; Starr is an affiliate of the Institute of Environmental Studies, University of Wisconsin.

²⁸ Arthur R. Marshall Laboratory of Ecological Science, Department of Zoology, University of Florida, Gainesville, Florida .

²⁹ University of Maryland Institute for Ecological Economics, Centre for Environmental and Estuarine Studies, University of Maryland, Solomons, Maryland.

³⁰ International Institute for Applied Systems Analysis.

³¹ International Society for Ecological Economics.

new Cosmology (Mathews 1991: 11-14).³² The award of the substantial Templeton Prize for Progress in Religion in 1995 to Professor Paul Davies (who does not acknowledge a personal God but feels the "underlying rationality of the cosmos" to be a better term for that concept)³³ for his work in this area. His recent inclusion in numerous esoteric cross-faith group media discussions on religion-related subjects bears witness to Science's modern status.

Recent popular books by scientists working in these areas offer the intelligent public a general understanding of their authors' excitement in participating in the expansive theory-development period of a new paradigm. It is becoming clear that the concept of complex dynamic, far from equilibrium systems not only links the physical and the metaphysical, but is also emerging as an opportunity to re-unite the disciplines which have become so fragmented over recent decades. The name of the new game is 'synergy', and its currency is change. The ecological world is arranged as a time hierarchy. Frequency, synchronicity, pulsation, evolution, fields of influence, multidimensionality, relativity, complementarity and connectivity have new relevance. Virtual reality, nanotechnology, quantum computing, genetic engineering, hydrogen fuel technology and nuclear fusion are emerging as great potential modal shifters.

These concepts are not necessarily new. Bohr first enunciated his Complementarity Theory in 1927 (Holton 1988: 1015; Pais 1991: 438), and concepts of universal interconnectedness are no strangers to Eastern religion and the green literature more recently. There is a strong sense in researching this, of "arriving [back] where we started" and "know[ing] the place for the first time".³⁴ Mechanistically trained scientists in Mathematical Physics, computer modelling, medical research and Engineering are encountering evidence supporting many of the previously denounced claims and Philosophies of environmentalists, alternative healers and Eastern religions (Capra 1983: 331-2; Weber 1985: 218; Wilber 1982b: 2).³⁵ As Redhead said, ending his Tarnier Lectures in 1994: "... physics and metaphysics blend into a seamless whole, each enriching the other, and ... in very truth neither can progress without the other" (Redhead 1995: 87).

³² Mathews compares cosmology with Metaphysics thus: "Cosmologies depict the large-scale structure, origin and evolution of the concrete world". Metaphysics differs in domain: cosmology describes the actual world in outline only; Metaphysics describes the hierarchy of reality layers, including the actual as one, but transcending this to include such levels as abstract, possible, spiritual (Mathews 1991: 11)

³³ SBS Television: Talking Heads series on "The Search For Meaning" 11/8/96, which was introduced with the statement: "Science is about the facts of the world; religion is about the interpretation of those facts", a nice Complementary statement, as indeed is the cosmology-Metaphysics partnership (see Complementarity).

We shall not cease from exploration
And the end of all our exploring
Will be to arrive where we started
And know the place for the first time." T.S.Eliot in "Little Gidding".

³⁵ Several 'medical breakthroughs' announced recently by Australian medical researchers have been used in clinical practice for years by the naturopathic community.⁹ Again, at the FLAMOC '96 international conference on Fuzzy Logic in Sydney in January 1996, whose delegates were approximately 2/3 engineers, by far the most positively energised and interesting discussion followed a paper on Fuzzy Logic, the Law of the Excluded Middle, health issues and Eastern religions, especially Buddhism. Interestingly, a high proportion of delegates had direct or cultural ties with Asia and

The wholistic, ecological systems-based approach is often claimed by environmentalists, feminists and urban ecologists) as the successor to the scientific Newtonian/Cartesian, atomist, individualist, reductionist and techno-mechanistic approach, whose Cosmology still underlies the functioning of most of our socio-cultural institutions, despite increasing awareness of "the invalidity of its presuppositions" (Mathews 1991: 47).

Mathews in her chapter "*Atomism and its Ideological Implications*" considers in detail the differences between two metaphysical archetypes termed 'Substance Pluralism' and 'Substance Monism'.³⁶ The former, Individualism, "portrays the world as a set of discrete, logically and ontologically autonomous substances ... Its rival ... [*the latter*] represents the world as a single universal substance." (Mathews 1991: 7, 7-48). **Table 10: CM: Metaphysical Archetypes: Substance Pluralism vs Substance Monism** summarises her distinctions between substance-pluralist, mechanistic and atomistic world views, and compares them with the elements of Substance Monism.

The words 'Newtonian', 'Cartesian', 'dualistic', 'Classical', 'Reductionism' and 'techno-fix' have now taken on a pejorative tone amongst EPPs. Confusion exists as to the validity of mechanistic approaches: Mechanism may be 'superseded' as a Cosmology, (see Brody below), but Classical Mechanics itself is far from defunct. Yet the position it represents can be accounted for in a Complementary way, transcending polarisation. **Link: Complementarity Theory.**

Exclusionary (either/or) Dualism, in atomistic hands tends to lead to the discriminatory modern Monoculture, discounting its Complements and middle ground, rushing inappropriately from one extreme to the other or expending large amounts of energy and materials to keep 'stable' a system out of balance. The Eastern yin-yang concept accounts for both ends of a spectrum, with each extreme merging with and containing the other, affirming the excluded middle and the interdependence of the extremes (Járos 1995: 23). **Link: Subatomic Theory: A Synergy of Complements.** Ideological attachment to such extremes provides a backcloth for oppression, violence and social and political instability, which give a apparent stability at a larger scale:

Why this sudden unrest and confusion?
(How solemn their faces have become.)
Why are the streets and squares clearing quickly,
And all return to their homes, so deep in thought?

Because night is here but the barbarians have not come.
Some people arrived from the frontiers,
And they said that there are no longer any barbarians.

Eastern Europe, which may explain the uncharacteristic (for an Australian engineering meeting) level of comfort with metaphysical and mystical topics evinced by the audience.⁵

³⁶ Alfred North Whitehead refers to the distinction between two types of monists, "those who put mind inside matter, and those who put matter inside mind" (Whitehead 1967: 55).

And now what shall become of us without any barbarians?
Those people were a kind of solution.

(Watzlawick, Weakland & Fisch 1974: 19 quoting Constantinos Cavafy on ancient Rome – "Expecting the Barbarians").

Watzlawick *et al*³⁷ continue by quoting Jung:

Every psychological extreme secretly contains its own opposite or stands in some sort of intimate and essential relation to it ... There is no hallowed custom that cannot on occasion turn into its opposite, and the more extreme a position is, the more easily may we expect an enantiodromia, a conversion of something into its opposite (Jung 1952: 53; Watzlawick *et al* 1974: 20).

Atomism has been strengthened by Neo-Corporatism, which, while using a global, systems approach to its own benefit, has shifted the balance from representative, and especially participatory Democracy, towards a populist Individualism (emphasis on the family unit, de-emphasis of civil society as collective or community, disadvantage of the non-orthodox, opportunistic government by opinion poll), and reliance on (unifocal, reductionist scientific) experts and reduced role of public right of input (Saul 1997: 15-18). Paradoxically, while the Ideology prescribes the 'freedom' of laissez faire, the reality is that the system has moved onto another set of Attractors or constraints (in this case, an economic bottom line), and these are proving to be malign, as the collective wants of the rich are demonstrated to make inroads on the needs of the poor and the environment in very real ways (George 1986: 23-48). We thereby return to the Darwinian 'survival of the fittest' concept, which is actually the key to the free market system, rhetoric notwithstanding (as attested to by the increasing numbers of people in gaol, the increasing violence of police, legislation to facilitate calling in the military in Australian domestic incidents, the fire sales of public assets in favour of MNCs³⁸ and the steady de-funding of social services and education). It appears to be a new, global form of Social Darwinism.⁵

It is difficult to recognise one's own signs of embeddedness in a conceptual mould, requiring attention to both language (direct and metaphoric) and context: a preoccupation of Niels Bohr (Honner 1987: 1-2), and later David Bohm, who experimented with a verb-based language ('the rheomode'),³⁹ as a re-visionary support for a new process-oriented concept of reality (Bohm 1980: 10-11, 27-47). Even Prigogine and Stengers are taken to task by Pred & Pred for commitment to their Classical training: their language of the active voice (subject-object dissociation, withdrawn perception, decontextualisation, detachment); their Atomism (building complexity from basic units); the limitation of enquiry to the tangible/macro/observable; and their discounting (by

³⁷ Family systems and problem formation and resolution theorists.

³⁸ Multi-National Corporations.

³⁹ **Link: Criterion Rheotics.**

claiming randomness of outcome) of the intangible, the local and social, and especially, power relations (Pred & Pred 1985: 462-5, 474). Thus a complex systems approach does not necessarily imply Substance Monism. A reminder to account for intangibles is a gift of Quantum Theory for human settlement conceptualisation, through the medium of Bohr's Complementarity Principle.

Feminists refer to this phenomenon in their area of interest as 'gender blindness', flagged by gender-discriminatory verbal expression. Demanding gender-neutral language as one of the corrective strategies is a consciousness-raising exercise which is perhaps necessary, but not sufficient to change the underlying conceptual position (it creates backlash, as a core paradigm is under challenge).⁴ Transactional Analysts speak of 'contamination' of the Adult (rational) Ego State, either by the Parent (family or cultural prejudice) or the Child (emotion) or both (Erskine 1997: 57, 158-161).⁴⁰ Never before has blind Ideology had such technology-enhanced destructive potential, thus a process of ideological consciousness raising and demonstrations of implemented alternatives are seen by urban ecologists as high priorities.⁵

⁴⁰ I have come to this view through listening to the self-centred and ungenerous attitudes expressed by many (not necessarily all) well-off people who are participating in the competitive system and winning at present. For instance a distressingly broad support for mandatory sentencing, the view of Aborigines 'well too bad they lost the war, they're hopeless alcoholics anyway', and the attitude of the present Australian Government that all jobless are 'bludgers' and should be made as uncomfortable as possible until they can be forced into a 'flexible' workplace that can probably not meet needs for decent survival.

4.2.7 SUMMARY: CONCEPTS & QUESTIONS

This section explains why this type of study was thought to be necessary, and introduces some of the concepts, such as time hierarchy, ordering principles, emergence, and connectedness, which will be needed later.

Many of these concepts are now used in human settlement design, but in some literature the use of Complexity Theory terms displays ignorance about their real meaning. Complexity and Systems concepts are not really being implemented in human settlements nor in policy. They are in Economics, but without appreciation that a complex system can never be free of constraint: the Attractor just changes (**Links: Chaos Theory; Hierarchy Theory: Constraint**). Demonstrations at the least, are required to overcome the barriers or 'path dependence' of the human settlement development industry. So is appropriate public education and promotion, and mass media assistance (albeit presently unlikely).

If a comprehensive model is required to enable people to think coherently about the subject, its style should be 'conceptual, general', and models should be used to inform action, not legitimise it. A list of desirable attributes for such a model is presented.

An argument arises when a generic model is proposed for systems which have traditionally been regarded as different in kind. Examples of such argument are presented, which focus on supposed differences between eco-systems and social systems, human systems and complex systems in the detail, but this is the wrong scale for argument. We are discussing the underlying system behaviours, constraints and other organising principles, not whether an animal has a policy nor whether human systems are like ecosystems. EPPs are claiming that humans in their settlements are ecosystems. Having accepted that, we need to reinvent our metaphors to match, as a key strategy for 'aligning with Nature'.

The subject of the complex structure of ecosystems is initiated through a short history of ecological Hierarchy Theory, and the concept of time hierarchy introduced and briefly traced across Ecology, Landscape Ecology and Geography.

4.3 BRIDGES FROM THEORY TO PRACTICE

4.3.1 INTRODUCTION

The Ecological Paradigm is emerging out of two broad scales of approach to ecological knowledge: the (usually) simple number, subatomic/ quantum/ relativity/ energy realm, which has a strong relationship with Physics, Thermodynamics and Philosophy (Ontology), and the macroscopic-biospheric scale, which includes the epistemologies of Unified Ecology, Hierarchy Theory, and their expression through medium number systems and such mathematical approaches as Chaos Theory, Q-analysis and Fuzzy Logic. The latter demand special mathematical consideration due to their complex connectivity, and the Mathematiques mentioned provide a pattern for interpretation of ecosystems, biological and social systems and some complex inorganic systems. The key here is the word 'pattern' and the key concept 'possibility', not 'prediction' nor 'probability'.

4.3.2 THE EMERGING SYNTHESIS OF HUMAN, ECOLOGICAL, SYSTEMS AND COMPLEXITY CONCEPTS IN SCIENCE AND PRACTICE

While natural and social systems, including human settlements and humans themselves, are examples of far-from-equilibrium, self-organising, dissipative, complex dynamic systems, and there exist a number of bodies of reductionist work on specific aspects of Complexity Theory, its integration and application in Human Ecology remain sparse, but interest is growing.

Does the rhetoric actually represent a linkage with formal Science? Could it be seen to be congruent with the latest understanding of the nature of Reality? To what extent could this theory usefully be integrated back into practice at either scientific, political or metaphoric level?

What I found was a tentative reaching out across a number of orthodox disciplines to attempt application of complexity concepts over the last 25 years, since linear thinking is now accepted (by all except decision makers, it seems), to be inadequate for complex systems, which social and eco-systems manifestly are. I also found a large number of references in the literatures on Mathematics, Chaos, Complexity, q-analysis and Quantum Physics, to the applicability of the work to ecological and social systems (for instance Abraham & Shaw 1992; Asmussen 1986; Atkin 1981; Barnsley & Demko 1986; Bohm 1980; Briggs 1992; Casti 1994; Gaspar & Gould 1981; Gleick 1987; Gould 1982a; 1993; Honner 1987; Johnson 1981a; 1990a; 1990b; Kauffman 1993; Kauffman & Johnsen 1991; Levin 1976; Olsen & Schaffer 1990; Pattee 1978; Pred & Pred 1985; Prigogine & Stengers 1984; Pu Bao-ming & Ying-Ming 1983; Rosser 1991; Schaffer 1985; Schaffer & Kot

1985;Smithson 1987;Stenseth 1986;Thom 1983;Tsonis 1992;Varela 1988;Weber 1982;Wolf 1986;Zohar & Marshall 1994).⁴¹

A creative burst of integrative activity especially in the late 1960s and through the 1970s and 1980s, advanced the inter-weaving of such diverse fields as engineering, Physics, Economics, Philosophy, Anthropology, Cybernetics, Sociology, Psychology, Education, Biology and Ecology, through the fresh eyes of Systems Theory (for instance see Bateson 1972b;1988;Capra 1982;Chadwick 1971;Dobson 1991;Ferguson 1980;Forrester 1969;1971;Harman 1988;Henderson 1979;Henderson 1991;Meadows & Meadows 1973;Meadows et al/ 1972;Owen 1991;Smuts 1991;Thompson 1987a;1991) The proponents of this cross-fertilisation have often been well qualified activist intellectuals and social philosophers such as Capra, Costanza and Henderson.

Interviewing social scientists working in that period,⁴² it seems that there was a rush to apply Systems Theory in the hope of improving the accuracy of prediction and modelling, and of legitimising the 'soft' sciences in a 'hard' scientific fundamentalist world. This lost favour after a decade or two in view of the complexity of the probability-based Mathematics required, which in the end, did not model complexity with sufficient specific predictive ability for those seeking the customary control approach to Science. The reasons for the unpredictable character of complex systems was apparently not yet appreciated. However others were abandoning linearity on the understanding that complexity was the paradigm of the future.

In the area of Mathematics, new approaches now seek to include and integrate teleological aspects when dealing with complex living or human-interfacing (technological) systems, taking new steps in computing with words, group decision making, pattern recognition and possibilistic analysis (as distinct from probabilistic).

Applications include sophisticated, memory-sparing technological process control systems and appliances (McNeill & Freiberger 1993;Zadeh 1995). Applications act on vaguely defined or uncertain information, and work with the fact that complex systems rarely operate in black and white terms, but are usually distinctly grey (or perhaps one should say 'rainbow coloured'), thus redefining the Law of the Excluded Middle (Aristotle), and Probability as a limiting case (Járos 1995: 23). From a human settlement perspective, the most notable of these models discovered by this author are Fuzzy Logic which uses multivalent variables, and q-analysis, which specialises in connectivity. For an overview of these see **BP 5.3: Working with Vague Information: q-Analysis & Fuzzy Logic.**

⁴¹ This list represents a small fraction of my own sampling of a set of huge literatures.

In the Social Sciences (Psychotherapy, personal development, Family Systems Theory, Psychosomatic Medicine, Organisational Development, Learning Organisation Theory, Conflict Resolution and Education, a new breed of integrated, holistic theories⁴³ has emerged since the 1960s. These are not so promoted but approach psychological complexity and communication in ways which are congruent with the principles to be enunciated below for Subatomic, Complexity and Hierarchy Theories. **Link: BP 5.2.**

In other cases, such as management, the perception that the world is indeed chaotic and unpredictable is stimulating the emergence of a new type of attitude to change: those who became internationally famous promoting excellence are now suddenly giving advice as to strategies for 'surfing' on chaos and thriving on it, niche creation, the nurturing of flexibility and rapid evolution: a complete revolution in the recommended approach to business (Berle 1991;Cato 1995;Peters 1987;Peters & Waterman 1982).

'Third Line Medicine', ('Ecological Medicine' or 'Clinical Ecology', a bio-social systems model of health and healing has emerged in most Western communities since the 1970s)⁴⁴ (Werbach 1986: 75, 112). At the other extreme, Modern Medicine and Field Ecology have been some of the earliest disciplines to benefit directly from technical applications based on Subatomic Theory.

In the areas of Environmental Science, Ecological Hierarchy Theory, Unified Ecology, Conservation Biology, Landscape Ecology, State-Of-Environment (SoER) Reporting and Ecological Risk Assessment have started to appropriate far-from-equilibrium thermodynamic concepts and are stepping towards a re-integration of humans into the ecological picture (Allen 1989;Grzybowski & Slocombe 1988;Hollick 1993;Slocombe 1993a;1993b).

Systems Theory as applied to the urban, regional, ecological, economic, educational, organisational and to personal management, has been developed by such as Forrester, Chadwick, O'Neill, Allen, and others. It was used in ecological and global resource system modelling by the Club of Rome, to re-alert⁴⁵ the human community to the limits to growth in 1972 and again in 1992 (Meadows et al/ 1992;Meadows et al/ 1972), and has been applied to urban modelling and planning (for instance Chadwick 1971;Forrester 1969;1971). It occupies a niche at MIT, Harvard, where it is used to explain the counter-intuitive production of the

⁴² Peter Smailes, Senior Lecturer, Department of Geography, University of Adelaide, pers. comm.

⁴³ The most notable and effective in this respect in the author's broad experience are the neo-Freudian Transactional Analysis and the neo-Jungian Process Oriented Psychotherapy. for summary versions of these models see appendix.

⁴⁴ Ecological (neo-Hippocratic) medicine, which takes a wholistic approach: "A system of Health Care which emphasises personal responsibility, and fosters a cooperative relationship among all those involved, leading toward optimal attunement of body, mind, emotions and spirit" (Werbach 1986: 122) quoting the American Wholistic Medical Association). The author has been professionally associated with this branch of medicine since 1980.

⁴⁵ Re-interpreting Malthusian concepts to the modern context).

'externalities' which emerge when complex systems are treated as linear or uni-scalar, and its use for training people, especially school children, economists and business students in the type of strategic, systems thinking needed to approach complexity (for instance see Forrester 1969;1971;1975;1994;1995;Meadows & Meadows 1973;Meadows *et al* 1992;Meadows *et al* 1972;Senge 1990;Senge,Kleiner,Roberts,Ross & Smith 1994).

In his systems education programme for American schools,⁴⁶ Forrester argues that the human mind is not naturally adept at strategic systems thinking, but that computers are particularly good at training people in this thinking style, providing a feel for the often counter-intuitive results, by confronting underlying assumptions. Furthermore, this knowledge is transferable across many disciplines, and encourages confidence and innovative personality in K-12 pupils (Forrester 1994:1).

The increasingly competent leading edge of systems modelling makes heavy use of high capacity computers, for instance General Climate Models (GCMs),⁴⁷ and the detailed, GIS-based work of the IIASA in Europe, one project of which tracks and predicts pollution across national boundaries,⁴⁸ and another⁴⁹ which attempts to model all the subsystems affecting sustainability (Shaw,Gallopin,Weaver & Oberg 1992). Dynamic GIS is now becoming available through the use of Fuzzy Logic ('PCRaster').

One problem that needs further attention from all the above proponents of Systems Theory is that special conditions apply close to transitions or catastrophe points. **Link: Hypercyclic Systems Theory.**

At a more practical level, references have appeared which acknowledge and address complexity more directly in design work: through preserving natural system functions, or copying natural processes (such as evolution or eco-cycles), patterns (in form, function or interference fields) (for instance Berg 1996;McHarg 1992;Mollison 1988: 70-105;Van der Ryn & Cohen 1996) and multi-functionality (Alexander *et al* 1977;Allen 1982;Gill 1990;Manning 1979;MFP-Adelaide Management Board 1991b;Mollison 1988;Spirn 1984).

The concepts of patterning, pattern recognition, pattern discovery (Science) and pattern application (Applied Science) in Design and Education are ubiquitous in the complexity literature. Q-analysis, Fuzzy Logic and Unified Ecology all contribute to the theory of patterning

⁴⁶ For further information see www.hps-inc.com (Stella software); <http://pesmc1.vub.ac.be> (*Principis Cybernetica* Project); <http://sysdyn.mit.edu> MIT site of systems learning materials under Jay Forrester).

⁴⁷ Of which Australia's CSIRO model is one of the most accurate.

⁴⁸ Demonstrated at the AURISA Conference, Adelaide, 1993.

(for instance see Allen & Hoekstra 1992; Artuso, Cvitanovic & Casati 1991; Atkin 1981; Casti 1994; Galbraith 1992; Gould 1982b; 1993; Gould, P., Johnson, J & Chapman, G 1984b; Johnson 1995a; Johnson 1981b; 1990a; 1990b; Kauffman 1993; Kaufman 1983; Wang 1983; Zukav 1979).

The more 'organic' Organisational Development literature from Senge, names five disciplines which form the cornerstone of the 'learning organisation', a successful modern approach to organisational development and change management based on Systems Theory: personal mastery, mental models, shared vision, team learning and systems thinking (Senge 1990: 5-11, 53-4). This theory explains events in terms of responsive patterns of behaviour which emerge from the deep structure of systems (what Atkin in q-analysis for planning would call 'supportive backcloth') (for instance see Johnson, 1981; Atkin, 1974; Gould, 1993).

This evolutionary type of approach, emphasises the wholeness and indivisibility of the biosphere, and that we are dealing here not with parts of a whole, but 'wholes within wholes' (Senge 1990: 371).

Senge and his colleagues describe a number of patterns or 'archetypes' which they use to pinpoint systems problems affecting organisations (and other systems). These are commonly found, colloquially named, positive feedback systems, such as 'balancing process with delay', 'limits to growth', 'shifting the burden', 'shifting the burden to the intervenor', 'eroding goals', 'escalation', 'success to the successful', 'Tragedy of the Commons', 'fixes that fail', and 'growth and under-investment' (Senge 1990: 378-90). Their common feature is the recognition of the tendency to discount the system aspects which have longer than immediate return times. As a group, they describe dysfunctional patterns. This descriptive type of user-friendly naming is easy to learn, and contains the treatment strategy in its label.

These archetypes and their naming strategy are reminiscent of the repetitive 'Games' people, organisations and nations play, first identified by Eric Berne as an aid to diagnosis and treatment of dysfunctional, individual behavioural patterns (Berne 1972: 23).⁵⁰

This concept is also directly applicable to that of 'Social Traps'. These consist in ('feel good') short-term responses to problems which conflict with the long-term best interests of the players

⁴⁹ Presented at the Global Forum in Rio de Janeiro in 1992.

⁵⁰ For instance 'If It Weren't For You', 'Now I've Got You, You Sonofabitch', 'See What You Made Me Do', 'Courtroom', 'Ain't It Awful', 'Rapo', 'I'm Only Trying To Help You', 'Stupid', 'Wooden Leg' and so on (Berne 1964: 7-9). These Games have a particular structure, and are repetitive and ulterior (out of awareness). They emerge as a series of 'moves': signal or 'con' associated with a Persecutor, Rescuer or Victim role, a hooked response or 'gimmick' complementing that role and representing a weakness such as fear, greed, irritability or emotional neediness, a series of reciprocal moves and responses, a switch (of roles), which causes a crossup (brief feeling of confusion - how did this happen?), and a final payoff (individual negative emotional response) which reaffirms each player's Life Position (poor self- & other- esteem), and Script, and may have different degrees of seriousness. The perpetuation of hostilities in Ireland and the Middle East are examples of 'Scripty' behaviour on an international scale.

or society, resulting over time in positive feedback, negative outcomes and long-term shocks, surprises or catastrophes. Examples are addictions, the 'Tragedy of the Commons', salinisation, pesticide overuse and pollution (Costanza 1987: 408-9). The trap results from discounting the slow variables (long-term, indirect effects) in the system, favouring short-term solutions which only partly address the problem (some aspect of the problem is discounted relative to self, others or the situation).

In the Bernian Game example, the short-term behaviour is set through immediate responses to the surface appearances, while discounting the underlying long-term emotional dynamics of interlocking Life Scripts. A switch eventually occurs where everyone involved is surprised by an emotional crossup, with bad feelings collected all round.

Another realm of patterning occurs in relation to functionality in Nature, that is, they are functional patterns. When looked at more closely, they too take account of longer term system behaviour, that is, the time element is critical. These are organised around spatial scales and have functional organising principles. **Link: Criterion Landscape.**

Similarly, Christopher Alexander and others' famous "*The Timeless Way of Building*" and "*A Pattern Language*" describe a (visual/functional) practical approach to the design problems of building and planning. Patterns are seen as solutions to 'archetypal' problems, and solution patterns and their relationships to other pattern constellations and larger scale patterns are also expressed in words which again, clearly define their purpose (Alexander 1979 ;Alexander *et al* 1977: ix-xiii). These are then available for creative local adaptation.

Pattern clusters are space and scale related, for instance 'subculture boundary', 'identifiable neighbourhood', 'work community', 'quiet backs' are larger scale context patterns for 'accessible green', which in turn is connected to the smaller scale 'positive outdoor space', 'tree places' and 'outdoor wall' (Alexander *et al* 1977: xii). Alexander's work is richly sociological in that it is derived from the observation of human habitat patterns which recur over millennia, and which reflect the characteristics of patterns which appear to please us, his aim being to assist people in designing for themselves.⁵¹

Entry no 101 in the Jerrabomberra Valley National Ideas Competition (Sainsbury, Launceston) adapted Alexander's pattern language to present 76 generic strategies for eco-sensitive development, to which the author referred as 'patterns' (**Table 11: RRCM: Entry 101 - Patterns of Sustainability**). These are presented as a numbered group in the manner of

Alexander, a comprehensive range of strategies, loosely arranged into sequences such as building, energy, water, sewage, waste, Economics and so on, and constitute a list of the type collected at the beginning of the research period (Stage I).

The above discussion illustrates the potential cross-disciplinary richness of a unified Theory of Complexity. The ontological and epistemological underpinnings provide a starting point for integrative research into complex adaptive systems, which must be mentioned for comprehension of the larger perspective and for understanding the Ecological Paradigm.

The pattern of the ecological crisis is essentially a Social Trap writ large: a multi-scalar psychological eco-Game, based on a serious level of discounting. The behaviour and belief systems associated with it would in an individual be diagnosed as suicidal.⁵¹

4.3.3 THE ECOCOMMUNITY - SUSTAINABILITY LITERATURE

A normal literature review is impossible for a big-picture dissertation, with any attempt to circumnavigate it remaining resoundingly incomplete. The following is equivalent to a conducted tour of key references from this particular journey, mostly at overview scale, and with at least 75% omitted. It attempts to answer the question: 'if I wanted to understand this field, where could I start?'

A 'green' approach to the world is reflected in an array of books which announce the 'greening of' such areas of interest as Medicine, Psychology, Politics, urban transport, America, Design, aid, cities, business and entrepreneurial activity (for instance see Bishop 1990; Conroy & Litvinoff 1988; Pietroni 1990; Reich 1971; Tolley 1990). The keyword 'green' from this bibliography alone renders 83 responses.

A vast green literature exists on every aspect of the relationship of humans to environment, especially Environmental Ethics, Environmental Justice, EcoFeminism, EcoPolitics, EcoSpirituality and Deep Ecology (for instance Birkeland 1993; Bookchin 1995; Deutsch 1977; Devall & Sessions 1995; Diesendorf 1993; Fox 1995; Guthrie 1995; Harries-Jones 1993; Ingold 1993; James 1993; Kheel 1995; Leopold 1995; Luhrmann 1993; Merchant 1992; Milton 1993a; Norton 1995; Regan 1995; Rollin 1995; Sagoff 1995; Sillitoe 1993; Singer 1995; Sterba 1995; Switzer 1995; Switzer 1993; Taylor 1995; Warren, K 1995; Warren 1993; Warren, MA 1995; Bird-David 1993; Collins 1998; Fox 1988; George 1995; Harman 1988; Lindfield 1986; Mies & Shiva 1993; Zimmerman, Callicott,

⁵¹ Promotional text on cover of 'A *Pattern Language*'.

Sessions, Warren & Clark 1993). This relationship remains marginal in the writings and activities of the human settlement development industry, and outside the universities, is generally unacknowledged as the source of the remarkable new opening of environmental consciousness of the last three decades (Grove-White 1993: 20-21).^{52,53} **Link: Criteria Organism, Confluence: Structure.**

Of the eco-community movement literature, typical examples are "*Sustainable Cities: Concepts and Strategies for Eco-City Development*" (Walter, Arkin & Crenshaw 1992), the proceedings of the biennial international EcoCity and Catalyst environmental design conferences (Birkeland 1995; 1998; Canfield 1990; Register & Peeks 1997); the Otay Ranch Ecologically Integrated Planning Case Study (Bell, Snow & Vary 1991) and the eco-community principles developed by the Ventura County Citizen Planners (Citizen Planners of Ventura County 1991). The Halifax Project produced its own contributions in better days, and continues to be a valuable source of books and materials on the subject (for instance Downton 1991; Downton & Munn 1993). Downton is presently completing a PhD on the subject.⁵⁴ This literature tends to focus on the practical, on both human community and biotic community in relationship, and 'radical' resource- and ecosystem-conserving strategies. Attention is paid to lists of principles and the definition and description of desirable or necessary patterns and processes for eco- and social sensitivity, rather than Ecosystem Theory as such, which tends to be assumed. These are the 'cookery books' for implementation. **Link: Confluence: Content for the Framework: Pattern Repertoires.**

An important element of the eco-paradigm thinking behind the smaller, bottom-up village concepts is the concern with the loss of community in modern developments (Architecture-Research-Construction 1985; Begon, Harper & Townsend 1990; Caddy, Slocombe & Caddy 1996; Cock 1991a; Dyson & Dyson 1989; Fellowship For Intentional Community & Communities Publications Cooperative 1992; Forsey 1993; McCamant, Durrett & Ellen 1994; Metcalf 1995; Mindell 1989; Naess 1989; Nozick 1992; Plant & Plant 1992; Rajan 1993; Register & Peeks 1997; Whitmeyer 1993). The emergence of community-building processes such as Human Scale Development (Max Neef 1991)⁵ in the practical realm, and recent Boyer and Massey lecture topics on the importance

⁵² While it pleases 'Science' to inflate its own significance in the realm of ecological knowledge, and it sees 'NGOs' and 'public opinion' as essentially capricious and irrational, given to "unscientific" outbursts" Grove-White points out that nearly every analysis, prediction and solution presently promoted by scientists and regulatory agencies had long-term origins in the efforts and persistence of NGOs and environmentalists, poorly-resourced, patronised and denigrated by scientists and their institutions (Grove-White 1993: 21).

⁵³ In a similar process, orthodox medicine has started to assimilate the knowledge of Chinese Medicine (acupuncture), Naturopathy and Orthomolecular Medicine (nutritional medicine), hypnosis (hypnotherapy), body therapies (manipulative Physiotherapy, Alexander Technique, Feldenkreis), and meditation (stress reduction), after a long period of attempted suppression, discounting and disdain, almost never acknowledging the source, and once mastered, seeking to dominate the field through 'expert knowledge' and restrictive practices such as legislation and prevention of access to insurance schemes.⁵

⁵⁴ Department of Architecture, University of Adelaide.

of and threat to social capital (Cox 1995;Saul 1997), reflect the 'software' of this social movement.

Cohousing, mentioned often elsewhere, is well-promoted by McCamant & Durrett. **Links: Criterion Community: Living in Community; Confluence: Process: Community, Content: Integrative Models for Post-Industrial Community.** The terms 'Cooperative Housing' and 'Collaborative Communities' are used by others to describe a constellation of similar arrangements, two useful sources being Lottie Cohen and Lois Arkin (*UCD Center for Cooperatives*), and Dorritt Fromm, who is well known for her work designing housing with shared facilities. She and McCamant & Durrett are architects. Cohen is a lawyer and Arkin coordinates the LA Ecovillage.⁵ (References on Cohousing include Architecture-Research-Construction 1985;Bamford 1997;Context Institute 1993;Dansk Byplanlaboratorium 1992;Fromm 1991;Gilman 1993;McCamant *et al* 1994;McCamant,Durrett & Hertzman 1993;Meltzer 1995;1997a;1997b).

There is another arena, of community-sensitive but not necessarily ecosystem-driven literature, which explores livability in the context of economic and/or social sustainability (for instance Appleyard,Gerson & Lintell 1981;Cooper-Marcus & Sarkissian 1986;De Naar 1990;Merchant 1992), community building, community land trusts (such as Institute for Community Economics 1982), community housing cooperatives (Selby & Wilson 1998) and human territorial issues (Andrew & Milroy 1988;Architecture-Research-Construction 1985;Context Institute 1993; including gendered space issues for instanceDavis 1991;Davison,Kendif,Stephens & Merrill 1993;de Vries & Keuzenkamp 1996;Gilman 1993;Hiss 1990;Kunstler 1993;Little,Peake & Richardson 1988;Lynch 1991;Meyrowitz 1985;Newman 1973;Nozick 1992;Plant & Plant 1992;Rose 1993;Taylor 1988) This overlaps with the literature on Environmental Psychology/Human Ecology (for instance see Adrados-Ruiz 1979;Boles & Hayward 1978;Krasner 1980;Levine 1989;Sadalla 1978;Sadalla & Stea 1978;Samdahl 1989;Ulrich 1981;Williamson 1981;Zimring 1981). **Links: Criteria: Community, Organism, Genius Loci.**

Local Government is becoming increasingly involved in stewardship and education and action towards sustainable goals. Various documents, reports, goals and Visions are cited in the text.

Another literature has grown in the area of Ecological and Environmental Health: global, city, building, individual human, and indoor. This includes the WHO Healthy Cities Programme, the Sundsvall Conference on health-supportive environments, and more technical works to assess Health Impact Assessment, health effects of contaminated sites and polluted ecosystems, and the

design of environments to support recreational exercise (Bistrup 1991;Brown & Barnes 1991;Brown 1989;Butz 1992a;1992b;Commonwealth of Australia 1986;1989;1994b;El Saadi & Langley 1991;Haglund,Petterson,Finer & Tillgren 1992;Houston & Ferguson 1991;National Health and Medical Research Council 1994;Register 1987;Sanders 1995;Tassie 1992;Wiesner 1992;Woelk 1992;Worsley 1990;Wright,MacDougall,Atkinson & Booth 1996). **Link: Criterion Organism.**

A number of alarming and popular books have appeared, with respectable⁵⁵ authors and cautionary titles like "*The Coming Plague*", "*Planetary Overload*", "*High Tech Holocaust*", "*Quick Poison Slow Poison*", "*Chemical Deception*" and "*The Miner's Canary*" ... which spell out the dangers to health from such threats as pollution, pesticide use, the Accelerated Greenhouse Effect and nuclear technologies (McMichael 1993) (Lappé 1991;Short 1994) (Bellini 1987;Ewan,Bryant & Calvert 1991;Ewan,Bryant,Calvert & Garrick 1993;National Health and Medical Research Council 1991). In Clinical Ecology, doctors refer to their patients as 'canaries': susceptible populations who give early warning of toxic conditions through their hypersensitivity illnesses. Brown mentions the 'guinea-pig' role of vulnerable groups (low income, education, social support, children) in non-wholistically managed environments, where urban consolidation is proposed as a single strategy (Brown 1992: 35). **Link: Introduction to Dissertation: On EgoCities & EcoCities, footnote.** Brown links an array of potential toxic and other health issues associated with climate change, using a CRES study on the effects of climate change on wombats: our biota are already indicating clearly to us, their vulnerability to human ecological impacts. Brown suggests that we understand non-human indicators to presage threat to ourselves (Brown 1992: 41-4). **Links: Criteria Organism, Indicators.**

The medical literature on the health impacts of indoor air has been slow to develop, but attention has been focused in the last decade as a response to the commercial/productivity impacts of 'sick building syndrome' (Minister of Supply & Services 1989;Pilatowicz 1995). The health theme is extended by a small but cogent literature on design for health in Aboriginal communities (Collings & Thompson 1987;Pholeros 1994;Pholeros,Rainow & Torzillo 1993).

Some authors such as McHarg, 1992 (planning); Mollison (metaphysical, design, rural and practical) and Van Der Ryn, Calthorpe & Cowan (development, philosophical, design), combine multi-scalar complexity and ecosystem concepts, working from the ground up (Van der Ryn & Calthorpe 1986;Van der Ryn & Cohen 1996). They normally deal with the intra-scale connections in far more detail than the inter-scale relationships, but make statements about the connection.

⁵⁵ By respected and well-qualified scientists.

The city must be seen as a part of nature and designed accordingly. The city, the suburbs and the countryside must be viewed as a single, evolving system within nature ... The social value of nature must be recognised and its power harnessed, rather than resisted. Nature in the city must be cultivated, like a garden, rather than ignored or subdued" (Spirn 1984: 5).

Other examples are the Rocky Mountain Institute-associated "*Green Development: Integrating Ecology & Real Estate*", "*Natural Capitalism: Creating the Next Industrial Revolution*" and "*Factor 4: Doubling Wealth – Halving Resource Use*" (Hawken et al 1999; Rocky Mountain Institute 1998; Von Weizsäcker et al 1997), regional scale planning for biodiversity (Peck 1998); and Ecological and Regenerative Design (Lyle 1994; Thompson & Steiner 1997; Todd & Todd 1994).

Links: Criteria Landscape, Biotics. We have now destroyed so much that we not only need to conserve what we have, we have a huge healing job to do: 'Sustainability' is now an inadequate notion.

Others specialise in building for or theorising about community (for instance Context Institute 1991b; Minister of Supply & Services Canada 1993b; Nozick 1992; Pepper 1984; 1991; 1993; Whitmeyer 1993), in Cohousing, mentioned above, or in integrated subsystem strategies such as water, transport, gardens (Phillips 1996), forestry, housing, governance, self-sufficiency or Economics (MacDonald 1996). **Links: UHSE Criteria, Community; Confluence.**

The "*New Urbanism Charter*" is based on the work of a dedicated group in the USA which has conferred on a different scale of focus each year, re-evaluating all manner of issues affecting ecological and social sustainability, and publishing the implications of their findings as bibliography, lists of principles on the Internet and elsewhere, and as books such as Katz, Van Der Ryn and Calthorpe (Calthorpe 1993; Katz 1994; Van der Ryn & Calthorpe 1986). **Link:**

Confluence: Content for the Framework; Criteria Landscape, Community. The Charter begins as follows:

The Congress for the New Urbanism views disinvestment in central cities, the spread of placeless sprawl, increasing separation by race and income, environmental deterioration, loss of agricultural lands and wilderness, and the erosion of society's built heritage as one interrelated community-building challenge.

We stand for the restoration of existing urban centres and towns within coherent metropolitan regions, the reconfiguration of sprawling suburbs into communities of real neighbourhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy. (Unreferenced information sheet supplied by MultiFunction Polis Australia January 1997).

D&C 6.4: Principles from the Charter of the New Urbanism contains the full list of Principles.

The urban village movement (especially UK, espoused by Prince Charles) has similar objectives (countering sprawl, rebuilding community and street life), and tends to rely more on retrofit and infill, giving a much less 'twee' appearance than the US version, and a richer texture derived from integration with historic buildings.

Urban villages are mixed use centres with medium density housing, shops, workplaces, and a central public transport stop. They have safe, attractive streets, some public parkland, and opportunities for recreation. Their design promotes energy efficiency, pedestrian activity and social interaction ... (Energy Victoria, Environment Protection Authority, Department of Infrastructure & Energy Research and Development Corporation 1996: 1).

A survey of UV features across Europe demonstrated a concentration in the area of urban form, small footprint, street layout, position of public buildings and 'model town' aspects (Aldous 1992: 92-3). A NU/UV fetish has been (recently) popular with developers in Australia, being one of the mainstays of the MultiFunction Polis/Mawson Lakes development in Adelaide, and (the urban form) prominent in the Jerrabomberra Valley National Ideas Competition as well (also see Aldous 1992; Energy Victoria *et al* 1996; Hocking Planning & Architecture Pty Ltd, Martin & Dunlop 1993).

In Australia and the USA, New Urbanism (NU) has tended to be mis-read as building top-down gated communities for the frightened well-off,⁵⁶ and is far from its idealistic roots. Eco-villages and Cohousing communities may or may not be urban villages (usually 'bottom up' ones), but the 'top down' urban village is usually at somewhat larger scale than the former two, and often the product of a speculative development which has the size to require a shopping centre and the ability to support 'mixed use' (such as Mawson Lakes). There is no mention of codes to control resource consumption in Katz' book, which details a number of projects in the NU style.

Link: Confluence: A New Style of Development.

The NU emphasis is definitely visual (a regimented, immaculately controlled, 'neotraditional', lollipop style), and its goals social: the rebuilding of community, the reclamation of public space, convenience and the setting of covenants that control the 'look' rather than ecological function. The main environmental strategy (as at Mawson Lakes disabled by private interests – transit, pedestrian promenade) lies in the urban form, with its compact footprint, 'mixed use'⁵⁷ and attention to pedestrianisation. 'Seaside' and 'Laguna West' (two famous US examples) have site plan patterns that look very similar to the MFP's Mawson Lakes (Katz 1994: 3-29).⁵ **Links: Plate 12: Collage: Site Plans; Criterion Landscape.**

The concepts of multiple use/stakeholders/functions/partners (as in 'MultiFunction Polis'), and integrative strategies have been advanced as ways to conserve scarce resources and improve efficiency of land use (Spirn 1984). This has been popular with developers, who can thereby

⁵⁶ This is certainly sometimes the case in the USA also (interview with resident, referring to importance of safety for children). Also see (Katz 1994:xxv, 3-29). These developments are for the well-heeled. MFP's \$120,000 New Haven is more accessible and less pretentious.⁵

⁵⁷ Although there is no real mixed use: most of the mixtures go no further than the opportunity to have a generous shopping opportunity near home. The lifestyle gives the impression of being largely 'holiday' in tone. The style does not translate well to Australia (but is increasingly common), not being solar sited nor having adequate roof and verandah development for solar protection.⁵

maximise availability of building land and co-opt land unsuited to building for other purposes (such as bicycle paths, recreation areas). Conservationists, who would rather have unspoiled habitat, are at least happy to have wildlife corridors albeit subject to human invasion.

Urban form is a well-known battleground (for instance see Blau, La Gory & Pipkin 1983; Commonwealth of Australia 1995c; Energy Victoria et al 1996; Kenworthy 1991; Kenworthy, Laube, Peter & Barter 1997; Lynch 1981; Marling & Knudstrup Olesen 1992; Newman 1991; Newman & Kenworthy 1991; Newman, Kenworthy & Robinson 1992; Newman & Kenworthy 1989; Sadalla & Stea 1978). There has been a territory dispute for many years between Professor Peter Newman (and Dr Jeff Kenworthy) of the Institute for Science and Technology Policy at Murdoch University, and Professor Pat Troy of ANU Canberra, who have vied for the Government Ear especially on this topic. Newman and Kenworthy are globally famous for their work on Transit Oriented Development and car dependency, coming from an ESD position and speaking out against urban sprawl, from city scale. Their work is elegantly supported scientifically by Holzclaw, who studied the relationship between urban form and density, environmental and other costs, with automobile dependence (Holtzclaw 1991;1994).

Link: Criterion Landscape.

Troy comes from a more socially-oriented position, seeing urban consolidation as 'perilous'. He argues strongly against the Newman case for increasing urban density, coming from a more individual scale and omitting the collective effects on habitat of continuing car dependence. He claims that public open space and infrastructure command similar areas for high and low density development, and having land for domestic activities like growing food and space for children are lost to high density. He relies on Urban Policy rather than urban form, but the policy must commit to clarity and transparency of assumptions and value judgments, equity of social outcomes, abatement of all forms of environmental stress, not just global warming, and development of a more equitable public consultation process (Troy 1996: 29, 105, 171, 172-8). With an ageing population, domestic land use is clearly undergoing significant change, with a move towards sustainable retirement settlements now evident in the USA, and possibly to be followed in Whyalla, SA.⁵⁸

The Transit Oriented Development (TOD) as espoused by Newman and Kenworthy (Newman 1991; Newman & Kenworthy 1991; Newman et al 1992), overlaps with myriad other urban village terms: transit supported village/city/community, 'five minute city', 'walking city', 'pedestrian

⁵⁸ No doubt *inter alia*.

pocket' (Calthorpe 1992), 'mixed use development', 'traditional neighbourhood', NU, 'Planned Unit Development' (Hocking Planning & Architecture Pty Ltd et al 1993: ii). TOD was recommended by two thirds of the Jerrabomberra Valley National Ideas Competition entrants (Rounsefell 1994e: 34), and serves to integrate individual villages to a larger scale, simultaneously offering advantages in connectance, community, resource and energy conservation, habitat sparing and climate protection (a 'multi-function' strategy). **Links: comments about health above; Criterion Connectivity: Transport & TOD.**

The ESD version of ecological development, which is starting to converge with the eco-community literature, is represented by the appendices to the AMCORD Urban Manuals; the OECD Ecological Cities Project (Commonwealth of Australia 1995d; Neilson 1993) and the mammoth Canadian annual Innovative Housing Conference (my version 1993) (Minister of Supply & Services Canada 1993a; 1993b; 1993c; 1993d). The final⁵⁹ edition of AMCORD had substantial guidelines for sustainable site design and development. Until 1996, the then Department of Urban & Regional Development (ACT) ran workshops and published a steady stream of documents on sustainability-related topics (for instance Commonwealth of Australia 1994c; 1995a; 1995b; 1995c; 1995e; 1995f).

An offshoot of orthodoxy which is also merging with EPP ideals is Ecotourism.⁶⁰ While most operators still seem to think that the 'eco-' just refers to the natural resource being exploited, some helpful literature has been made available from State Government sources in South Australia and the RAIA (Royal Australian Institute of Architects) (Pholeros, Tawa & Opie 1994; Vulker & McDonald 1989). Other supportive works on ecologically or socially sustainable housing and design, including some that take Australia's difficult climate into account, have emerged from the RAIA, the architecture and design professions, Permaculture and communitarian sources, for instance: autonomous housing (Vale & Vale 1997), thermal design (Szokolay 1995), alternative energy houses (Skurka & Naar 1976), passive solar housing (Wright 1978), democratic architecture (MacDonald 1996), affordable housing (Davis 1995), low income solutions to home ownership (Institute for Community Economics 1982), Aboriginal housing and housing for health (Pholeros 1994; Pholeros et al 1993), spiritual healing through housing (Day 1990), psychologically pleasing patterns of design (Alexander 1979; Alexander et al 1977), design for bushfire (Holmgren 1993), earth shelter (Baggs, Baggs & Baggs 1985), living machines (Todd &

⁵⁹ Disappeared along with the demolition of the Department of Housing and Regional Development in 1996 at change of Government.

⁶⁰ The 8th Ecotourism Association of Australia Conference will be held in Victoria (11/2000), and an ET-guide training school has been established on Kangaroo Island (9/2000).⁵

Todd 1994), interior design (Pilatowicz 1995), and green design (Mackenzie 1991). **Links:**

Criterion Ecocycles; Confluence: Content.

At this stage there is more practical instruction or reporting of processes and achievements for specific communities than scientific assessment of eco-communities. Perks and Van Vliet (1993) from the Faculty of Environmental Design at the University of Calgary, published by the Canada Mortgage and Housing Corporation, have produced an exceptional piece of research which assesses thirty Scandinavian eco-community projects over five weeks in 1991 (Perks & Van Vliet 1993). Checklists of sustainability features and project characteristics are given for five case studies from Sweden and Denmark, and the other projects collectively. These are categorised in the standard sectoral rather than an 'ecological' manner, but even this research makes no attempt to benchmark or measure ecological outcomes. Perks has produced other research, such as "*Consumer Sensitivity to Sustainable Community Design*" with Wilton-Clark: a householder survey in Calgary in 1995 (n=62; 32 sustainability strategies questioned). This found the majority responded very favourably to nearly all the strategies. The findings were most impressive, and should be presented to Australian developers, including those designing Mawson Lakes, and especially those doing future tracts.* **Links: Criterion Community; Confluence: Content for the Framework.**

A more 'scientific' literature is beginning to expand which seeks to evaluate resource-related sustainable strategies including the Victorian Greenhouse Neighbourhood Project study in 1993 (for instance Energy Victoria *et al* 1996; Holtzclaw 1991; 1994; Loder and Bayly Consulting Group and others 1993). This has been difficult except in indirect, theoretical terms (for instance see Newman & Kenworthy 1989), until such strategies have been more widely implemented. The Greenhouse Neighbourhood Project (1993) demonstrated the direct benefits from constrained urban form:

... estimated that savings of 26 per cent in heating and cooling energy, and 57 percent in transport energy could be achieved by developing subdivisions on the basis of urban village principles rather than conventional practice (Energy Victoria *et al* 1996: 1).

If 'improvement' is to be sought, then indicators and benchmarks become an important issue, and should be thought through in the design phase if possible. Indicator development at all scales from individual (health) to local (neighbourhood) to urban, regional, bioregional, national and global, sectoral, cross-sectoral and economic, has been a major pre-occupation in governance and conservation, more in the last twenty years, but particularly in the last five (for instance Adriaanse 1996; Brown *et al* 1994; Brown 1996; Canada Mortgage & Housing Corporation 1993; Commonwealth of Australia 1992a; 1996b; Department of Environment & Natural Resources

1997;Houston & Ferguson 1991;Marling & Knudstrup Olesen 1992;Meadows et al/ 1992;Mercer 1994;Office of the South Commission 1989;Peet 1996;Rennings & Wiggering 1996;South Australian Department of Environment and Natural Resources 1996;Spellerberg & Hardes 1992;Taub 1987;Worsley 1990). However this is not straightforward nor conceptually integrated, and tends, by necessity, to be simplistic. The resource management, auditing and environmental emissions literatures are huge (reflecting the subject's complexity), and difficult to include for practical reasons.

Two of the aspects most amenable to measurement are life cycle (OECD & IEA c1993) embodied energy and carbon dioxide emission: for instance the (UK) domestic sector uses about 30% of national energy and produces about 25% of the CO₂ (Vale & Vale 1997: 26). Operating energy reductions for housing offer greater savings over the life of a building than does embodied energy. But net energy savings also depend on materials longevity; recyclability of materials; envelope design including thermal mass and insulation characteristics; embodied energy and efficiency of heating and cooling systems; and process consumption, such as generation and infrastructure characteristics, resource extraction and transport energy, and distribution losses and location (Cole 1993: 55;Henderson 1993: 4-7;Rosenfeld & Price 1993: 16-18, 20-24).

Sainsbury's Eco-Cost programme⁶¹ showed that all else being equal, transport energy costs were the most significant variables (thus advising local building materials use where feasible). But research on resource use and environmentally damaging emissions shows that CO₂ emission and embodied energy do not coincide. Cole (Department of Architecture, UBC) believes that fuel type, and CO₂ and other emissions, are often better indicators for environmental damage than energy attributes.⁵ (Cole 1993 & pers. comm.)

Vale & Vale demonstrate that CO₂ reduction and energy conservation can best⁶² be achieved by replacing the usual processed and widely distributed food supply with domestic food production (Vale & Vale 1997: 26-7). The relativities of such information must thus be locally and wholistically interpreted for materials and strategy selection (Minister of Supply & Services Canada 1993d). It is no wonder that this has all been written off as too difficult, or that simple indicators are used. One must start somewhere. Values for Greenhouse Gas impact from everyday consumer items and behaviours are at last becoming available (for instance see Lenzen 1998a;1998b;1999;2000). In 2000 the Electricity Trust of South Australia and the SA Housing

⁶¹ Entry 101, Jerrabomberra Valley National Ideas Competition: embodied energy in building materials.

⁶² Which is not to say that this should be the only strategy - they recommend a zero emission, autonomous house which deals with most metabolic functions on site, and minimal use of mostly electric vehicles. (:27).

Trust finally reported on a comparative energy study in public housing, initiated in 1992. **Link:**
Criterion Ecocycles.

Equipment for energy and water use incorporated into experimental housing can enable better management and monitoring: providing more exact information on operating energy. A number of evaluation and computer programmes have emerged which purport to simplify environmental, energy and materials audits of several kinds and on different scales (linkage: Ecocycles). Computers have also been used in ecotourism to provide feedback for guests about their personal resource consumption during their stay, and similar resources were originally mooted for Mawson Lakes residents.⁵

Ecological Economics rather than the Environmental, Resource or Neoclassical, Economics or Accounting,, has emerged as the discipline most likely to enlighten a balanced eco-econom-social system (Bergman, Maier & Todtling 1991; Costanza 1991; Costanza, Norton & Haskell 1992; Costanza *et al* 1993; Damania 1991; Department of the Environment 1993; Diesendorf & Hamilton 1997; Henderson 1979; Henderson 1991; Jacobs 1984; McNeely 1988; Ormerod 1994; Peet 1992; Prugh, Costanza, Cumberland, Daly, Goodland & Norgaard 1995; Rennings & Wiggering 1996; Suter 1995; The Group of Green Economists 1992). References to the application of Systems Theory and Ecology, Landscape Ecology and other Sciences in Human Settlement Development appear throughout the section on Criteria of Observation (UHSE).

4.3.4 SUMMARY: BRIDGES FROM THEORY TO PRACTICE

This section sets the scene for linkages that will be made in later chapters.

The Ecological Paradigm is described by a region of Mathematics known as 'medium number systems'. These are complex and non-linear, and lie between small number simple systems and large number simple systems. **Links: Hypercyclic Systems Theory; Theory of Scale.**

Linkages are now recognised between the new Science of dynamic complexity and many traditional areas of concern, from the subatomic to the cosmos. The Ecological Paradigm seeks to replace the mechanistic metaphysical archetype and its destructive consequences, with an archetype of interconnectedness known as 'Substance Monism'. **Links: Subatomic Theory; Hypercyclic Systems Theory.**

Systems Theory emerged in the 1960s, and has continued quietly since then, after initially faltering in the Social Sciences, mainly because the mechanistic paradigm required simplicity, scientific certainty and predictability. As appreciation has grown of the unpredictability of complex systems and the complex reality of social and ecological systems, disciplines are reworking their theoretical structures in response. The language of Wholism, synergy, Possibility and patterns takes its place beside Atomism (Reductionism, Individualism), Probability and linear measurements, which represent limiting cases. A number of examples of application are given, together with a short cross-disciplinary analogic discussion of patterns. Chaos and Complexity are to be cherished as the generators of life and resilience.

A semi-annotated tour is taken through the main areas of literature which formed the backcloth for this dissertation. It points out the main issue areas and indicates an array of readings in each. Realistically, it makes no attempt to be comprehensive, nor does it cover the references for the theory development of the dissertation itself: it is the Backcloth, not the Traffic (Holtier 1992: 375-6).

4.4 HUMAN SETTLEMENT ECOLOGY AND METAPHOR

We create the world that we perceive, not because there is no reality outside our heads ... but because we select and edit the reality we see to conform to our beliefs about what sort of world we live in. The man [*sic*] who believes the resources of the world are infinite, for example, or that if something is good for you then the more of it the better, will not be able to see his errors, because he will not look for evidence of them.. For a man to change his basic, perception-determining beliefs – what Bateson calls his epistemological premises – he must first become aware that reality is not necessarily what he believes it to be. This is not an easy or comfortable thing to learn, and most ... have probably been able to avoid thinking about it (Mark Engel, Preface to Bateson 1972b: vii).

4.4.1 INTRODUCTION: METAPHOR & MEANING

To the extent that the universe is no longer seen as a machine, made up of a multitude of objects, it may now be pictured as one indivisible, dynamic whole whose parts are essentially interrelated and can be understood only as patterns of a cosmic process: a systems view which is organic, holistic and ecological (Capra 1982: 66).

Paradoxically, in the Ecology of Paradigms, people and processes now present in our increasingly heterogenous society, are each unique particles in a group field, ultimately ephemerally alone, substantially immortal⁶³ and universally connected.

In many African cultures, old people teach children by means of metaphoric tales ... "Look at your hand. All the fingers are different ... If all fingers are the same, your hand cannot function" ... The philosophy in Malinké culture is that all individuals, both humans and animals are different, and "if you force them to be the same, the only way left to them to be different is to get on top of one another. This creates conflicts and wars" (Camara, 1975)⁶⁴ ... for [*the Malinké people*], heterogeneity means interaction for mutual benefit, while for many ... Europeans and Americans, heterogeneity tends to mean unrelated diversity, for which interaction is a hindrance. For Malinké people, heterogeneity enables positive sum relations, while for Europeans and North Americans, heterogeneity tends to mean negative-sum relations. In ecology, we learn that an ecosystem consists of interactions among heterogeneous elements ... needed for risk dispersion ... resource diversification, with mutually beneficial interactions (Maruyama 1994: 57-8).

This section considers intangible linkages between Cosmology and the apparently concrete reality of the built environment. It addresses the nature of Paradigms and Metaphors, and refers to some which will provide part of the backcloth for later conceptual principles for human settlement design. A human strategy that assists the comprehension of complex entities has historically (and necessarily) been the creation of mythical and metaphoric structures. These form the deep organising principles of much of the language structure, the interpretation of experience and unconscious cultural transmission (Lakoff & Johnson 1980: 139-84).

Mathews in "*The Ecological Self*" defines Cosmology as "the indispensable context for the social and normative thinking that informs a culture, and even for the individual's own experience of his or her self", and Mythology as "a narrative which tells us what we are, where we came from and where we are going". Joseph Campbell (she says), attributed four functions to Myth: the mystical, the translation of the universe according to the available Cosmology, the guidelines to a quality life, and the imprinting and reinforcement of the moral order. Myths always refer in

⁶³ In the material recycling sense.

⁶⁴ (Camara 1975: 273-84).

some way to a Cosmology, and Mathews sees them as "the process whereby a normative structure is extracted from a cosmological base", unlike a fashionable view that sees Mythology merely as a psychic or cultural projection, and thus discountable as a primitive tendency beyond which modern society has developed with the help of Science (Mathews 1991: 43).

Semiology can be used to understand the linkages between signs and symbols and Social Mythology, and defines the language of their channelled expression in Art and Design. Here Myth is also regarded as a type of speech, or a system of communication, a message which explores and transmits cultural values, although it may be seen as derived from Sign via Metaphor (suggesting a two-way process) (Barthes 1973: 109; McWilliams 1998: 8).

A first order semiotic system exhibits qualities of Complementarity⁶⁵ and emergence, consisting in the Complementary aspects of Signifier and Signified, which combine to produce an emergent entity, the Sign. While language (including all types of media), Freudian-interpreted elements (dreams, behaviours) and literature are seen as first order patterned entities (Signs of something going on at a deeper level), Myth is seen as second order, a metalanguage, a code or Signification. The global Sign or language-object (which could be a picture, a piece of art or writing, or a building design), is embedded as a Signifier within the second semiotic layer, which as a Myth, presents simultaneous meaning and form, related as a classical, conjugately variable pair⁶⁶ (Barthes 1973: 109-115). Thus a building (a Sign), along with its strictly practical structure (Signifier) and the meaning to which it itself refers (Metaphor), is inherently a coded entity, embedded as a form in a Myth which refers to the Cosmology of that culture.⁶⁷

Wittenberg and Sterman list several properties common to Metaphors and Paradigms, and view them as essentially the same concept, the latter an extension of the former: Metaphors are ubiquitous in discourse, transfer schemata between areas of experience, filter and define, yet are inherently limited in their mapping to reality (Wittenberg & Sterman 1996: 4-5).

The heart of the model is the identification of the metaphorical and epistemological facets of paradigms with metaphors, limited representations of reality that crack when strained, producing anomaly and crisis ... paradigms are extended metaphors. (Wittenberg & Sterman 1996: 4)

They reassert Kuhn's proposition that "something like a paradigm is prerequisite to perception itself" (Wittenberg & Sterman 1996: 4). Or as Bohm says

⁶⁵ **Link: Subatomic Theory: Bohr's Complementarity Principle.** Capitalised to indicate specified meaning.

⁶⁶ A pair of aspects which have a mutually varying reciprocity: when you try to comprehend or measure one, the other becomes less observable, visible or measurable as the other becomes more so - as with Heisenberg's Uncertainty Principle. **Link: Subatomic Theory: Uncertainty Theories.**

⁶⁷ Thus the ubiquitous 'postmodern', air-conditioned building, which defies, and indeed distorts both traditional and ecological reality (for instance having no eaves or verandahs in an arid Australian setting), is an appropriate reflection of the prevailing values now resulting in social and ecological breakdown. **Link: Plate: Metaphor.**

... everybody has some kind of metaphysics, even if he thinks he hasn't got any ... what is needed is the conscious criticism of one's own metaphysics, leading to changes where appropriate and, ultimately, to the continual creation of new and different kinds. In this way, metaphysics ceases to be the master of a human being, and becomes his servant, helping to give an ever changing and evolving order to his overall thinking (Bohm 1969: 41).

This is similar to the concept of 'Basic Position' in Transactional Analysis, an essential element of the 'Frame of Reference' or world view (Childs-Gowell 1979: 30). Without a position about self, close and distant others and life, a person does not know how to behave or respond. The same applies in TA Theory to family groups, communities and society at large, and in Anthropology.⁵ In practice, the TA Frame of Reference is an entity emergent from a constellation of internal processes and structures, which in health is updated throughout life, but is fixed by psychopathology, and the target of psychotherapists:

An individual's frame of reference is the structure of associated (conditioned) responses (neutral pathways) which integrates the various ego states in response to specific stimuli ... It provides the individual with an overall perceptual, conceptual, affective, and action set, which is used to define the self, other people, and the world, both structurally and dynamically. In particular, it is the framework within which the individual answers such questions as: "How do I know I exist?" and "Who am I?" It can be thought of as the skin that surrounds the ego states binding them together and acting as a "filter" on reality. (Schiff 1975: 49-50)

Postmodernism refers to this as having a 'construction of reality', and Narrative Therapy capitalises on this by emphasising story-telling, a technique that does particularly well with Australian Aborigines (Gare 1995: 126; White & Denborough 1998: 157-175; White 1997: 130-147).⁵

Metaphor is defined semiotically as "... application of name or descriptive term or phrase to an object or action to which it is imaginatively but not literally applicable".⁶⁸ However Michael puts it more strongly:

Metaphors and analogies are different. Analogies treat one situation as if it were the same as another ... expected to match only in a limited way ... since metaphors treat one situation as the same as another ... [*with*] no limit they can enter the psyche more deeply and unquestioningly ... the essence is understanding and experiencing one kind of thing in terms of another (Michael 1995: 475). [*Emphasis Added*].

Meaning (as applied to understanding of the output of design processes) is constructed through an interpretive system that progresses from (identificatory) Sign, through Metaphor, to Myth, which interprets cosmological understanding (McWilliams 1998: 9). Metaphor is used consciously to enrich experience through poetry or visual communications.

Lakoff and Johnson detail its ubiquitous but unrecognised presence in all our ordinary language:

... metaphor is pervasive in everyday life, not just in language but in thought and action. Our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphoric in nature ... the human conceptual system is metaphorically structured and defined. Metaphors as linguistic expressions are possible precisely because there are metaphors in a person's conceptual system (Lakoff & Johnson 1980: 3,6).

⁶⁸ Concise Oxford Dictionary 1982.

Lakoff & Johnson have identified a number of classes of Linguistic Metaphor that can be demonstrated to reflect deeply embedded cultural values, whether generally or at subcultural scale for specific metaphoric conflicts. Orientational Metaphors, for instance, give clues to the values system: with so-called 'Spatial Metaphors'. Good is 'up', bad is 'down', so we might refer to 'things looking up', 'reaching a peak', 'being at an all-time low' or doing 'high quality work'. Happiness, health, life, more, bigger, future and control are listed as being 'up' on this basis. Likewise with a Newtonian values set, rational is up, emotion is down ('he rose above his feelings'). Other Orientational Metaphors include front-back, on-off, centre-periphery and near-far (Lakoff & Johnson 1980: 16-17, 22-24, 25).

Ontological Metaphors, which have a variety of functions, help us deal with intangibles as if they were concrete, perhaps because we can more easily conceptualise entities in physical terms. Thus we reify or even personify emergent entities as if they had independent status (the market decides, peace settles on people, hatred gets out of hand, happiness reigns, the stress gets people and we fight cancer). Such metaphors are often elaborated for use in particular situations, the verbal output from which can be traced back to these concepts, being indicated by the choice of actual words used.

For instance the Metaphor of type 'The Mind is an Entity' may lead to 'The Mind is a Machine' (using expressions such as 'tick over', 'grind out', 'apply the mind to...', 'cogs, closed/open', 'operating', 'wheels turning', 'running out of steam') or 'The Mind is a Brittle Object' ('fragile', 'brittle', 'might snap', 'shattering', 'going to pieces'). *[A computer Metaphor has recently become noticeable, reflecting the latest technology: 'Garbage In-Garbage Out' (GIGO), 'needs reprogramming', 'having a glitch', 'having a bug' or a 'crash', 'needing downtime', 'shorting out', 'bring your cursor over here!', 'number crunching', 'select something', 'keywords', 'key into a conversation', 'RU there?']*. Other common Metaphor groups refer to containers, visual fields and battles (for instance use of war-like terms when describing argument, love, trade, evolution or cancer) (Lakoff & Johnson 1980: 25-34, author).

This type of analysis of Metaphor has implications for a Wholistic Theory Of Causation: **BP 5.4: The Problem of Cause**, which turns out to be relevant to the systems view. Concepts of cause are core organising principles for physical and cultural interpretations of reality. Lakoff and Johnson see them not as undecomposable blocks in metaphoric buildings, but as experiential gestalts - "complexes of properties occurring together", as wholes with less basic parts (Lakoff & Johnson 1980: 71, 69-76).

Moving from the individual expression of metaphor-invested language to the designed elements of the built environment, intuitive understanding of metaphoric communication is commonplace but not usually explicit. Examples are concern with streetscape (conformity to an aesthetic ideal, usually traditional), construction of 'phallic symbol' tower buildings (masculine power, mastery and dominance), the post-modern (pluralist, eclectic, negation of modernism) and neo-traditional (comfort and safety, romantic conservatism), iconic buildings (place-ego), bush gardens (eco-centrism), cottage gardens (English Nationalism or aspiration), window boxes and heart-shaped holes (Germanic Nationalism), topiary, massive appearance (upper class), large, elaborate gates (various nationalistic or affluence statements), austere concrete multiplexes on grass (modernist), or experimental energy housing (techno-modernism). The earth-sheltered, roof gardened, water-conscious, greenery-nested, cooling towered and natural and crafted materials appearance of typical eco-community design proclaim many facets of the Ecological Metaphor. **Links: Criterion Genius Loci; Plates 7,8,9,3,5: Metaphor, Placemaking, Halifax, MFP Aspirations.**

The planner in charge of the 1999 project to get some development ("any development!!") onto the EcoCity Core Site in Whyalla (rural industrial South Australia), wanted to put some ordinary housing there and "tweak it to look ecological". I said "No, I think you have it round the wrong way: build eco, then tweak it to look suburban so average people can relate to it!" **Link: Waterloo Green Home (Plate 7).**

While arguments, ideas and theories often attract a Building Metaphor (having foundations, constructs, buttresses, basements, frameworks, strengths, functionality, bricks and mortar, shells; being shaky, strong, weak, constructed; caving in (Lakoff & Johnson 1980: 46-52-3, 98), buildings often attract Body Metaphors (having a prosthetic function of body extension which encloses and protects like a skin, but allows perception and communication through windows and doors, and allows personal relaxation by relieving the individual body of its wall-like functions (Scarry 1985: 38-9). This is based on the contention that a building is in the role of a nurturing parent, which comforts and assuages pain, thus enabling full expression of the senses and allowing the 'body' to become an effective actor in the external world and a participant in society (Drake n/d: 32-9).⁶⁹

When researching or describing reality, what is observed will thus be constrained by the cosmologic-metaphoric position of the researcher. When undertaking design work, much

recursion between logical levels is required. Decision making and policy development are never far from the maker's Mythology. And the process of social change and learning inevitably involve changes in interpretation and meaning.

In changing to an EPP Paradigm or Cosmology, consciousness of metaphoric consistency in output, and having a working knowledge of Metaphor, is helpful for designing, introducing and marketing the new Mythology. The structural expression will appear as pattern and sign, combining to contribute to a special Sense of Place. The marketing industry is expert at such strategies, but they do it covertly yet blatantly. To succeed, the Ecology movement needs to stop being so naïve in this area, and learn how to tune in to where the public consciousness is, where its unconsciousness is, and to use the marketing system with awareness, overtness and sound ethics.⁴⁹ This is an urgent political matter, as Plate 4 (UEA) Key notes on the Whyalla reaction to Urban Ecology illustrate. A number of examples of 'normal looking' eco-buildings are illustrated in **Plate 7: Collage: Metaphor in Built Environment** below. The image at bottom right of Figure 49 well expresses the EPP Metaphor of a happy 'Ecotopia' where an EcoCycle-adapted City emerges green and healthy from a very sick industrial NOW, but the public does not generally share an appreciation of the organic look, and does not need to embrace it to be more technically 'sustainable'. **Links: Criterion: Genius Loci; Figure 5 (NMB Bank).**

4.4.2 METAPHOR, PARADIGMS & THE CITY

Approaching the notion of Metaphor from the scale of the whole city, Lynch, in his treatise on good city form, examines 'three great normative models' of the city through time, which reduce to the Metaphors of

Crystal: geomancy, magical patterning and meaning, sacred geometric, stable hierarchical, psychological, power symbolic, rhythmic

Machine: practical, intellectual, predictable, law-driven, geometric, linear/mathematical forms, grid patterned, movement of whole, stability and autonomy of parts, parts linked mechanically, growth by addition, no wider meaning, segregation of functions, celebrating technology and engineering, and

Organism: physiological, wellness/illness concepts, bounded, extension by budding, celebrating Nature, homeostatic dynamism, self-regulating, cyclic, purposeful, emotional, complexity-appreciating, form/function linkage, fuzzy internal boundaries, sharp external boundary, systems approach, hierarchical tree structures, health and community emphasis (Lynch 1981: 73-95).

Examples of all these models can still be cited in modern times. With the organismic model, Lynch makes links to its antecedents in utopian thought, the romantic landscape movement and socialist reformers, (the history of which involves a reaction against the social and environmental

⁶⁹ In the Jungian Art Therapy "House-Tree-Person" exercise, the drawing of a house tends to represent the family, particularly the family of childhood, and is very useful for ascertaining the emotional atmosphere through which the client grew up.⁵



Plate 7: Collage: Metaphor in the Built Environment - Key

1 & 2 Phallic Symbology (Male dominance)

1: Adelaide planning disasters proposed 1997; 2: Traditional Mosque Kuala Lumpur Malaysia.

3 Manaus, Brazil

Austere, modern style (efficiency), but design relates to the top-heavy craft on the Amazon River, upon which all who prosper depend. Celebrating the Industrial Age (Machine Metaphor).

4 Eco-Technical

Domes at Horsens experimental housing community in Hundsted, North-East Denmark. These are intellectual, very precise, orderly, high conformity, very 'Parent-Adult' buildings, faithful to the Buckminster Fuller tradition (a Science Metaphor). **Links: Transactional Analysis.**

5 Fortress Metaphor

Also phallic. Hill town in Southern France.

6 Modern Fortress

RMI example: Darmstadt Passivhaus near Frankfurt cuts heat demand by 90%; electricity by 75: delivers superior comfort (Von Weizsäcker 1997: Plate 2). But note the fortress signifiers: an 'ESD' building, not EcoCommunity. (Machine)

7 & 8 Power/Dominance and Submission Metaphors

Money speaks. New development in Anatolia, Turkey. 7: classical building position taken by the powerful (often the Church in newly settled Western societies: the planned Anglican Church on Whyalle core site has been displaced by rezoning for commercial only). 8: classical soulless, mass-produced lodgings for the poor (internationally funded, and replacing the practical but human scale traditional architecture - **Links: Placemaking 7; Places of the Soul 1&2** - the new supermarket is nearby!).

9a-d 'Normal-Looking' Eco-Housing

9a: Suburban mud brick passive solar house by Energy Architecture Adelaide (glass & shading on West);

9b: Findhorn EcoVillage. Scandinavian look, (insulated), timber-clad, triple-glazed windows, glasshouse technology, individual variations. Buildings clustered around winding path.. (Togetherness, Community) (**Link Findhorn Collages Plate 13**);

9c 'Green Home' Waterloo Canada: state-of-the art energy efficiency, full of amazing technology. Most building materials recycled (car body roof tiles, rubber pavers, polyethylene bread bag carpets; smart triple glazed argon windows, computer-controlled air and water temperatures, heat exchange, water conservation, sealed-unit gas cooker, air-blown sandwich insulations, non-formaldehyde press-boards... (Unpretentious Techno);

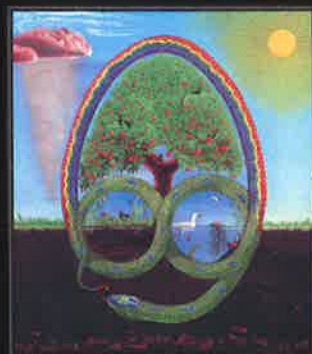
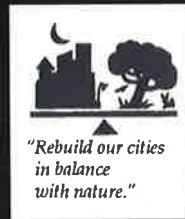
9d Experimental energy housing with SPVs, Davis California. Connected but identical, compact, postmodern-looking buildings in rows, suggest ESD, top-down initial conditions.

10a-h Logo Metaphors

a: Authoritarian 'Parent-Adult': Royal Australian Planning Institute Sustainable Development Conference, Canberra 1992 (control, precision design, Parliament House symbol) + locational (autumn colours, soft but geometric); b: Spirit (yin yang, balance) + heart/caring (primary 'Child' colours & chunky design); c: Opposing City West (geographic/locational); d: TNS: Scientific, symbolising Ecocycles & Earth, clean 'Adult' presentation (like the TNS 'consensual' teaching method based on incontrovertible scientific evidence); e: Spiritual (circle, Nature, rainbow colours, 'butterfly's wing' chaos concept): Global EcoVillage Network; f, g, h: Complexity Metaphor: EPP 'hotch-potch': Urban Ecology (USA, Australia), balance theme; USA unaccountably nocturnal (stars, rabbit) Australian Nationalist differencing of g (suburban scale building, windows in city buildings & appurtenances on rooves, Southern Cross, eucalypt, kangaroo); h: Permaculture: the full complex scene, 'endorsed' by the Aboriginal *Rainbow Serpent*.

Sources: Author's photos from Field Work; Image 6 as cited; logos from literature and conference materials, 10c from Visual Journal OCW.

The City Messenger, Adelaide
December 10, 1997: 9



consequences of the mechanistic/industrial revolution), naturalists and regionalists. He refers to its first full statement by 19th Century writers such as Ernest Haeckel and Herbert Spencer, followed by the 19th-20th Century works of Geddes, Mumford, Olmsted, Howard, Odum, MacKaye, Perry (concept of the neighbourhood unit), and Glikson⁷⁰ (ecological wholism of regional landscape and human community; and implemented by such as Henry Wright and Raymond Unwin) (Lynch 1981: 89-91). The ethic of cooperation, the emphasis on community, organic form and function, 'natural' materials, balanced diversity ('social mix'), homeostasis and neighbourhood self-sufficiency with close human-nature linkage, has echoes in latter day Urban Ecology (for instance see Citizen Planners of Ventura County; Downton 1991; Trainer 1991; Walter *et al* 1992).

Lynch affirms many of its percepts but objects to the *Organism Metaphor* as a problem analogy. Cities are not organisms, he says, nor machines; not autonomous nor do they reproduce, become ill, have life cycles or have physiological systems. And hierarchy is an unstable and unsatisfactory notion with which to conceptualise a city.

Actually cities can have all those qualities, either metaphorically or as emergents. Most such objections are weakened by the understanding that hierarchy in organisms is arranged on principles of time, space or functional connectance, rather than the power organiser so familiar but not unique to human systems (the political forces behind resource allocation are not the issue, their effects are). Nor are metaphoric structures necessarily fully occupied literally by their subjects (Lakoff & Johnson 1980: 53), not all living entities fully conform to the usual definition of organism (Allen & Hoekstra 1992: 16), and the web structure Lynch recommends still has hierarchical character, based on frequency differentials and connectivity (O'Neill *et al* 1986: 142-6).⁷¹

The homeostatic system character of organisms is also paralleled by the regulatory processes in which the city participates, potentiated in special ways by the drivers of human values, needs, wants and proclivities and the balancing feedbacks of community mores, legislation and regulation.

The point of arguing with Lynch on these issues is to claim that while agreeing with him as to the appropriateness of an Ecological Model, aspects of such a model would include an *Organismic Metaphor*, not necessarily supersede it. In addition, though, we are seeking a

⁷⁰ (Glikson 1971).

supportive Metaphor here, in expectation that this will assist comprehension and the re-assignment of meaning, and also on the understanding that we are attempting to re-align the Mythology with what we perceive to be the reality: this IS an ecosystem by our definition, not just an analogy.

The first human settlements were enlarged trading posts to which one may apply a 'Bazaar' or 'Marketplace' Metaphor: a place of connections. This remains a reality, and IT&T now also suggests a *Brain Metaphor* for humans: less complementary images give humans a *Cancer Metaphor*. Larger populations were made possible by the invention of agricultural technologies, the discovery of reliable and storable food crops (such as grains) and better food storage (Allen 1977; Allen & Ilitis 1980). Many were strongly fortified, probably deserving a 'Fortress' Metaphor (often more aptly applying at the scale of a house or housing cluster in modern cities). See Plate 7. Their inhabitants were preoccupied with survival, social order and relationship, spiritual, interpersonal, community, dominance and so on. Relationship is still a crucial aspect of human community, never superseded, even under deliberate erosion of social capital in favour of Individualism or extended through virtual community.

The ancient *Crystal Metaphor*, with strong religious connotations, also persists, as "*The Secret Plan of Canberra*" contends in explanation of Canberra's geometric skeleton (Proudfoot 1994). This speaks to the cultural or ideological structures that underlie urban form, street layout, the use of public art and monuments and the ambience of the milieu, the sensory or psycho-spiritual qualities of the place. The scale and style of the built environment are indicators for the relationship between centralised power and the people (Lynch 1991: 5).

The *Machine City*, with smoothly-operating, replaceable parts and clearly separated functions as in a factory, persists in our modern zoning systems, and retains relevance in mechanically-related contexts such as formal connectance systems (transport), and engineering issues of many kinds, (such as physical the design of buildings, factories, bridges and motor vehicles). Dynamic and entropic systems are also embedded in the biosphere.

The medical model of *Organism City*, with health, pathology, organs (heart, lungs), metabolism, circulatory, respiratory and waste systems, is still relevant to health, well-being and basic needs for high level function, that is, to making judgments about the roles, functions and performance of infrastructure on city scale, and about similar issues on the scale of living individuals

⁷¹ "Trophic levels' are simply another attempt to reduce ecosystem dynamics to population dynamics" (O'Neill et al. 1986: 65). "The attempt to explain all ecosystem phenomena in terms of populations is simply another form of unacceptable reductionism" (O'Neill et al. 1986: 71). Restrictive Metaphor!

(including humans, plants and animals). This Metaphor is alive and well as the basis for the 'Extended Metabolism Model' in current use by Environment Australia for State of Environment modelling of human settlements (Commonwealth of Australia 1996b: 19), however the diagram used by the Australian Government is linear, and makes no attempt at all to come to terms with ecocycles, which it should do if the name were to represent the concept.⁷² Figure 49 (Criterion Ecocycles) illustrates the similarity between this and the 'Linear Society' diagram used by *The Natural Step* in its training programme to identify a key source of unsustainability. The 'Ecocycles-Adapted Society', from a different Swedish origin,⁷³ depicts a cyclic Metaphor in simple terms.

Lynch continues:

Above all, perhaps, it is this holistic view which is the most important contribution of organic theory: the habit of looking at a settlement as a whole of many functions, whose diverse elements (even if not strictly separable) are in constant and supportive interchange, and where process and form are indivisible. This idea and the accompanying emotions of wonder and delight in diversity and subtle linkage are an enormous advance over the models of eternal crystal or simple machine. The model might be even more apt if it could divest itself of its preoccupation with simple plant and animal associations, with limits, stabilities, boundaries, hierarchies, autarchies, and inevitable biological responses. Incorporating purpose and culture, and especially the ability to learn and change, might provide us with a far more coherent and defensible model of the city. (Lynch 1981: 98).

Having first questioned the possibility of having an Urban Normative Theory, Lynch goes on to suggest an ecological model which prescribes needs-based performance criteria as a functional and more appropriate basis for urban design and policy building than meaningless, quantitative regulations. This discussion is based on the premise that normatives are essentially related to urban form, and as such, have intricate and unfathomable relationship to human values: a city, a natural phenomenon of incomprehensible vastness, and encompassing myriad conflicting interests and meanings, can not and should not be designed as a whole. There is, nevertheless, a constellation of

... basic requirements for survival and well-being, and ... [in any given culture there are important common values] ... which amount to the old-fashioned notion of the 'public interest' (Lynch, 1981:103, 99-108).

Lynch asserts that the above principles underlie much of modern Planning Theory, yet he confesses they have not been much implemented in practice.⁷⁴

⁷² The refuse-resource loop coupling necessary to deal ecologically with the issue of urban waste. While some cyclic thinking may in fact be behind waste management strategies, it must be explicit in functional diagrams for both educational and strategic reasons. This is the same diagram provided to tenderers for the job of developing human settlement indicators for Australia in February 1997, the outcomes of which prompted the writing of the final section of this dissertation.

⁷³ The Natural Step (TNS) is a sustainability training organisation; the Swedish book whose cover provided the 'ecocycles-adapted society' concept, was written for presentation at the UN Habitat Conference, 1996.

⁷⁴ Lynch writing in 1981, may well have been surprised at the level of ecological activism expressed by a new generation of local government agents attending the *Pathways to Sustainability* International Conference in Newcastle, NSW Australia in 1997. Much of this activity has been centred belatedly around implementation of *Local Agenda 21*, which was supposed to have been initiated immediately after the Rio UN meeting in 1992. The 6-year delay to imperfect

If the values are ephemeral, at least we can define the needs for a good life. Lynch sees urban form at human scale as important to individuals, but at city scale, as relevant only to social and economic realms. Decisions and action, while explained with apparent rationality, result not from well-defined chains of reasoning, but emerge instinctively and unthinkingly from 'thickets of values' which shift over time. Lynch says here that different conditions pertain to different scales. **Link: Confluence: Transpersonal Ecology.** But he also says that different scales have different Mythologies (interpretations of the over-riding Cosmology): the individual interface with urban form is one thing (let us say mediated through the individual Parent - the personal framework of ideals tailored to protect, control and nurture the individual psyche, the personal repository of normatives), while at city scale values and interpretations emerge from a shifting Collective Parent,⁷⁵ whose content varies (by compound processes presumably related to parenting, media, education, social relations, other communication and political interaction), the normative function of which should be represented by a 'public interest' criterion based on needs, or 'requirements for survival and well-being' for society as a whole).

Thus Lynch's *Ecological Metaphor* accepts many of the holistic premises of the *Organic Metaphor*, and re-focuses attention away from (that is, 'either/or') what he sees as the ecological features of the city (plants, animals, hierarchy, biological relationships), and towards an evolutionary approach ("the ability to learn and change"), with inbuilt functional normatives based on need.⁷⁶

The system operating at individual level is not different, but the interpretations, constraints and content will be. The everyday experience of (Transactional Analysis) psychotherapists, is to find apparently rational actions being influenced or filtered by preconscious emotional and introjected drives of readily identifiable structure and function: a 'thicket of values' that can readily be sourced if necessary and time allows. **Link: Ordering Principles: Personal, Social & Cultural Ordering: Life Scripts.**

Lynch's search for an appropriate descriptive model for human settlements concludes:

It is indeed something changing and developing, rather than an eternal form, or a mechanical repetition which in time wears out, or even a permanent recurrent cycling which feeds on the degradation of energy, which is the concept of ecology. Yet the idea of ecology seems close to an explanation, since an ecosystem is a set of organisms in a habitat, where each organism is in some relation to others of its own kind, as well as to other species and the inorganic setting. This system of relations can be considered as a whole, and has certain characteristics of fluctuation and development, of species diversity, of intercommunication, of the cycling of nutrients, and the pass-through of energy. The concept deals with very complex systems, with change, with organic and inorganic elements

implementation is not surprising, but constitutes a warning to the impatient that solution of global problems will not necessarily be swift.

⁷⁵ **Link: Background Paper: Transactional Analysis...**

⁷⁶ A truly needs-based economy would be a radical change indeed.

together, and with a profusion of actors and forms ... An evolving 'learning ecology' might be a more appropriate concept for the human settlement, some of whose actors, at least, are conscious, and capable of modifying themselves and thus of changing the rules of the game. (Lynch 1981: 114-5).

4.4.3 DYNAMIC AND COMPOUND METAPHORS

Coming to terms with a more complex and pluralistic world, and particularly activities like trying to 'save the planet'. require synergistic Metaphors, a learning process that allows metaphoric evolution and change, and the Metaphors themselves need to represent dynamism.

Lynch above is describing a shift to what David Bohm would describe as 'the rheomode': a transition from a concrete, spatial organising principle to one based on time, frequency and change. The difference is mirrored by that between the terms 'ecologically Sustainable Development' (ESD - a linear, one-off effort at local or global sustainability), and 'Ecologically Sustaining Development' or 'eco-community development' (ECD - an evolutionary, dynamic process), as mentioned above. To align with Nature is thus to align with a complex, webby, restless, pulsating, cycling, multi-scalar, process-driven entity.

Even more 'rheotic', Lovins from the Rocky Mountain Institute think-tank, constantly talks about a new 'design mentality': an active, optimistic, 'can-do' approach to technology that seeks to "rethink everything we consume: what it does, where it comes from, where it goes, and how we can keep on getting its service from a net flow of very nearly nothing at all - but ideas" (Hawken *et al* 1999: 81, 111-124). Lovins' presentations have the full and engaging force of a new approach to design, and his action *Design Metaphor* has a wonderful 'knife-through-butter' quality. He urges *Lean Thinking* and radical, integrated action, as this is far more effective (Hawken *et al* 1999: 111-124).

Michael emphasises the importance of a Metaphor to ecological management⁷⁷ that highlights learning, so as to be compatible with "the purposes and experiences of learning in a fluid, amorphous world" (Michael 1995: 476). Using Lakoff & Johnson as a model, he lists a series of words and phrases supportive of action in such a world, (designed to offer alternatives to ubiquitous Western constructions of reality such as spatial orientation, boundaries, [*control*] and fragmentation, and action through war). **Table 12: CMCE: Metaphoric Potential for Ecological Paradigm** reproduces and slightly extends his list.

Westley refers to the 'visionary leader' phenomenon (**Link: Early Findings: 'fire souls'**). They appear in crisis times and can, through intense, visionary capacity, help people leave defunct Mythologies behind. leading them out of the wilderness into new Paradigms that may better

serve ecological management. He cautions, though, that "strong ideologies, myths and paradigms are important to action, but are potentially detrimental to interpreting and incorporating new information about the environment", as are rational-choice processes like Strategic Planning, and inconclusive Ideologies (Westley 1995: 400). Tuning in and flexibly responding to a changing context is a crucial survival skill for any organism, and may be blocked by a rigid ideological filter.

Research has shown that humans are naturally driven to learn, and that responsive action (as distinct from just responsiveness or sensitivity to external stimuli), can readily be supported by designing in mechanisms to facilitate and disseminate learning (Westley 1995: 400-1).

In metaphoric terms, the mission is facilitated by webs of collaboration and consensus, active listening, continuous learning and adjustment, responsive action, and most effectively, a Gardening Metaphor: "What kinds of gardens do we want, and what kind can we get?" (Westley 1995: 426, 406).

Michael warns, however, that the Metaphor, being so primal, so reified into concreteness, so important in drawing boundaries that protect us or organisations from external impacts, and so much under challenge by new information, can easily be pushed with its subscribers, into a reactionary position: learning is difficult. Real change implies new Myths. Constraints to learning come in many guises: socio-cultural (deviation from norms and values, impact on important relationships), emotional (personal vulnerability, risk, unfamiliarity, disruption, confusion, fear of change) and cognitive (information divergency, uncertainty, misleading, confusing or conflicting information, pluralism, complexity, over-simplification) (Michael 1995: 465-72). He asks us to be gentle:

Indeed, in our current world situation, opening oneself or one's group to a larger "data base" reveals the terrifying prospect that the world is now so complex that no one really understands its dynamics ... those intent on pursuing their interests seldom can risk sociocultural ostracism by acknowledging this to others, and usually not even to themselves. Hence there is a need for a learning approach that acknowledges this situation by being both humble and compassionate (Michael 1995:474).

Michael's analysis of the implications of switching to a learning approach for ecological management, is summarised in **Table 13: ES: Strategies for Learning Approach to Ecological Management**.

The document published to support the Inter-Sectoral Dialogue prior to UNCED in 1992 recognised Metaphor as a "vital cognitive interface" for the task of assisting global transformation to an Ecological Paradigm, of both understanding and policy development, even of explaining the process of running UNCED. It observed "people and cultures can become

⁷⁷ In contexts where ecological conservation and appropriate management are central activities.

entrapped in simplistic metaphors that are inadequate to the challenge that they face" and "if there is to be the 'fundamental shift in attitude' so frequently called for, this can only be triggered and articulated by new and richer metaphors" (IFC 1992: IFCD55A). **Link: Ecology of Paradigms below.** Wondering why metaphor has never been researched properly, its importance being known, it goes on to list a series of "Sustainable Development Metaphors", and then investigates the use of Metaphor for enhancing policy, reframing problems, reframing inter-sectoral cooperation, and exploring an ecological approach to world governance.

Tracing the elements of a Postmodern approach to the environmental crisis, and being aware of the essentially dynamic nature of the new eco-paradigm, Gare seeks to define, source and reformulate, a metaphysical characterisation which would "give primacy to becoming over being":

... Western civilization is faced with a basic rift between the way nature and the way culture are conceived. Those who approach the world through culture treat the science of nature as part of culture, while those involved in science attempt to conceive of humans as part of nature; but neither is able to do justice to the other ... it will be necessary to develop a science which takes becoming as basic (or Being in Heidegger's sense) and conceives 'beings' as islands of stability within the flux of becoming (Gare 1995: 105, 107) [*"Postmodernism and the Environmental Crisis"*].

Gare is particularly concerned with restraining Science from being a tool for world domination, and links this with a discussion of its use of Metaphor and its basis in Metaphysics. Like Heidegger (after Nietzsche), he sees Science and Metaphysics as implicated in the "forgetting of Being". However he argues that through the development of a Process Philosophy (a "Post-onto-theological Metaphysics"), Science may be regaining this awareness, and thereby withdrawing from its destructive instrumental role (Gare 1995: 114).

The process-privileging Philosophies of Bergson and Whitehead emphasise that Being is temporal. Bergson saw the description of the world in spatial terms as a control strategy that used vision to atomise reality into multiple static objects ("a collection of predictable things that can be controlled"). On this basis, Gare advocates a shift from visual to auditory analogies that would serve a new, wholistic world Metaphor: the world as melody or symphony. Whitehead in "*Process and Reality*", was concerned about the "fallacy of misplaced concreteness". He used a non-Cartesian mathematisation to systematise the world, and the Metaphor of "a process of becoming" (Gare 1995: 115, 115-6).

Prigogine in his monograph "*From Being to Becoming*" (**Link: Organising Principles**) also took up this core metaphoric difference, speaking of the need to move from one to the other: "We come therefore close to the central problem of Western Ontology: the relation between Being and

Becoming." These are thought to be Complementary,⁷⁸ not opposed. Being (beyond identification with time or timelessness), is associated with initial system conditions; Becoming is associated with the laws governing change over time (Prigogine & Stengers 1984: 310).

There has been a tendency to reject an old Metaphor and move on to another. However there are multiple ways of understanding. Some of the old ways are still useful and still used, including those mentioned above. When dealing with complex systems, it is helpful to have Compound Metaphors, and to take multiple 'snapshots' of the reality before us: we need to mentally classify information, otherwise we feel overwhelmed by the detail. At the same time we must be wholistic, inclusive and integrative (Rounsefell in press).⁷⁹

New Metaphors for human settlements currently emerging, which may be woven into this complex backcloth include the atavistic Satisfier City, always with us, but brought to a new level of extravagance by the Capitalist Ideology and its technologies. The advertising industry has promoted short term satisfaction of every possible whim, claiming to maximise choice for each individual.⁸⁰ Human settlement centres are now increasingly being designed to stimulate the senses: we look at paintings, movies and crowd spectacles, listen to concerts, eat and drink in endless variety, socialise, share social drugs (caffeine, tea, nicotine, marijuana, ecstasy ...), seek sexual partners, move about by dancing, running, cycling, swimming or walking: every perceptual channel is stimulated to habituation, if not addiction. These aspects, ever so, but now technologically enhanced, are related to the Criteria Population and Organism (**Link: Unified Ecology**). The former maps who is to be found where and when and why; the latter spells out basic needs and differentiates these from wants.

Another Metaphor has emerged with transport, public utility infrastructure and communications technology - a Web or Network of connectivity, analogous to food webs and signalling systems in ecosystems, and accelerating social connectivity: multiple universes simultaneously present and interacting. Concepts like 'multi-function', 'multi-disciplinary', 'inter-departmental', 'whole-of-government', 'integrative strategies', 'multi-cultural', 'business network', 'global village' and 'partnership' have emerged. These represent the oneness of Complementarity on the one hand, and the inclusive diversity of Conceptual and Political Pluralism on the other. They flag the arrival of a new appreciation of the complexity of the modern scene, the multiple connections and the new theme of meeting challenges through partnership rather than conflict (although a

⁷⁸ **Links: Subatomic Theory: Bohr's Complementarity Theory, rate dependency.**

⁷⁹ "Snapshots on Sustainability" edited textbook in press 1999.

web of conflicts would still represent connectedness, so the deeper issue is relationship). This is the Complementary foil to the system structure described below. **Links: Criterion Connectivity; Theory of Scale: Connectivity/ Relative Disconnection.**

The adoption of an Ecological Metaphor for the task of explaining, designing and implementing human settlement elements and systems, is the EPP commitment. A compound Metaphor is proposed here, containing a number of sub-units which represent different aspects of ecological reality, preserving those of continuing value, and emanating from an Ontological Metaphor of Complementary Being and Becoming, the interface of space and time in effect, which may be more like a symphony than a vision. This is a generic concept: an 'Ecology of Metaphors' if you will. Tuning in to this music and allowing what is there to emerge rather than commanding and controlling, is more likely to produce patterns like those of Alexander (Tables 84, 85), Day (Plate 9) or the NMB Bank in Amsterdam (**Figure 5: ES: NMB Bank Amsterdam**) than modernist austerity, but there are many types of music. The NMB Bank is a large building, executed with a great deal of technical control, but the humanity of the design process shines through in an unmistakable way. The artless, self-built, 'barefoot Architecture' appearance of *Roman's Hut* metaphorically belies its architectural design. **Links: Criterion Organism: Plates: 9: Places of the Soul, 4: Urban Ecology Australia.**

The eco-system itself, the 'Meta-Metaphor' is simultaneously sympathetic to the epistemological Metaphors of Cycle/Pulsation, Web/Net (communication/relationship), Symphony, Garden and Organism; with Crystal, Machine, Satisfier and Bazaar (and any other that becomes eco-socially relevant, whether positive or negative) as facets, not core.

Cities have often been likened to symphonies and poems ... are objects of the same kind ... the city has elements at once of biology, procreation, organic evolution, and esthetic creation. It is both a natural object and a thing to be cultivated, individual and group; something lived and something dreamed. It is the human creation par excellence. *Tristes Tropiques*, Claude Lévi-Strauss (in Spirin 1984: frontispiece).

'I think we can safely say we have another type of economics here. One type is the standard stuff that we are all familiar with' – he was too modest to call it the Arrow-Debreu system, but he basically meant the neoclassical, general equilibrium theory – 'and then this other type, the Santa Fe-style evolutionary economics.' ... [it is] another valid way to do economics ... complementary to the standard ones ... this effort to catalyze a sea change in economics is only part of its [the Santa Fe Institute's] effort to catalyze the complexity revolution in science as a whole ... 'Nonscientists tend to think that science works by deduction.' he says. 'But actually science works mainly by metaphor' ... the kinds of metaphor people have in mind are changing (Waldrop 1992: 326, 327 -reporting Arthur).⁸¹

⁸⁰ This has actually seen a massive reduction in choice, as the minority taste is not supported by profits, so its artefacts are withdrawn in favour of the mass demand. The minority item (if available at all), withdraws to the scarcity zone accessible only to the rich.

⁸¹ Brian Arthur interview for "Complexity: The Emerging Science at the Edge of Order and Chaos" (quoting Ken Arrow summary at end of internal workshop).

4.4.4 AN ECOLOGY OF PARADIGMS

How one can change these images, or at the very least make people aware of the implications of their spatial evaluations and perceptions, is a ... complicated but vital matter. To influence and change deeply entrenched images that have been built up since childhood is a most difficult thing, sometimes demanding solutions that initially seem so outrageous, impractical and expensive that they are dismissed outright. Yet sometimes outrageous solutions of yesterday are tried, and we find tomorrow that they are really not so outrageous at all. Indeed, we often find ourselves accepting as perfectly obvious, rational and necessary a solution to a problem that seemed quite absurd to our more limited visions of the past (Gould & White 1974: 179).

The days of argument about the patterns of theory development have passed, and the term 'paradigm shift' is well known to all scientists and social theorists. The term is used constantly by non-mainstream folk who struggle to implement their brave new eco-world.

Feyerabend in his paper "Professor Bohm's Philosophy of Nature" (reviewing Bohm's "*Causality and Chance in Modern Physics*", 1957), remarks on Bohr's use of Classical irreducible building blocks of theory, combining Berkeley's Perceptionism and Mach's Elements in his description of Complementarity (Feyerabend 1981: 223-5).⁸² Bohm, by contrast, subscribes to a Realist tradition of continuous (asymptotic) improvement in the theoretical representation of reality.

Improvement of the 'building blocks'⁸³ of theory (such as Laws of Nature), can and should occur. His position on the argument then current between proponents of Classical Determinism and (random) Probability is that reality is stratified into at least three levels, each with its characteristic laws and types of experimentation, the lower levels being antecedent or causal to the apparently random emergent behaviour at higher levels. While some laws such as General and Special Relativity may apply across levels, others are specific to a level, and a complete explanation of the whole system requires a theoretical infinity of laws and levels (Feyerabend 1981: 226-8). This approach foreshadows the stratification of Hierarchy Theory, the modern theory of emergence in chaotic systems and the Prigoginian 'order through fluctuations' discussed below.

The laws of nature, whether they appear in the form of causal laws, or in the form of probability laws, are regarded as a Hegelian synthesis, as it were, of the idea of absolute determination (the thesis), and of absolute randomness (the antithesis). This way of describing Bohm's procedure is by no means a mere verbal trick, for it is Bohm's conviction that in all fields the alternative use of opposite sets of concepts is to be preferred to the exclusive utilization of only one of them (Feyerabend 1981: 228).

Brody takes the mechanistic or modular approach of regarding concepts as building blocks from which theories and models may be constructed (Building Metaphor), and which are often, along with physical techniques and mathematical formalisms, 'mixed and matched' as required.

⁸² I would question this, as Bohr's *Order of the Elephant* went with a self-designed Coat of Arms that included the yin/yang symbol.

⁸³ Again that Atomist Metaphor, but an organic, evolving building, more like an organism.

Wittenberg and Sterman⁸⁴ present a Kuhn-related model of knowledge which consists in an Ecology of interacting Paradigms competing for members, each with its community of practitioners, its favoured Epistemology, its ways of self-reinforcement (through such things as self-reproduction by research and training activities, tenured institutional control, gatekeeping of access to learned journals, resource allocation and referee selection), its level of confidence and its delicate balance between viewing anomalies as puzzles to be solved or as threats to the Paradigm.

Their findings are that the characteristics of the model are those of a self-organising dynamic, evolutionary system, with path dependence and positive and negative feedback processes; that Paradigms are subject to life cycles with identifiable phases related to the characteristics of their contexts, and that the timing of the emergence of a new Paradigm to coincide with a drop in confidence in the dominant one, is a far better predictor of survival than competition (which "decimates the weak and strong alike"). As in business, survival is not necessarily the reward of the best product, but of the product which first manages to occupy a niche: survival of the first, not the fittest (Wittenberg & Sterman 1996: 1, 5, 13-14).⁸⁵

We found that intrinsic capability has but a weak effect on survival. The hazard rate for paradigms seems to depend almost entirely on the environmental conditions surrounding their birth⁸⁶ ... The interplay between intrinsic explanatory potential and historical contingency is quite subtle ... of those paradigms that manage to survive their initial years, those that are more powerful remain dominant longer, on average ... weak competitive environments make it more likely a new paradigm will rise to dominance, but can condemn even powerful paradigms to early deaths as they are extended too far and too fast, generating anomalies and destroying confidence prematurely (Wittenberg & Sterman 1996: 24, 23).

Nuclear and quantum physicists in particular are often forced to work with a 'hotch-potch' of theoretical elements ('theory soup'). Bohm and Peat, Brody and Chew all point to the need for Conceptual Pluralism: to hold simultaneously a number of interlocking and partly successful models or theories without initial favouritism. The expectation is that by creative processes, active experiment, improving understanding and technological competence, and recognition that all Science is approximate, integrated knowledge will emerge [*Oceanic Emergence Metaphor, or a Hatching*]. Diminishing areas of ignorance or demarcation of the regions of validity may indicate the continuing usefulness of older theories: a policy of 'conceptual democracy' (Bohm & Peat 1987: 110; Brody 1994b: 267; Capra 1983: 326; 1985: 251). To quote Brody⁸⁷:

The problem becomes ... not to decide between two theories of X-rays (particle-like and wave-like), but to find ... one theory which possesses the capacity of both.' (Brody 1994b: 273).

⁸⁴ Wittenberg: Dept. of Political Science, MIT; Sterman: Sloan School of Management, Massachusetts Institute of Technology (MIT), Cambridge MA, USA.

⁸⁵ For example the triumph of VHS videorecorders over the better-designed beta. 'Survival of the first' is a second-hand concept of origin uncertain to this author (?Allen & Starr).

⁸⁶ Link: **Chaos Theory: 'exquisite sensitivity to initial conditions'**.

⁸⁷ Quoting Bragg, 1912.

As with the Classical, Quantum Physics usually now takes an asymptotic, evolutionary view of theoretical fitness, a Pendulum Metaphor that indicates a Realist position: there is a real, objective world, an ultimate Truth is where the pendulum comes to rest, and a concept of Progress presses on towards that goal (a Journey). Bohr took such an approach, labelled 'Moderate Holism' (Honner 1987: 15, 17, 21).

Brody, discussing the structure of theories, describes Kuhn's Paradigm Shift pattern as simplistic, and notes that theories evolve and change [*organic metamorphosis*], especially in the period of reformulation and scope definition between major 'revolutions'. Models are developed to take account of narrowly-defined, specifically mathematically formalised problems [*islands of sanity in a mad sea*], and with new problems it is often necessary to use a number of incompatible models simultaneously until a more fundamental General Theory emerges which can explain their partial successes. This most often arises from describing different aspects or scales of the same universe [*the descriptions-of-an-elephant story*,⁸⁸ or sometimes a Military 'fixes on a target' Metaphor] (Brody 1994a: 40-45).

The development, description and flexibility of a society's world view are critical issues for survival, for a society and for its people. Thus the purpose, manner and mechanisms of change and the tension between change and social and personal stability, are crucial contextual issues. Bohm & Peat in particular, identify conceptual rigidity as the key inhibitor of the flow of creative process upon which a healthy, problem-solving and crisis-minimising evolution of society depends, and draw comparisons between play, creativity and Science (Bohm & Peat 1987: 49-51, 104-115, 146). They describe the process of free play between formal logic and creative or intuitive reason, the former testing the rationality of relatively fixed forms (ideas/ assumptions/ mathematical and other structures), and the latter the seat of creative perception, where conceptual dissonance is dynamically processed. **Link: Ordering Principles: Order Through Fluctuations.**

While a certain amount of structure is necessary for stability, there needs to be an active response to signals that previously rational and functional concepts have become dysfunctional for the current context, or that the tacit underlying order is undergoing change. Under conditions of change, false claims that everything is in order or that the old ways are best, do

⁸⁸ One version has a group of Indian blind men investigating an elephant, each feeling a different part and announcing very different conclusions about the nature of an elephant (eg punkah, wire brush, tree trunk, sandpaper, rope, firehose, digging stick), until one man is engulfed in manure, at which point a completely different scale of interpretation becomes available for contemplation.

not address the realities of the relationship between the internal and external structures of society.

Bohm & Peat describe the process of change as the fundamental ordering principles underpinning society evolve, where clinging to outdated assumptions results in conceptual lags as revolutionary new ideas are presented and gradually integrated across academic disciplines and society as a whole. They too, challenge the Kuhnian idea of the inevitability of alternating revolution and quiescence associated with Paradigm Shifts, where the new Paradigm is supposedly incommensurable with the old, and significant change happens only during the revolutionary period. They trace the radical transitions in the 'tacit infrastructure' of society from ancient times to the present. **Table 14: CM: New Orders in Society** takes similar idea from the combined work of Bohm, Capra and Henderson. **Link: Ordering Principles.**

As Bohm sees it, the new and old ideas may be mutually irrelevant rather than incommensurable, the latter implying the potentially violent and destructive reactions of a serious level of fragmentation. This could theoretically be avoided by recognising the ongoing evolutionary nature of knowledge and understanding, and of change in the systems of theories and principles that underlie the notion of a Paradigm. Sudden discontinuity and revolution are not inevitable, and examples of significant creative change throughout 'quiescent' periods are legion. Free dialogue within society and openness to creative process and the plurality of ideas, are then crucial to the achievement of social "transformation without disruption" (Bohm & Peat 1987: 25-7, 29, 104-111).⁸⁹ **Link: Hypercyclic Systems: Holling's Infinity Loop.**

Environmentalist rhetoric notwithstanding, a superseded Paradigm or its components do not necessarily become obsolete or irrelevant to a new framework. In particular, there are many areas (especially at the human scale) where the despised Cartesian/Newtonian Mechanism has worked extremely well: we do in fact want objective safety standards in our machinery. While we may be preoccupied with Mechanism, the realm of Meaning and purpose is also present whether acknowledged or not. We do indeed have a particle nature, but we are also waves relating to a larger whole. There is always a context. We need never forget why we want objective safety standards, and on the other hand should put Science in its place as a useful tool. Brody notes that Chaotic and Nonlinear Mechanics are both outgrowths of Classical Mechanics, not opposites, which Brody evaluates thus:

⁸⁹ Based on this argument, the attempted suppression of alternative views by defunding Non-Government Organisations and Australia's National public broadcaster are short-sighted strategies with undesirable long-term implications.

... generally considered to have been 'disproved' by Einstein's relativity theory on the one hand, by quantum mechanics on the other. Yet this outmoded, disproved, and falsified theory continues to be taught in university courses of physics, indeed is considered almost basic there. Is this only a piece of outrageous conservatism on the part of the scientific establishment? (Brody 1994a: 44-45).

Brody goes on to explain that by scoping the region of validity, the 'disproving' of a Theory defines its limitations, indicates how and where to look for weaknesses, and may well result in the development of a better theory. This has been the case with Classical Mechanics, which is still uniquely applicable in some regions where Quantum and Relativistic Theory are not, and which is still required to inform Quantum Mechanics in "intricate yet obscure" ways (Brody 1994a: 45). The relationship between Classical and Quantum Mechanics is explored further below. Furthermore, while Quantum Field Theory, the 'most accurate theory ever', has been tested to an accuracy of one part in 10¹¹, General Relativity, which includes Newtonian Theory, has been confirmed as accurate to one part in 10¹⁴, limited only by the accuracy of earthly timepieces (Penrose 1996a: 61). What has been under challenge is thus the Atomism, Scientism, Reductionism: the Absolutism of the world view which underlies mechanistic thinking: the Metaphor and interpretation rather than the Mathematics itself.

Convergent knowledge, (such as describes a simple, non-living entity) will asymptotically approach perfect understanding the more one seeks information (Schumacher 1977: 144-7). But in Complementary fashion, divergent entities (such as living systems) give more detail and complexity the more closely they are studied. A divergent entity is in constant interaction with its environment, and different responses also result from the changing organising principles in different phases of the system lifecycle. This invites insoluble argument across logical types (**Links: Complementarity; Criteria of Observation**).

Divergent problems offend the logical mind which wishes to remove tension by coming down on one side or the other; but they provoke, stimulate and sharpen the higher human faculties without which man [*sic*] is nothing but a clever animal. A refusal to accept the divergence of divergent problems causes these higher faculties to remain dormant and to wither away, and when this happens the 'clever animal' is more likely than not to destroy itself (Schumacher 1977: 147).

While the divergence problem in Science is plagued by attempts at oversimplification, an international convention such as UNCED suffers from the need to accommodate multiple Paradigms all at once, a practical political Pluralism rather than an intellectual one. The IFC⁹⁰ Pre-Rio Preparatory Process produced a caricature set of six hierarchical structures representing competing world views, which they saw as an Ecology of Frameworks, each of value for particular functions. These were Labelled Politics, Consumerism, Culture, Business, Greens and Law & Order (**Figure 6: BICMES: Competing Models**). The fields of concern were well-being, learning, environment, trade and regulation. The task of Sustainable Development was seen as

production of a functional synthesis, which facilitated or constrained these perspectives according to the situation, but did so by negotiating responses to a series of inevitable strategic dilemmas. Openness, negotiation, inclusiveness and willingness to be subject to constraint safeguard common well-being (especially environmental), have considerable virtue.

These six functions and fields combined into thirty 'strategic dilemmas', which they grouped into fifteen tensioned groups for analysis. That is, they identified the trouble spots in advance. For instance:

Quality of Life: Over-consumption and exploitation of non-renewable resources vs reduction in quality of life (+ full employment of the few) to safeguard environment (IFC 1992: IFCD53) ("*Systemic Mapping of Strategic Dilemmas*").

A climax condition notion is irrelevant in a dynamic equilibrium context ... which is constantly changing, so the appropriateness of a Paradigm will also change with the context. **Link: Complexity Theory.**

If a budget of flexibility is to be a central component of our understanding of how the environment-civilization works, and if a category of pathology is related to unwise spending of this budget, then surely the flexibility of ideas will play an important role in our theory and practice ...

The ideas in a civilization are (like all other variables) interlinked ... any given idea or action is subject to multiple determination by many interwoven strands ... [*this*] is characteristic of all biological fields [*including animal or plant anatomy or behaviour and ecological processes*] ... moreover it is rather unusual to find that any feature of a biological system is at all directly determined by the need which it fulfils ... in contrast to the products of human planners and engineers ... [*which are*] constructed to meet specified needs in a much more direct manner, and [*are*] ... correspondingly less viable ...

... against this complex background, it is not easy to construct a theory of flexibility of ideas ... two clues ... [*may be*] derived from the stochastic process of evolution or learning[:] ... the paradigm of extinction by way of loss of flexibility [*and*] the phenomenon of habit formation ... [*which*] sorts out ideas which survive repeated use ... trusted ideas then become available for immediate use without thoughtful inspection,⁹¹ while the more flexible parts of the mind can be saved for use on newer matters⁹² ... the 'natural selection' which governs which ideas shall survive longest ... [*and*] how this process sometimes works to create evolutionary culs-de-sac (Bateson 1972b: 496-501).

4.4.5 POLITICAL ARRANGEMENTS IN A DIVERSE SOCIETY: COMPETITIVE VS COOPERATIVE PARADIGMS

Wittenberg and Sterman's paper describes the competitive dynamics of scientific revolution, and explains the mechanisms for success of a single paradigm in competition with others. They spell out in detail the self-organising systemic character with its punctuated equilibria, path dependence and emergence (Wittenberg & Sterman 1996). However in an overconnected, divergent and diversifying realm such as today's society, the political arrangements are increasingly needing to accommodate a multiplicity of points of view, not just one. To claim 'majority' representation is no longer appropriate: even if (a heterogeneous) 51% were an

⁹⁰ International Facilitating Committee.

⁹¹ 'Parent' Ego State (Exteropsyche) in TA.

⁹² 'Adult' Ego State (Neopsyche) in TA.

acceptable majority, this leaves 49% unrepresented, claims to represent 'all the people' notwithstanding.

While scientific knowledge may accumulate asymptotically in the background, the political scene appears to be approaching a choice point: to continue with the politics of competition and conservative dictatorship, with its public cynicism, divisiveness and exclusion, or to restructure decision making in a way that is much more open, participatory, representative and accountable, balancing rights with responsibilities.

An increased emphasis on local participatory democracy was a consistent recommendation of the Jerrabomberra Valley National Ideas Competition entrants, but this will not emerge without a supportive backcloth, community desire and a genuine devolution of power. This would require a long time scale, much education in civics and from experience, an extension of emphasis on participatory processes, and expert knowledge of conflict resolution, but to preempt the need, for training in conversation (Table 16). The Adelaide 2020 Vision Planning Review in 1991 demonstrated quite clearly through its low public participation rate despite Herculean staff effort, the public cynicism towards this type of public consultation (one of the most expensive and extensive ever conducted in Australia). My 1991 survey of planners from all Adelaide and metro fringe Councils (n=50), demonstrated that planners also felt left out (**Table 15: RRES: Planners Suggest Strategies for Large Scale Public Consultations**). On review, 2020 Vision was true to its brief: a process for collecting issues likely to produce resistance to State Government intentions, but not a participatory or creative process (Rounsefell 1991a: 82-5).

Today ... we are leaving industrialism behind and rapidly becoming a de-massified society ... the rising activism of minorities is not the result of a sudden onset of selfishness ... it is ... a reflection of the needs of a new system of production ... we need to jettison the frightening, but false, assumption that increased diversity automatically brings increased tension and conflict in society ... given appropriate social arrangements, diversity can make for a secure and stable civilization [*where conflict is lower due to a wide diversity of objectives*] (Toffler 1980: 429, 430, 431). [*And see quote on Malinké at head of section.*]

Mathews argues that the Newtonian Cosmology presented a discouraging Mythology of indifference to the atomised individual through the medium (Myth) of objective, dissociated Science. That as the Newtonian framework has been superseded by Science itself, while its Normative Mythology has persisted, so our culture has become progressively ungrounded, confused about values and uneasy, seriously alienated and insecure. Science as a Mythology could, she says, "reveal a universe that was alive, sentient, and evolving toward some specific ideal". It is not committed as a Myth to Newtonianism's "fact/values distinction, portraying the world as inert, insensate, devoid of telos, of value, purpose and meaning" (Mathews, 1991: 46, 45-7).

The essence of Substance Pluralism is competitive: either/or, and strongly associated with modernist Realism. That of Substance Monism is unification: both/and. If everything is connected, and all entities are at a core level parts of each other, then competition makes only transient sense, but this type of notion is extremely important to an individual trying to meet survival needs in a competitive world, especially in the absence of a strong sense of community or personal continuity, other than individual descendency. The Aristotelian-Cartesian-NeoClassical system with its ubiquitous presence of competitive, self-centred individuals, litigation, policy and politics, needs to be accounted for in Planning or Design, even when proposing cooperation as an ideal. It is after all, the present Dominant Paradigm. Furthermore, most individuals and groups sustain a context-related balance, albeit often uncomfortable, between competitiveness and cooperativeness (for example the stance of 'us' against 'them' in cultures, neighbourhoods, workplaces or sports teams).⁹³

In view of the observed strategies first of flocking then of 'every individual for itself' in extremis of many biota under conditions of overconnection to (shortage of) food supply (Allen & Starr 1982),⁹⁴ phenomena like crowd and 'NIMBY' behaviour in humans may be better understood, and particularly the exaggerated competitiveness and meanness emerging with the *Scarcity Paradigm*, Economic Rationalism.

Postmodernism takes a dynamic and relativist or perspectivist approach to reality, and an anti-structuralist or oppressive interpretation of competition. This view at first appears to be more egalitarian than Individualism, but might more accurately be dubbed 'neither/nor' (not) in the Boolean Metaphor, at least in its outcomes. In the process of "dismantling ... objectivity" (Blackburn 1996: 295), it strongly emphasises the non-rational aspect of Complementarity, and may be quite authoritarian in taking this view to extremes (as in the quote above). Post-Structuralism does rely on competitive terms for interpretation, a problematique of power relations, which appears to indicate an ideal of inclusiveness or Concept Pluralism. But the Postmodernist position does not overtly espouse any particular values set except in the negative terms of disapproval of righteous claims to The Truth.

⁹³ Recent research confirms that humans, chimpanzees and wolves all exhibit behaviour uncommon elsewhere in the animal kingdom. This involves 'coalitional violence', a territorial behaviour usually of politically unconstrained young males (whoever takes the military role in the species), whereby parties seek to damage the potency of neighbours by going on marauding excursions at the boundary of their territory, seeking solitary neighbouring 'soldiers' to maim and kill. This behaviour is not about gender, competition over females or specifically over food. It is entirely about power and dominance, on the basis that dominant groups have the pick of all these resources. The Psychology underlying modern warfare has not changed from these primitive drives, although the technology has. ABC Radio National 10/4/99, "The Science Show", Prof. Richard Wrangham & Dale Peterson (Wrangham & Peterson 1999). See also <http://www.harvard.edu/>

⁹⁴ Territoriality appears to be a device for lowering connectedness of a system which is dangerously overconnected (Allen & Starr 1982: 204). **Link: Theory of Scale: Connectivity.**

Pluralism: The general tolerance of different kinds of thing, or more particularly of different and perhaps incommensurable descriptions of the world, none of which is deemed to be more fundamental than any of the others ... It is also a cardinal doctrine of post-structuralist literary theory, where it frequently consorts with relativism and general suspicion of a notion of 'the truth'. Sometimes this is a relatively innocuous doctrine that there is no way of stating the unique truth ... at other times it may be the more sinister doctrine that no view is true, or that all views are equally true (Blackburn 1996: 291).

Lynch's "constantly shifting sea of values and positions" is described in terms reminiscent of Complexity Theory (below). This is a helpful approach to deconstruction (a term that betrays a mechanistic or building metaphor), but problem solving is given no assistance in selecting from or comparing alternatives for action (Gare 1995: 97). For EPPs this is sorted out by adherence to a 'Green Theory of Value' after Goodin (Goodin 1992: 22-26), that envalues Nature as the context of other thought, but its expression is complex:

... according to certain Eastern philosophies much favoured by certain 'deep ecologists', this eclipsing of the self and merging of the individual with the whole of the universe is an independently desirable outcome ... not all the reasons we might have for assenting to the green theory of value would necessarily require us to presuppose that proposition. Buddhism and its ilk is a separate issue, to be argued for separately ... what really matters ... it is perfectly possible - logically defensible - for us to think that it is important for people to have personal identities and personal projects, and for us nonetheless to think that it is important that those fit into some larger (natural) contexts. If that is our view, as I think it is of a great many greens and would-be greens, then that provides a rationale for ... *[simultaneously]* ... (a) pursuing green public policies, to secure the larger natural contexts ... (b) refusing to adopt green personal lifestyle recommendations aiming to deprive us of the distinctively personal stance from which harmony with nature would be satisfying or even meaningful (Goodin 1992: 82).

Goodin argues that the supposition that all those espousing a Green Theory of Value must "endorse all forms of greenery" is a heresy that drives away large numbers of potential political supporters. Thus the institutional framework (Backcloth or context) needs to be Nature-valuing, but Individualism must be given space at lower scales (but never provide the overall context).

Humans are capable of both cooperative and competitive behaviours. Most people's lives are marked with a mixture, preferably a balance of these, depending on the context and scale of interaction. A football team may be fiercely competitive in play, at the same time as cooperating fully within the team structure. In a classical symbiotic marriage, the husband's jurisdiction is the outside world, while his wife's is inside the home, so he may define reality without, and she, within, yet they may present a cooperative 'couple front' in other settings.⁹⁵ In a hierarchically-structured organisation, a worker may be cooperative within her own level, and competitive above (from a 'one-down' position) and below (from a 'one up' position).

The Basic Position of communities of interest (attitude to acceptance of self and similar other) is profoundly important to outcomes. People claiming to stand up for the 'rights' of another group (such as militant feminists), within a rhetoric of cooperation and democracy, can be extremely oppressive.⁵ The Transactional Analysis Aphorism 'I'm OK, you're OK' has deep

Metaphoric meaning. Links: Criteria: Community: On Love as the Biological Basis of Social Life, Organism: Human Psycho-Social Needs; BP 5.2: Transactional Analysis.

There appear to be optimal situations for cooperation and competition. For instance in parenting, it is clear that severe pathology can result when a parent competes for love, attention, resources or even survival, when supposedly nurturing a young child, especially an infant.⁵ Ken Mellor⁹⁶ and Mary Goulding,⁹⁷ have often stated in psychotherapy training that all psychopathology arises ultimately from having a competitive Frame of Reference of this type.⁵ Aggression and competitiveness are now apparently in high-gear positive feedback. **Link: Theory of Scale: Constraints.**

On a societal level Milbrath, quoting heavily from Schmookler, Eisler and Berry, establishes the depth from which the 'dominator society' flows, and describes the helplessness of a society that is organised around partnership and protection of Nature, before the aggression of one committed to the accumulation of power [*for example the Australian settlement situation*]. Such a society's options are limited, since there is no self-defence without either escaping to an inaccessible place, adopting a well-organised guerilla war or taking on the aggressive style of the aggressor (Kay 1991: 485; Milbrath 1989: 44) [*or finding a strong champion who wants something you have and doesn't want to be seen taking it by force*]. **Links: Hypercyclic Systems Theory: Kay's work: Figure 27, Table 46.**

Since power is derived from rapid exploitation of resources and either colonisation or seizure of the resources of less aggressive groups, accumulating large population and land holdings, there is a tendency away from Nature, and towards stratification (specialisation into controllers and 'drudges'): a highly competitive situation. Wrangham concludes from his cross-species studies (footnote above), that gentle societies need strong and visible defence systems (**Links: Organising Principles; Theory of Scale: Constraints**), and to have ways to constrain or constructively harness the dangerous proclivities of politically unfettered young males (Wrangham & Peterson 1999). EPPs would appeal to Morals and Ethics in such situations, and look for champions in opposing camps, but also keep the young men busy doing good ecological works and appreciate what they do!

The typical EPP, while acknowledging competition as one of many possible relationships, and often interpreting orthodox social and ecological reality in competitive terms, has a central

⁹⁵ A Complementary Symbiosis as defined by Transactional Analysis theory as distinct from Competitive Symbiosis, where the two symbionts compete for a psychological position (Schiff 1975: 7-9).

⁹⁶ Senior Transactional Analysis psychotherapist from 1970s, and Yogic Master, Melbourne,

concept of Substance Monism, sees reality as a messy yet paradoxically efficient, evolving complex dynamic system with an indefinable inherent wisdom, and has an ideal of respectful but pragmatic cooperation. He or she prefers striving for personal mastery to competition for its own sake (as distinct from fun). Inclusiveness is espoused as Concept Pluralism and Wholism, but a strong values set is carried, predicated on basic rights and needs for system, social and biotic survival.⁹⁸ Ecological NGOs have significant overlap with the peace movement (for instance see the work of Dr Rosalie Bertell).^{99,5}

Ecological thinkers tend not to have direct answers to serious violence, usually retreating to statements that if everybody lived in community and threw themselves into caring behaviour and earth-healing, sustainable lifestyles, there would be much less problem. But intentional communities find that they have constantly to work on relationship and conflict resolution, preempting escalation. Those that survive tend to have a core of firm general behavioural rules.⁵ Sport seems increasingly to be taking a conflict-displacement role in the wider community. The likely need for increasing attention to non-competitive forms of conflict resolution, has seen active response from both the Transactional Analysis and Process Work communities. Background - Paper: Transactional Analysis as a Multi-Scale Model for the Social Sciences, has already been referred to.

The approach to 'getting there from here' is in many ways unsatisfactory and slow. While often forced into competitive behaviour by the nature of the mainstream system, EPPs constantly tries to demonstrate alternatives. This includes taking a long-term view, and adopting the gentle methods of conversation, passive resistance, persistent determination, 'walking the talk', building demonstration projects, information sharing (especially now on the Internet), and infiltrating mainstream committees.

The vigorous Australia-wide responses in recent years to the messages and visits of Robert Theobald,¹⁰⁰ John Ralston Saul¹⁰¹ and Paul Hellyer¹⁰² encourage one to think that discomfort levels may be rising enough to constitute a social movement. This movement includes but goes

⁹⁷ Co-originator of the Redecision School of Transactional Analysis.

⁹⁸ Usually subject to substantial compromise in a consumer society.

Medical epidemiologist and Catholic nun, visited on research journey in 1993, Association for Concerned Citizens, Toronto. Bertell (*inter alia*), researches and publishes on the health and environmental impacts of military activity, much information of which she gleans directly from publically available but little publicised military literature. She makes the valid point that military impacts and energy and materials usage are never quoted in national statistics, and that they are enormous and significant; also, not widely known, that after WW2 the ionosphere was deliberately damaged experimentally (personal communication 1993).

¹⁰⁰ Robert Theobald was a British economist, social philosopher and futurist, living in the USA. He died in 1999. He made major efforts to communicate his message of the need to come together in respectful conversation and active listening, to completely rethink all our precepts, systems and institutions, so as to effect profound social change. This triggered the emergence of the 'Reworking Tomorrow' movement.

¹⁰¹ The dangers of Corporatism.

beyond the usual 'activist circuit', and has the support of many people in leadership positions, who are surprisingly open to the ideas, concerned about the system, yet have not known what to do.¹⁰³

The right wing Pauline Hanson political phenomenon of 1996-8 self-destructed, but unmet human needs are driving a resurgence of this and other movements as elections approach, and not just in classical low income groups. The initial conditions for the emergence of this astonishingly large group (some 15-25% of Australia's voting population, especially rural), were identical to those for the more urban *Reworking Tomorrow* movement that responded to Theobald, but the Hanson ambience was negative, divisive and paranoid. The *Reworking Tomorrow* ambience, also contracted since Theobald's death but persisting, is very different, having 'treating each other well' (mutual respect), servant leadership, ecological sustainability, social justice, collaboration, community building through the lost art of conversation, effective decision making and inclusiveness, as core values. Theobald's advice was to behave as if this were already the Dominant Paradigm.

One of Theobald's facilitator colleagues in Australia, Dr Alan Stewart, has established himself as a professional conversationalist, running training 'learnshops' based on '*Open Space Technology*',¹⁰⁴ and using strategies that beat at the heart of the 'both/and', Quantum approach. In his unpublished paper "*Conversation and Debate in Public Discourse: Some Fine Distinctions*", Stewart distinguishes between debate and conversation. Debate, the competitive core of our public discourse, inevitably creates winners and losers, disquiet and distrust around governance, lack of satisfaction in solutions and non-ownership of problems. After Theobald, he argues powerfully for conversation as the way forward, in a world beset with complex problems we must all own and responsibly address. He cites two examples, the Republic and the River Murray salinity issues, both of which have been set up as competitive, unproductive debates, and both of which must be resolved in partnership, with the highest forms of collaboration, based on ongoing conversations. **Table 16: ESCM: Conversation** entabulates Stewart's handout, which contrasts debate and conversation in detail. He proposes that we reclaim the verb to converse - from the Latin *con versare*, to turn or dance together - a non-frivolous term, with an associated noun, 'converse' (used similarly to 'commerce'): a first step from an adversarial to an inclusive approach to handling complex issues":

¹⁰² The sinister side of economic Globalism.

¹⁰³ Personal communication, Robert Theobald, September 1998.

¹⁰⁴ This is a set of ground rules for running meetings where people feel safe to be open, take responsibility for their participation, and treat each other well. See www.openspaceworld.org/ and www.openspacetechnology.com/.

People of good will can *choose* to do this. Its effectiveness will be enhanced by referring only to the process, to converse, with no qualifiers [*such as 'respectful', 'providential', 'skilled', 'courageous'*] ... I believe that we all have responsibility to converse with each other, based on a belief in the power of conversation and trusting in where it will take us (Stewart 2000).

Such EPP philosophy sits well with Deep Democracy as defined by Mindell,¹⁰⁵ (and with the colloquially expressed Transactional Analysis Basic Position of psychological health, 'I'm OK, you're OK'). The emerging wisdom is again to look beneath the '-isms' and relate to each other as people again. That relationship has never been more important.

Our challenge is to carefully develop organizational and conflict resolution skills so that they reflect democratic principles and are widely applicable ... Worldwork¹⁰⁶ must not be limited to inner peace or outer equilibrium but must apply to real situations where there are chaos and attack, transformation and conflict ... the tools of worldwork can only succeed with the attitude of deep democracy, that special feeling of belief in the inherent importance of all parts of ourselves and all viewpoints in the world around us. While worldwork is a set of tools that must be continuously updated as we better understand our planet; deep democracy is a timeless feeling ... is our sense that the world is here to help us become our entire selves, and that we are here to help the world become whole (Mindell 1992: 5).

And as a learning from the survival of the African American woman Bernice Johnson Reagon:

History repeats itself. Communism, which planned to overcome monarchy, created a totalitarian regime. Democracy in the United States, which aimed to overcome rulership by one class, made new feudal boundaries to keep certain people down. This is why social activists and facilitators must make awareness their first priority. Don't overlook social rank or the spiritual rank that fuels revenge ... If you are in the white mainstream, you may claim that life in a democracy cannot be compared to life under a dictatorship. The thought is shocking. Yet psychologically, the effect of oppression is the same. Democratic societies without awareness finally create the same inner experience as dictatorships. Individuals from marginalised communities must obey, or their lives will be worthless (Mindell 1995: 176).

¹⁰⁵ Mindell himself and his institution, are powerful EPPs.

¹⁰⁶ Large group conflict resolution as practised by Process Workers trained by Mindell's Institute.

4.4.6 SUMMARY: HUMAN SETTLEMENT ECOLOGY & METAPHOR

The first section describes the relationship of built environment design to the metaphoric-mythical expression of built environment, and iterates the necessary presence of a Frame of Reference in language (which functions through a metaphoric structure), interpersonal relationships (enabled through having a Basic Position), the interpretation of the symbolic messages in Art, Design and Architecture, and orientation in the world (intuitively read through the sign system described by Semiology).

Metaphors for the city are then contemplated, in particular the Crystal, Machine, Organic and Ecological, and an argument is presented for a multi-faceted complex Ecological Metaphor with cyclic, webby, organismic, mechanistic, brain, crystal, bazaar and satisfier features. But these are incomplete lenses through which we may start to comprehend a complex, process-driven story of Being and Becoming, a 'syn-phony' rather than a vision, which may or may not be harmonious.

It is apparent that human society is involved in a period of major transition, including from a largely linear view to a complex one. We are aware of the painful and competitive 'flip-flop' between the mainstream or dominant paradigm and proponents of a new eco-socially responsive Paradigm, and one can observe the 'greenwashing' of the mainstream group in order to retain competitive dominance without in the end changing the consumption-driven market system on which it is based.

Periods of change imply change of Paradigms and the Metaphors that entrain them, or even whole Cosmologies. The process of paradigmatic shifting is reviewed and recognised as another example of a complex, dynamic, evolutionary entity, with the characteristics of an *Edge of Chaos* system. Paradigmatic dominance has been shown to be related to the initial competitive conditions at their birth rather than their explanatory potential. Paradigms have life cycles.

Metaphoric concepts which reflect what scientists think they are doing, are indicators for their basic positions about reality. A rich mix of language-embedded Metaphors forms a subtle organising matrix that reciprocally supports this activity (and indeed all our lives). Such indicators include culinary, oceanic, military (also gladiatorial),¹⁰⁷ organic, psychiatric and architectural metaphors. The two main ways to see theory development have been as a single-minded linear construction of a building from blocks, and as an organic process welcoming Conceptual Pluralism, with emergent concepts providing increasing clarity. Both have

¹⁰⁷ There have been a number of famous battles between subatomic physicists around the interpretation of theory (eg Einstein-Bohr, Hawking-Penrose).

asymptotic characteristics (converging on an ultimate Truth). Few of these arguments distinguish between the structuring of theory itself and the structure of the reality the theories describe. As it turns out, both appear to be subject to the type of ordering typical of the *Edge of Chaos*, to be discussed below.

There are periods where sudden paradigmatic shifting occurs, but much activity goes on between major shifts, models are developed and consolidated, incommensurate models may produce emergent, transcendent meta-explanations, and major shifts may not discredit so much as refine or redefine existing frameworks, including the supposedly debunked theory of Classical Mechanics.

Finally, the differences between cooperative and competitive frames of reference are exemplified and related to various concepts from politics to war; Science could be inclusive instead of exclusively, alienatingly Newtonian; Postmodernism at community scale is a neither/nor approach, useless for informing action, even as it excels at deconstructive analysis (an atomist undertaking). The striving of those concerned to implement a more caring, cooperative, wholistic society, is starting to generate networks and take the form of a social movement, inspired by social philosophers mainly originating in North America, and to whom Australians are responding in all States.

5 THE SUBATOMIC SCALE

5.1 INTRODUCTION

Do you see what has happened to meaning? Theory is no longer a reverent paying heed to the phenomena themselves (a letting the data speak for themselves?), but an imposition of a preselected, preformed, à priori template. And, by Jupiter, what is contemplated will fit! Can you not hear the strident Roman demand to shape up and conform, in contrast with the gentler and patient Greek questioning and paying heed? (Gould 1981: 73).

Subatomic Theory is unexpectedly relevant to the everyday human world and the development industry: to the nature of the Cosmologies driving our interpretation of reality, the issues we prioritise and the decisions we make. It helps to explain our Metaphors, which in turn are indicators for the major philosophical shifts we have made and arguably need to make, and is indispensable to an internally coherent explanation of the Ecological Paradigm. Profound change would result if some of the concepts mentioned below, such as the inclusiveness of a 'both/and' approach or the Complementary sensitivity to intangibles and to local meaning were, even as single strategies, implemented directly in human settlement practice.

5.2 RELATIVITY AND THE ECOLOGICAL SELF

Einstein was labelling the latest development of a long process of conceptual change when he produced his theories of relativity (Bohm 1965: 4-8). From the middle ages through Copernicus, Galileo and Newton, relativistic theories were being developed, but were hampered by choosing frames of reference such as the Earth, the Sun, and distant relatively fixed stars, in a context of absolute notions of space, time, motion and distance. A hypothesised 'ether' created confusion as the medium in which all motion occurred.¹ Einstein realised the equivalence of mass and energy, and then in one stroke revoked Absolutism and made relative the concepts of space, time and mass, using the constant speed of light as a relational frame. The Laws of Physics then described relationships of the same form across all frames of reference. The Special Theory of Relativity refers to relational frames under uniform motion, and has to do with time as a fourth dimension, related to three dimensions of space ('spacetime'), while the General Theory of Relativity refers to all frames, including those under acceleration, and has to do with gravity (Baggott 1992: 35;Bohm 1965: 71-3, 110;Einstein & Infeld 1938: 59-65, 156-7). Einstein first formulated his Relativity concept in a paper "*On the Electrodynamics of Moving Bodies*" in

¹ Reconsideration of such notions may be indicated having accepted the existence of anti-matter.

Annalen der Physik in 1905 (Smilga c1965: 241). Suddenly, a world of metaphoric mechanical certainty became a slippery world where everything depended on something else, and spacetime was the fundamental, universally connecting substance of the universe.

Mathews in *The Ecological Self* presents an integrative but complex philosophical argument which draws on Spinoza's Monistic Theory of Substance and Einstein's Special Theory of Relativity, ('Geometrodynamics'), which she uses as a metaphysical blueprint. She excludes Quantum Theory as a model, in view of the wide range of interpretations extant in 1988. She describes an undivided universe composed of spacetime, which is elastic, curved and folded. Davies adds 'world lines', the non-linear trajectories² of object systems through spacetime (Davies 1988: 123-5). Matter is a localised condensation of spacetime. Everything in the universe, which is apparently expanding,³ is connected to everything else, thus supporting the aphorism made famous by Barry Commoner.⁴⁵

Mathews painstakingly builds a case for the interconnectedness of everything, which she acknowledges is an insight of Eastern philosophies, but rejects those traditions in order to derive a culturally congruent Theory. She argues for the universe as a 'self', an open system that is self-valuing, self-interested, self-realising, self-maintaining, and has intrinsic interconnectedness. The unit of survival is not a breeding individual nor a family unit, but an organism-in-its-environment, wholistically nested in a wider self-system (Mathews 1991: 1-6, 109-116). Davies (discussing Von Neumann's work in Quantum Theory) also describes a theoretical nested system of observer systems, but stops at universe level since "there is, by definition, nothing external that can observe it" (Davies 1988: 134-5).⁶ This is very different from a disconnected universe of separate, individual entities that may impinge in empty space under the influence of external forces (the Newtonian model), but which still seems to inform the Atomistic dominant Western paradigm at policy level. This ontological concept of embeddedness extends naturally into the Ecological Theory of Hierarchy and Unified Ecology, which are regarded as Epistemology, and dealt with separately below.

² According to changes in acceleration; at rest = straight, vertical (see Davies' diagram); also referred to as "world tubes" by Bohm (Bohm 1965: 9-10).

³ Another theoretical discussion relating to the concept of time and alternative universes, which will not be addressed herein, attaches to this point (Davies 1995: 183-95, 219-32).

⁴ Centre for Biology of Natural Systems, Queens College.

⁵ The relevant aphorism is 1).Everything is connected to everything else. The other three are: 2).Everything has to go somewhere 3).Nature knows best 4).There is no such thing as a free lunch (Commoner 1992: 8-14).

⁶ A nice entry point for 'God'.

Bohm calls for awareness of the crises in every area of civil society and the biosphere resulting from the fragmentation wrought by Atomism (Bohm 1980: 16-17), which has far-reaching implications in our search for underlying principles and their review. As Bohm says:

... it is not an accident that our fragmentary form of thought is leading to such a widespread range of crises, social, political, economic, ecological, psychological, etc., in the individual and in society as a whole ... it is important and indeed extremely urgent to clear up this deep and pervasive kind of confusion ... in which [*the mind*] is generally differentiating what is not different and identifying what is not identical ... (Bohm 1980: 17).

However it is not good enough merely to graft connections onto separate entities and call it wholistic. Complexity and Hierarchy Theories spell out the meaning of this 'greater than' aspect of whole versus parts. As will be seen below, interpretations of Quantum and Complexity Theories such as those of Bohr, Bohm, Chew, Prigogine, and mathematical approaches like those of Atkin, Zadeh, Thom, Gleick, Kosko, Kauffman, the Santa Fe Institute and the epistemological efforts of Allen and other Unifying Ecologists, Evolutionary Biologists and Ecological Economists, attempt in different ways to explain reality through dynamic Ordering Principles which accelerate or constrain complex systems in their processes of self-organisation. A story is emerging that makes sense of apparent Atomism at human scale, with universal connectedness retained as a fundamental truth, spacetime as an emergent phenomenon rather than a fundamental condition, time (rate relationship) as a crucial dimension, and relative disconnection as an indispensable structural statement.

5.3 QUANTUM THEORY AND ITS INTERPRETATIONS

5.3.1 IMPACTS OF THE NEW THEORY

"We are saved from being assaulted by the madhouse of the quantum in our daily affairs only by virtue of the fact that quantum effects are generally limited to the submicroscopic realm ..." says Davies in *The Cosmic Blueprint* (Davies 1989: 165). Yet he also adds that all matter is composed of atoms, which obey quantum laws, and "quantum systems are coupled together in ... [a described] ... strange fashion into a gigantic, indivisible assembly" (Davies 1988: 120, 125).

Disturbingly, Quantum Theory's first conceptual impact was to disturb Classical Theory's smooth notions of continuous spacetime and continuity of motion (Newton's laws), waves and fields (Maxwell's EMF equations), and thermodynamics (smoothly statistical), with evidence of discontinuity at the quantum scale (quantum jumps or sudden transitions at subatomic level) (Honner 1987: 27-8). With Bohr's explanation of emission spectra and refinement of Rutherford's atomic nucleus-plus-electrons concept, a new Theory of Atomic Structure (and thereby Inorganic Chemistry) was announced, with electrons moving in stable orbits and characteristic energy and field effects occurring when they jumped from one orbit to another (1912).

Einstein drew attention to the dissonance between Quantum and Classical Theories (1909), the main problem being that light had been shown conclusively to have either particulate or wave-like behaviours, depending on the experimental setup, but not both simultaneously. Einstein's (re-)discovery of light quanta⁷ (1906) and the photoelectric effect, were confirmed, earning him a Nobel Prize in 1921 (Baggott 1992: 9-15, 30-31). The question of universal connectedness took on a new quality as argument arose as to the behaviour of particles so small, and with such tiny distances and either large or incredibly weak force fields, that detection was very difficult, very expensive, very indirect and certainly beyond the scope of technology then (and mostly still now) current. Strange possibilities emerged, such as distant action, hidden variables and the further layers of reality these apparently imply.

The breakdown of Classical Mechanics at quantum scale meant that many familiar concepts had to be questioned: causality and determinism became separated; the spacetime framework developed limits⁸; conservation of momentum and energy were questionable; the relationship

⁷ The concept of light as particulate characterised the work of Newton (within the now quaintly viewed, mechanistically derived ether, etherons, and guide waves: understood as the interference fields of characterless light particles influenced into 'Newton Rings' by what are now known as 'pilot waves'), and Malus (1775-1812) who spoke of 'luminous molecules' or 'molecules of light' where modern physicists would say 'photons'. Malus' Law was a statistical expression of the Quantum Principle, which describes the persistent unity of the quantum. At the same time Huyghens' spherical wavelet Propagated Wave Theory was extant. Before Newton, Descartes' Unified Fluid Field Theory held sway, in which light and matter were both seen as disturbances. The work of Young, Maxwell and Faraday deflected interest into Magnetism and the waveform character of light for a century, to be refocused on photons by Einstein in 1905 (Finkelstein 1996: 156-62).

⁸ Hawking and Penrose offer a diagram which illustrates the relative centimeter sizes of entities needed to conceptualise and put in perspective the level at which spacetime 'breaks down' ('Planck's length' or 'Planck Scale'): an "impossibly small" high energy spacetime level where a "future theory, quantum gravity, presumably takes over" from gravitational

between observer and observed became unclear and indeed ambiguous, as observation could no longer be separated from the observing apparatus - the physical was no longer strongly separated from its description; the physical significance of both mathematical formalism and perceived reality were in doubt; the relationship between quantum and macro scales needed consideration, since there was apparently overlap at high quantum levels, and the whole scheme became suspect as soon as any of its elements did (Honner 1987: 39-49, 48-49, 53, 27). As Bell says, the mathematics of waves is smooth, deterministic and Classical, but definite events also occur, (such as colour, intensity, and scintillation size of points in the case of light), so the world must be approached in two ways, as a "wavy 'quantum system'" and the remainder which is "in some sense 'Classical'": "for me it is the indispensability, and above all the shiftiness, of such a division that is the big surprise of Quantum Mechanics. It introduces an essential ambiguity into fundamental physical theory" (Bell 1987b: 187-8).

Beyond ambiguity, for the first time, it was realised that different laws could apply to different scales (Redhead 1995: 50-56). No longer could the objects of Physics be studied as single or low number entities moving through space and time, since elementary particles moved around in billions and elements occur in mixtures and compounds, and even though most Quantum Theory is argued in terms of single particles, the real situation involves probability predictions for both particle and wave manifestations, with the inherent issue of probabilities of relationship or connectivity rather than probabilities of things (Capra 1982: 66,69; Einstein & Infeld 1938: 289-94). **Link: BR 5.3: Working with Vague Information.** Classical solidity was shown to be a mirage of approximation built on wave-like probability patterns (Capra), and the line was re-drawn between subject and object, implicating the apparatus, researchers' concepts and experimental context, immediately a scientific phenomenon was observed (Clark 1994: 1035). This of course directly challenged the delusion of Objectivity, a matter of concern to EPPs and still not well appreciated by the lay public, while exploited by politicians and big business.

Capra refers to a quantum jiggling (called by Zohar and Zukav respectively, the 'quantum dance' or the 'subatomic dance'):

... a typical 'quantum effect' ... This tendency of particles to react to confinement with motion implies a fundamental 'restlessness' of matter which is characteristic of the subatomic world ... The closer we look at it, the more alive it appears ... atoms ... link up with each other in ... an enormous variety of molecular structures which are not rigid and motionless but vibrate according to their temperature and in harmony with the thermal vibrations of their environment ... We have come to realise that there are no static structures in nature ... stability is one of dynamic balance, and the further we penetrate into matter the more we need to understand its dynamic nature to understand its patterns (Capra 1982: 78-9).

attraction. These levels are: Earth diameter 10^9 , dime 1, atom 10^{-8} , nucleus 10^{-15} , breakdown of spacetime 10^{-33} (Hawking & Penrose 1996: 48, 44-9). If a quantum emergence perspective were adopted, it could be said that spacetime actually emerged at that scale, rather than becoming lost.

Not only jiggling occurs, apparently:

It is as if we smash two toy automobiles together and instead of shattering into bits and pieces, they come apart into more toy automobiles, some of which are as large as the originals ... Subatomic particles forever partake of this unceasing dance of annihilation and creation. In fact, subatomic particles are this unceasing dance ... Hindu mythology is virtually a large-scale projection into the psychological realm of microscopic scientific discoveries. Hindu deities such as Shiva and Vishnu continually dance the creation of universes while the Buddhist wheel of life symbolises the unending process of birth, death, and rebirth which is part of the world of form ... (Zukav 1979: 217) .

As we penetrate into matter, nature does not show us any isolated building blocks, but rather appears as a complicated web of relations between the various parts of a unified whole (Capra 1982: 77-8).

and quoting Stapp⁹:

An elementary particle ... is, in essence, a set of relationships that reach outward to other things (Capra 1982: 70) .

Furthermore, since we can only approach the quantum level through human scale, with human scale observation and apparatus and Classical or ordinary human language (Honner, 1987: 60-3 discussing Bohr's views and concepts), the latter must be adapted in some way to reflect characteristics of the new reality which were inferred only indirectly, perhaps only through probability, or through 'thought experiments'. The terms 'particle' and 'wave' are misleading, as they convey a image that is not necessarily thought to exist in fact.¹⁰ The fact that the observer at quantum level was apparently 'collapsing' or 'reducing' an actual observation from an array of possibilities at the moment of measurement, and that particles, once 'entangled' with each other thereafter 'knew' instantly what each others' spins were ('action at a distance', possibly conflicting with the speed of light as an absolute), seemed to threaten the very foundations of rationality.¹¹ "If you really believe in quantum mechanics, then you can't take it seriously" (Penrose 1994: 309) expresses the paradox which emerges in the guise of argument between positivists and realists in the quantum context.

⁹ University of California.

¹⁰ This statement refers to the ontological position taken by the scientist in question as discussed below: some will take a Realist or relative Realist position (assuming a concrete subatomic reality), others a Formalist (concepts are adopted for mathematical convenience) or Positivist (only the measurable is important) position. Others (starting with Bohr) will say that the use of macro-level concepts is the nearest we can come to a subatomic reality, by a process of projection, but the nature of subatomic entities would be different if we could be there to experience them directly. 'Particle' and 'wave' are only approximate concepts, and are certainly not the same at quantum scale as the meanings these terms carry at macro scale. Further below this scale, at quark level, strange, abstract theoretical terms, such as 'up', 'down', 'strange', 'charm', 'bottom' and 'top' have been deliberately used to categorise quarks in a way that avoids confusion with macro entities (Baggott 1992: 87).

¹¹ The Einstein-Podolsky-Rosen thought experiment indicated that if the Uncertainty Principle applies, then action at a distance must be inferred, thus violating the absolute limit of the velocity of light C , otherwise Quantum Theory must be regarded as incomplete (implying the existence of hidden variables). While Einstein preferred this view, Bohr demonstrated a false assumption in EPR's definition of reality, and defended the Copenhagen interpretation by reiterating the relevance of Complementarity and the observer effect in setting up even hypothetical experiments. Following suggestion by Bohm that these ideas could more practically be tested using atomic spin in 'entangled' atoms rather than position or momentum, further work in this area by Bohm, Bell, and Aspect, Grangier & Roger, appears to support the concept of action at a distance (violating Relativity), non-local hidden variables, and incompatibility with local hidden variables (Baggott 1992: 97-104, 115-148).

5.3.2 UNCERTAINTY THEORIES

Heisenberg's Uncertainty Principle (HUP) or 'indeterminacy relations' in subatomic particle Physics was established in 1926. It originated theoretically from the unresolvable duality of waves and particles as expressed by Einstein and De Broglie, and created an argument between Heisenberg and Bohr which stimulated the latter to reconsider quantum Epistemology, leading ultimately to Bohr's Complementarity Principle (Honner 1987: 45-6). It reflected the tradeoff in accuracy inherent in measurements of particles at this scale, between paired observables such as position and momentum, or time and energy (Honner 1987: 45-9).¹² Heisenberg's instrumentalist approach led him to believe that the only meaningful description of a system was the measurable, and that the uncertainty indicated limitations on what was measurable. Bohr disagreed strongly, seeing wave-particle duality as the core issue for Quantum Theory, needing different, mutually exclusive approaches to measure the two aspects of one entity: a conceptual conflict between what is measurable and what is knowable (Baggott 1992: 32-3).

Hawking attributes the profound impact and continuing misapprehension of HUP to its challenging the belief in ultimate determinism of the universe. *Edge of Chaos* Theory is in the same position today. Heisenberg first exemplified his Principle by explaining the impossibility of accurately knowing the position and velocity of a particle simultaneously. Thus if a fix can not be established, a prediction is not possible. Quantum Mechanics was presented as a new theory by Heisenberg, Schrödinger and Dirac (1920s). By taking a Positivist view and excluding everything unmeasurable (a persistent issue in Science still), they postulated a quantum state consisting in undefinably combined position and velocity (Hawking 1988: 58-60).

Thus Bohr clarified inconsistencies between Heisenberg's formal and informal descriptions of uncertainty by redefining the uncertainty as inherent ambiguity: a radical break with Heisenberg, which makes the measurement phenomenon unanalysable. The differences in interpretation of the informal language of Physics resulted eventually in the total and disastrous collapse of communication between Bohr and Einstein, the former comfortable with ambiguity in fundamental concepts, the latter demanding that fundamental assumptions be unambiguous. This left a legacy of confusion and no common informal language for the two fundamental theories (Quantum and Relativity) (Bohm & Peat 1987: 84-7).

¹² Heisenberg, in trying to resolve the non-commuting relationship between pairs of observations, accidentally invented Matrix Quantum Theory, the 'new Quantum Theory'. He used *Planck's Constant* and invented a multiplication rule describing the non-commutation of matrix elements (which was well-known to matrix mathematicians). Subsequently Born, Jordan, Schrödinger and Dirac worked on the matrix, resulting in the inclusion of complex numbers $i(\sqrt{-1})$, and De Broglie wave-particle concepts, resulting in *Schrödinger's Equation*, and the special interest area of Wave Mechanics (Honner 1987: 42-3).

Bohm & Peat carefully analyse what they see as the flawed communication at both formal and informal levels amongst the scientific community as to the nature and implications of Heisenberg's Uncertainty, which by informal description in the Heisenberg interpretation suggests "some definite quantity whose actual value is not accurately known" – is an expression of ignorance (Bohm & Peat 1987 79, 76-86).

Taking quite a different position on ignorance, Kosko¹³ berates most modern physicists, arguing that uncertainty is the inevitable result of using linear mathematics in non-linear situations. It is a tradeoff between two graphs of parameters that are in orthogonal relationship (right-angle triangle relationship, which underlies both HUP-type uncertainty and the Subsethood Theorem at the heart of Fuzzy Logic).¹⁴ Kosko predicts that Quantum Theory will ultimately collapse unless it takes account of the complex, non-linear nature of the real world, and starts to consider Quantum Chaos. As he complains, the Copenhagen treatment of Quantum Theory is by linear Statistical Mechanics, and that explanation does not allow for the likelihood or possibility of sub-quantum hidden variables nor non-linear relations (Kosko 1993: 104-114).

This is actually one of Bohm's areas of attention. Kosko gives examples of commonly-recognised uncertainties, some known in other disciplines even shortly before Heisenberg, for example Linear Time Invariant (LTI) systems in signal processing, with the uncertainty in time/frequency of signal spreading. The same principle is found in the firing of kitten brain neurones, which minimises the LTI uncertainty, and in digital filtration. Kosko takes an aggressive stance on the "physics monopoly on uncertainty principles". His central point is that for such orthogonal relationships, both parameters pertain in a linked and continuously variable manner, with the measurement problem being more tangible in the middle range and the relevance of Probability being the limiting case where the system has ground to a halt or shifted to its extreme values (0,1). This is an interference field of two parameters. Complex fields (such as quantum scale, or urban, ecological or social systems in the macro) have similar dynamics but must accommodate many parameters, and chaotic mathematics will apply above about three degrees of freedom (Kosko 1993: 105-6).

Neither does this problem go away if defined as simply a conflict between scales of observation. Prigogine challenges the orthodox position that the extension of Heisenberg Uncertainty is irrelevant to the macro scale (living systems), claiming that randomness and the wave function in non-equilibrium systems are still seen to translate at macro level to the concept of order through

¹³ Kosko has degrees in Philosophy, Economics, Mathematics and Electrical Engineering; Assoc. Prof. Electrical Engineering, USC in 1993.

fluctuations. This applies to medium number system behaviour at the *Edge of Chaos* ('deterministic chaos'), where order emerges from a creative interface between relative stability and disorder ([Link: Hypercyclic Systems Theory: Chaos Theory](#)). He is also therefore, like Kosko, attributing Uncertainty to the operation of complexity as such (Prigogine & Stengers 1984: 177-209).

Bohm argues that as Quantum Theory implies a quality of wholeness, then the non-analysability of the orthodox position means that randomness by this interpretation must be accepted as an inexplicable and unanalysable feature of all existence. Irreducible randomness then imposes limits on the expression of meaningful order (Bohm & Peat 1987: 134). Bohm's analysis of chaotic processes redefines chaos as involving an infinite number of degrees of freedom and hidden variables¹⁵ rather than complete randomness.

The section below enlarges on Bohr's Complementarity, and the following section relates this to Ordering Principles.

5.3.3 BOHR'S COMPLEMENTARITY PRINCIPLE

In 1927 at Como, Bohr offered a resolution to the growing dissonance between the (wave theory, causality chains and ordinary space-time coordination and mechanism) and Quantum (Photon Theory) descriptions of light. He pointed out that these systems are two Complementary aspects requiring different descriptive modes, one of which relates to the observed, the other the observer-observed complex including the instruments of observation in all their detail,¹⁶ which inherently carried the selection of apparatus, the purpose or interpretation: the meaning. This is a problem quite different from measuring continuously variable paired observables.

Light, for example, may be measured as a particle or as a wave, but not both at once, and the researcher's purpose determines the questions asked ("when you ask particle questions you get particle answers; when you ask wave questions, you get wave answers"). The wave character is

¹⁴ Cauchy-Schwartz inequality, apparently well-known to students of elementary calculus (Kosko 1993: 114).

¹⁵ This was a major area of argument 20-30 years ago, which is beyond the scope here to follow to the present. At that time, Belinfante did a comprehensive review of hidden variables theories, disproving the claim that they could not exist, reporting the failure of theories trying to disprove QT itself, and also the failure of physical experiments to that point to support anything beyond unaltered QT. He was not able to relativise Bohm's 1951 "cryptodeterministic nonrelativistic wave mechanics", but speculated that it may be possible (Belinfante 1973: 3-4, 312).

¹⁶ Bell invented the quaintly-named 'beables' to attempt to deal with the ambiguity of words such as 'observable', 'system', 'apparatus'. Local beables are "those elements which might correspond to elements of reality, to things which exist. Their existence does not depend on our observation. Indeed observation and observers must be made out of beables." ("Beables for Quantum Mechanics" in Bell 1987a: 174).

subject to ambiguity (significance not clearly definable), which is not further analysable,¹⁷ and is also demonstrated by Bell's Theorem not to be explained by the experimenter's inevitable impact on the research object. The research complex just 'is', and nothing more can be said about it. Thus, although reports all describe this issue in terms of particle-wave duality, this is more to do with the fact that the two aspects were being addressed through different perspectives of observation. Subsequent work by Bohm has indeed described particle, wave and chaotic processes all at Quantum scale (Bohm 1980: 189; Bohm & Hiley 1993: 41).

Bohr did not describe two separate realities, but pointed to two incompatible, Complementary descriptions of a unified reality, both being necessary for a complete description. This set of issues appears to need teasing out, as a number of concepts are conflated here. The particle-wave uncertainty can satisfactorily be comprehended through Kosko's explanation of uncertainty principles and its Complementary nature through Bohr. The Classical-Quantum distinction is developed further above and by Bohm as described below, under Ordering Principles, and by Penrose's understanding of an energy barrier between the two levels, rather than an atomic mass one, as commonly assumed. In the Classical realm, 'objective', wave observations appear to be (relatively) accurate. The (light) particle, however, is a quantum issue, and subject to quantum measurement conditions, which may in turn have Classical scale implications; Quantum Fields also provide the wave-like character at quantum scale. The (observer complex) / (observed) Epistemology is the key distinction of Bohr's Complementarity Principle.¹⁸ As it turns out, no matter at what scale of observation, an empirical description can never shake off its context, which accompanies it like a shadow. That Bohr was referring to a single reality unifying mechanism and meaning, is an important point, which does not lose its relevance at the scale of the human habitat and beyond.

... it is decisive to recognise that, however far the phenomena transcend the scope of Classical physical explanation, the account of all evidence must be expressed in Classical terms ... this crucial point ... implies the impossibility of any sharp separation between the behaviour of atomic objects and the interaction with the measuring instruments which serve to define the conditions under which the phenomena appear (Honer 1987: 53). [*Bohr's emphasis*].

What Bohr was saying had a number of components that relate to the problem of conditions for unambiguous communication (that is, Epistemology):

1. A transcendent view must be taken, to integrate apparently conflicting "aspects of our participation in nature"; this implies a circular as well as dialectical notion of reciprocity as in Yin-Yang; supersedes as well as embracing, causality, taking over the role of causality "at the bounds of experience" (:56).

¹⁷ Bohr claimed that the entire measurement phenomenon was unanalysable, being limited to the form and content of the experimental conditions and the results.

¹⁸ Redhead, intending to 'de-baffle' students of QT philosophy, summarises QT interpretations as: hidden variables (an untenable, disprovable glorified statistical mechanics), Complementarity (a mere linkage of Microphysics to Classical Physics, with its Complementarist extension a vague and ambiguous dogma based on dangerous prejudice), and a Realist approach (where quantum observables actualise their potentials through observation) (Redhead 1987: 45-51).

2. The distinction between observer and observed is no longer clear at Quantum level (as it is, apparently at least, in Classical Mechanics), due to lack of control of the object-observing instrument interface.

3. Causal determinism does not operate at Quantum level, nor resolve wave-particle duality.

4. The Correspondence Principle must be adjusted to deal also with the application of Classical concepts to Quantum observations (Bohr, 1913: Classical Theory and Quantum Theory produce equivalent results for high quantum numbers: this marked the beginnings of Bohr's recognition of Complementarity as he switched between two incompatible systems, checking the others' results against each, finding essential correspondence).¹⁹

5. A "lesson in Epistemology" arose here which had application in all areas of science: this is analysed in detail by Honner and presented verbatim in the Table on Complementarism.

(Honner 1987: 35, 48-64). *[Emphasis added]*.

In summary, for complete description of any system, measurement and meaning aspects must both be included.

In Honner's view, Bohr's central contribution was the blurring of the strong, causal subject-object separation of Classical spacetime through his Complementary description (Honner 1987: 2). Bohr, over his lifetime, extended his concept of Complementarism beyond Quantum Physics to Psychology, Biology, Human Anthropology, Sociology, Law and Linguistics, seeing it as a new type of Relativity; it has been promoted as an Epistemology by Bohr and subsequent workers such as those below, and recognised by Honner as ultimately metaphysical (Holton 1988: 1018-1023; Pais 1991: 438-446). **Table 17: CM: Bohr's Complementarism: "A New Kind of Relativity"** expands on the application of Complementarity to a number of such disciplines, as described in Pais and Holton in particular.

Quantum Complementarity Theory gains quantitative support from Heisenberg's Uncertainty Principle. Since conceptual extension into other areas lacks this support, Pais named this epistemology 'Complementarism'. _While some of these distinctions sometimes appear to imply that Complementarism is merely another way of labelling different logical types (as where meta-themata represent the emergent collective or provide the cover set for individual units), the observer and interpreter still need to be considered at the same scale, and interpretations are usually closely interacting with conceptual cover sets: the distinction is between structure and interpretation, mechanism and meaning, 'what?' and 'so what?'

Classical atomistic description, which happens to work well objectively in the range of numbers inhabited by humans, even when the observer is excluded, is always complemented by the 'quantum' description wherein the observer, the purpose of observation and the measuring apparatus are inherent. A further elaboration of this concept arises from Zohar's Bohm-

¹⁹ See Penrose above.

influenced interpretation, which speaks of the 'both/and' character of Quantum thinking and the 'either/or' of the mechanistic or Classical. This starts with the requirement to take into account "both participation and description":

This inherent uncertainty of quantum reality, its both/and character, replaces the familiar fixedness of the mechanistic world. Machines are very definite things, the same in all circumstances. Their performance may alter slightly in a given environment ... but they don't change internally. They don't become something else altogether ... An electron or photon on the other hand, in its constant creative dialog with its environment, with the overall context of the experimental situation ... [which] ... in quantum philosophy ... is known as 'contextualism'. (Zohar & Marshall 1994: 21)

Zohar's main thrust is the emphasis on parallels in Complementarity between Quantum Theory and our own experience in a macroscopic world. She uses such examples as the need to choose between getting the facts of a situation and the need to 'feel it out'²⁰; the strong context dependence of quantum reality, human language and human nature; our self experience as a combination of spontaneous, free-willed beings (particle) and as elements of a larger group (wave); and the 'oneness' plus 'globality' (after Penrose) of conscious thought processes. In addition she describes an emergent theory of self and social functioning which she characterises as 'quantum self' and 'quantum community', emerging from a creative and flexible balance between particle-like Individualism and wave-like relational focus. She proposes and sees evidence of a reorganisation of society, which seeks the 'both/and' collaborative, diversity-affirming characteristics of 'quantum reality' (valuing individuality and simultaneously the collective), rather than the Newtonian 'either/or', winner/loser, competitive approach (Zohar 1990; Zohar & Marshall 1994: 96, 203, 44-6).

Thus at our present stage of social evolution we find ourselves in an impossible political bind. On the one hand the various forces of modernism have robbed public life of its meaning. On the other, in reaction, many people have ... turned to ... [neo-] tribalism in an attempt to recapture the kind of meaning found in older, more traditional societies and their shared public life ... To get beyond this bind and its destructive consequences ... we need a whole new model for political organization ... a truly 'quantum society' ... must incorporate the wisdom and truth, the value and the meaning of older, traditional social groupings ... also recognise that we no longer live in those ... and understand ... their limitations ... [in an as] yet unrealised social evolution ... which incorporates what is good of the past but within the context of a new, post-modern political reality. (Zohar & Marshall 1994: 223)

Zohar recommends a 'quantum covenant with "the Void"' which espouses a politics of partnership, committed I-thou family relationships, recognition that we are both self and other, living at the edge of many possibilities "poised towards internal relationship, community and an emerging consensus", celebrating diversity, committed to dialogue, to our common ground and to the future (Zohar & Marshall 1994: 224-81).

These distinctions are also clarified by Pattee's classification of rate-dependence and rate-independence, which offers a criterion that can be applied at macro level to reduce interpretive confusion, bridging conceptual areas.

Thus Pattee, concerning biological and social structures, then Allen & Starr in relationship to Ecology and particularly evolution, propose that every complex system has two deep aspects requiring completely separate methods to describe them. One is rate-related, particle-like, law-driven, logical, objective, structural and mechanistic [*'hardware'*]; the other is wave-like, rate-independent, linguistic, teleological, subjective, functional and related to meaning, policy²¹ and history-dependent²² local rules [*'software'*] (Allen & Starr 1982: 56-65; Pattee 1978: 192-5).²³ 'Rate-dependency' means an entity changes with time, and can be measured in terms of frequency. 'Rate-independent' aspects being about values and meanings, do not change if applied faster, are inextricably connected with the observer, and can not be measured directly.

Table 18: CM: Complementarity Principle (After Pattee) summarises and differentiates the qualities inherent in Complementary systems descriptions.

This concept of rate-dependency ties the Complementarity concept into the frequency-based ordering of Hierarchy Theory. The concept or rate-independency ties it into the relativities and teleologies of relationship and meaning (Community Criterion, conceptual or dominance hierarchy). When viewed from the perspective of Complementarity, the rate independent aspect may contain just one or a collection of sets of values, meanings and conditions. As the planners say: 'if the public thinks there is a problem, then there is a problem, even if we don't think so'.

BP 5.5: Applications of Quantum Theory Complementarity discusses other extensions of these ideas into current settings. The 'collections of sets of values' encompassed interpretive Complementarity links with the multiple 'constructions of reality' of Postmodernist Deconstruction, and the synergy of very particular Conceptual Pluralism of EPPs.

²⁰ A strong, consistent and rewarding strategy this author used in wholistic medical practice.⁵

²¹ Plants and animals also can be seen as having policies, albeit non-cognitive ones.

²² 'Sensitive to initial conditions'.

²³ This is the take-off point for argument as to whether there is a single universe which succeeds in manifesting itself at the point of measurement (by 'collapse of the wave function into reality'), every other possibility existing in potential up to that point and as a 'failure' thereafter, or multiple universes wherein at each decision point, every potential position actually simultaneously exists in multiple universes which never meet but may have subtle influence on the observed one (Davies, 1988 : 128-141).

5.4 THE SYNERGY OF COMPLEMENTS

All things include the interaction of Yin and Yang. Yin and Yang create each other: Yin can never be identified without consideration of Yang and vice versa. All reality is relativistic. Yin and Yang transform into each other: Yin at the greatest extent of its condensation and structuring must begin to disintegrate to become Yang. Yang at the height of its dispersion and expansion must begin to contract to become Yin (Townsend & De Donna 1990: 32).

Quantum Complementarity is not exclusive in its use of a concept 'Complementarity'. For instance architects often use the term to indicate non-specific synergy between elements of a design. 'Complementary Opposition' of Xu & Li, and Sabelli's 'Union of Opposites', are attempts of process thinkers to affirm the creative or synergistic importance of relationships between oppositional elements in complex dynamic systems (Sabelli 1989; Xu & Li 1989). However these are essentially dichotomous approaches.

Járos²⁴ sees dichotomous thinking as a socially undesirable remnant of infantile (self/not self) mentation,²⁵ which, notwithstanding its technological achievements, should be countered specifically by teaching children about complements and synergy (Járos 1995: 24). Dichotomous thinking easily shifts to justify many troublesome social attitudes, behaviours and entities such as Racism, Dictatorship, Fundamentalism, Feminism, Affirmative Action [and 'glass ceilings'], and lobby groups (Járos 1995: 23). It is particularly impactful in the claim to objectivity espoused by proponents of the Scientific Method, which assumes mechanism and meaning (the Newtonian facts/values distinction) to be separate entities (and to exclude the latter) - the specific area of difficulty addressed by the Quantum Complementarity Principle.

The Law of the Excluded middle, denying the grey to support the black and white of Aristotle's Laws of Contradiction²⁶ and the Excluded Middle (Bivalence),²⁷ has often been applied inappropriately to complex systems by dualistic classification which discounts shared properties and focuses on superficial differences in one dimension (black/white, female/male, good/bad, old/young, in/out). Literatures on Dualism have emerged at least in Sociology and Feminism. This 'Exclusivity of Opposites' favours one polarity over the other. It is difficult to discuss this topic without practising the Exclusivity of Opposites oneself.²⁸ Járos mentions a number of approaches and principles which negate the Aristotelian Law, including Fuzzy Logic, the dualistic examples above, his own process-based systems approach called 'Teleonics' and the pre-

²⁴ Research physiologist, Department of Anaesthesia, University of Sydney.

²⁵ Developmentally located between about 7-10 months when an infant first displays separation anxiety, and 2-2.5 years, the window of opportunity for resolution of the 'social contract', which accepts the reality of the presence of others who also have wants, needs and feelings, and must be accommodated. **Links: Transactional Analysis theory; Criterion Organism: Maturana's definition of love as the basis for human society, and Basic Position.**

²⁶ "A cannot be both B and not-B"... "The same thing cannot at the same time both belong and not belong to the same object and in the same respect." (McNeill & Freiberg 1993: 52 quoting Aristotle's Metaphysics).

²⁷ "A must be either B or not-B"... "Of any subject, one thing must be either asserted or denied." *ibid.*

²⁸ "There are two sorts of people: those who divide people into two sorts of people, and those who don't!"

Aristotelian contemporaries Buddha, Lao Tsu (Tao Te Ching) and Heraclitus of Ephesus, who dealt in systems and process concepts (Járos 1995: 23-25).

Fuzzy Logic²⁹ works with the grey continuum between black and white, supporting an understanding which sits comfortably with reality as we know it, and also affirming an Eastern perspective³⁰ (McNeill & Freiberger 1993: 200-205). Partial set membership allows substantial inclusiveness and more accurate mapping of Complexity. I can simultaneously support Party A to extent 0.6, Party B 0.2 and Party C 0.5.

Teleonics takes a concentric hierarchical view: the world (layered from atom to universe), is seen to present as process units or process systems (bundles of processes), with structures and matter as background, not unlike q-analysis³¹ Traffic on its Backcloth. Examples of such process units include cells, organisms or society (multi-scalar system). Rather than conceptualising discrete entities that interact through processes and are physically bound, Teleonics sees the process units as participating in goal-related processes that are not confined to entities, and that extend beyond their physical boundaries as a universally connected web, and are informationally bound. Physical or conceptual entities emerge at points (appearing as boundaries) where inward and outward processes strongly interrelate.³²

Complementarity is invoked in functional terms. For instance, in the homeostatic mechanisms relating to blood glucose regulation, where the description 'Complementary Opposition' (antagonism) may be used of glucagon and insulin by a dualist, Járos would use 'Complementary', because he essentially shifts up-scale to view the larger system, including both. The subject is then defined as 'shifting glucose from liver to cells' (system definition) instead of 'action on the glucose molecule' (limited aspect), This limited nomenclature is universal in Physiology.³³ While de-emphasised through this mind-set, differences are used Scientifically at small scale, deliberately at times, to stimulate uncertainty and its attendant creativity, always keeping the similarities and system goals in mind (Járos 1995: 25).

²⁹ **Link: BP 5.3: Fuzzy Logic.**

³⁰ The First International Discourse on Fuzzy Logic and The Management of Complexity, FLAMOC '96, at the University of Technology, Sydney, was dominated by engineers, whose numbers were very noticeably dominated by people of Asian and Eastern European origin, who made an important contribution to the Járos presentation on Philosophy. Fuzzy Logic was first developed (concept 1964) by an Eastern European (Russian/Turkish/Iranian) living in the United States (Lotfi Zadeh, who before 'Fuzzy Logic', coined the term 'System Theory' in 1951; he also attended this conference), but he had to go to Japan to find support initially, as America was obsessed with Probability Theory approaches, and feared apparent imprecision. The Japanese were possibly more culturally comfortable with Possibility Theory, and seeing its potential, actively took up Zadeh's ideas, to become the first to produce 'smart' technologies (the Sendai train, CamCorders, fuzzy washing machines & vacuum cleaners) based on this Mathematique (McNeill & Freiberger 1993: 11-13, 243-83).

³¹ **Link: BR 5.3: q-Analysis.**

³² See Allen et al below: structures are processes that persist long enough to be measured.

³³ Other examples come easily to mind: IQ tests, much of modern symptomatic medical diagnosis, GDP/GNP as indicators for wellbeing, many voting systems, statutory planning regulations. This is a metonymic process where the representative term is reified and its referent discounted.

We should teach our children that men and women, day and night, black and white, people speaking our language and those who do not etc., are complements and not opposites ... Through it we might appreciate that the world cannot be divided into two camps, one of which is right and the other wrong. We might be able to understand those who might look different from us, but share the great majority of our concerns for love, peace, justice and beauty ... the Synergy of Complements is an inclusive principle: it does accept opposition, turning it to advantage. Unfortunately one cannot say this of the Exclusivity of Opposites (Járos 1995: 26).

5.5 PLURALISM

In the course of challenging the notion of Progress, to which he attributes the unsustainability of development, and in espousing an ideal of Co-Evolution, Norgaard, argues for an Epistemology of Conceptual Pluralism on the grounds that "our understanding of complex systems is necessarily based on multiple incongruent ways of knowing", the acceptance of which prevents unrealistic Universalism and acknowledges the inherent limitations of any set of assumptions (Norgaard 1994: 95-7, 226, 66).

It is necessary to distinguish between Conceptual Pluralism and the Ontological Pluralism of 'Substance Monism' (everything is connected), and 'Substance Pluralism' (Atomism: everything is disconnected). Theoretical Pluralism, really Eclecticism, concerns the 'mixing and matching' of sections taken from major theories. This has been the subject of argument between purists and integrators. Political Pluralism involves a somewhat decentralised power structure that ostensibly attempts to prevent political domination by any single elite (Goodall 1987: 360-1). Relativistic Moral Pluralism accepts that a range of positions exists, and demands equivalent consideration of each, making no values-based judgment or comparison of different systems (Blackburn 1996: 291). This latter is seriously problematic for those concerned with eco-social Ethics.

In multicultural countries with large immigrant populations (becoming the norm in most nations, especially the West/North), Political and Cultural Pluralism, race relations, social justice and conflict management have emerged as an issues constellation of considerable importance in a climate of perceived scarcity.³⁴

The fragmented situation well-established in many modern Western nations, and especially Australasia, of closely-fought elections and hung parliaments, often requires a great deal of negotiation with minor parties to ensure passage of legislation. A 'Theory of Virtue', presently gaining strength under Market Libertarian Economics, allows a social schizophrenia where different parts of society, rich and poor, support preferential treatment and wider rights for the wealthy (Wenz 1988: 26-32, 44-8). See **Table 19: Bi: Theories of Justice & Virtue**. Such a Theory tends to become unstable in the face of increasing scarcity, perceived difference, the realisation that 'trickle-down' wellbeing is a Myth with any benefit restricted to the upper middle classes, and a growing perception of unfairness.

³⁴ (Recent titles on pluralism include Brooks 1995; Katkin 1998; Kingwell 1995; Kothari & Parajuli 1993; Moon 1993).

In the end, the practical implication of Political Pluralism is the need to address with integrity, human rights and responsibilities at all scales and for all groups, regardless of racial, cultural or economic identity. EPPs would emphasise the responsibilities, the transcendent (and TA Theory) distinguishing for between the person and the behaviour for censure.

With the present³⁵ emphasis on public involvement in decision making, it is becoming increasingly important to devise ways to work with and synthesise the positions of people with disparate backgrounds, belief systems and proclivities. Such informal frames of reference can bear easily as much force in practice as formal academic theories, and may be equally inflexible. Pluralism at this scale is diversity: personal, social or cultural, and a knowledge of group dynamics and skill in synthesis become necessary when attempting to deal with it at a practical level, as it has both competitive and cooperative faces.

Conceptual Pluralism, Norgaard emphasises, requires in decision and policy makers especially, a self consciousness and attitude of tolerance to the structure, advantages and disadvantages of their own and others' frames of reference (Norgaard 1994:101-102). It has been consistently found in public consultation, by Process Oriented Psychotherapists in their 'world work' and conflict resolution with some of the world's most difficult groups, that 'the dissonant voice' has an important story to tell, and often leads the group to a new level of understanding if heard with respect and the right to speak is affirmed.⁵ This also applies to the 'whistle-blower' and the environment movement. Tolerance is required, although this is only the first step. The next step is actually to embrace the diversity: to carefully listen to the similarities and differences inherent in apparently incompatible positions as part of the creative process of problem solving, and trust the process of Emergence (Bohm & Peat 1987: 111-2).³⁶

With this type of context, the 'saving of the planet' needs to accept the existence of a diversity of views, and to propose actions which speak not just to the converted, but to all sections of society: a contract for transcendence. This means that the basic human and ecological needs of all involved must be considered in development, an obvious statement perhaps, but widely ignored in a market economy. The usual practice of relegating 'parenthood statements'³⁷ to the back shelf results in the wastage of time, energy, money and of a large proportion of, even

³⁵ A situation rapidly retreating at the time of writing, under the influence of Market Fundamentalism and Multiculturalism in jeopardy.

³⁶ The technology for computer-based nation-scale decision making is available and secure, just awaiting the desire to implement it; Fuzzy Logic offers a weighted decision-making system which could be used to even greater effect than the Probability-based systems that will probably be used, if any. A smaller-scale discussion tool, the 'Groupputer', which has tens of keyboards inputting to a single giant screen, is also available (Rounsefell 1992; Sun & Eklund 1994; Zimmermann, Zadeh & Gaines 1984).⁵

³⁷ The politically incorrect term 'motherhood statement' was actually more reflective of the disrespect often meted out to the values of mothers.

most, material gained by public consultation. If such statements were recognised as the values they are, and actually used to inform regulatory, policy and development approval processes, the public would probably experience a genuine reciprocity with government.

Complementarity (capital 'C') as used in this dissertation, honours the values, belief systems and apparatus brought to observation by research, at the same time as acknowledging the measurements made. In human settlement design, development and management, there is a conjunction of interdisciplinary team members, not just of one worker. Especially if a community is centrally involved, as recommended by EPPs, then a commitment to a Complementary, Synergistic Pluralism is essential: the integration of Epistemologies and Ideologies (Mythologies), re-including the excluded middle, and all dissident voices respectfully heard and their needs met, if not in one way, then in another. Utopian perhaps, but an honourable and urgent ideal, always underpinned by a 'Green Bottom Line'.

The UHSE Framework developed in the final sections, produces a practical tool that responds to this. Allen & Hoekstra's Unified Ecology was the only attempt I found to develop a clean model explicitly allowing intellectual integration across (here Ecological) disciplines. Its extension to human settlements makes the same gesture towards other disciplines, while opening a path to and from Ecology, as required by EPPs. It is unfortunate that such typing should continue to be needed. The intangible and the qualitative have always been with us. The difficulty in an Empiricist, Atomistic age, has been to have them considered democratically with the quantitative. Complementarity provides a simple tag that may assist designers to remember to do so: a restatement of the old adage 'facts are values-laden'. But the new invitation is not merely to 'fact' (and) 'value'. It will turn out to be a complex interference field derived from a plurality of approaches more appropriate to a post-modern context and an Ecological Paradigm.

It is fair to say that my life was transformed when I recognized that the way to work with people was to enter a conversation looking for the point where there was common ground. Once I could find it, I could build on it and it often took us in directions which none of us anticipated (Theobald 1998d).

5.6 SUMMARY: SUBATOMIC THEORY

The purpose of this section is to introduce a number of concepts which attach the ecological approach to its conceptual roots - structures and processes more often thought of as belonging to Physics, Metaphysics and Philosophy, which will be found to recur throughout this dissertation. Dramatic change would result in human settlements if the subatomic level of ecosystem theory were regularly to inform and structure ordinary development practices and policies. This especially applies to the concepts of Relativity and the 'both/and' attitude, which is derived first from Quantum Complementarity Theory and the Synergy of Complements, but a number of other 'basic principles' also emerge, which are underlined below.

Einstein's Special Theory of Relativity, which deals with the four-dimensional realm of spacetime, marks the major conceptual transition from a rigidly ordered, absolute and deterministic world, to a dynamic world where everything is relative. It questions and separates determinism and causality. This theoretical framework is used together with Spinoza's Monistic Theory of Substance by Mathews as a philosophical basis for her 'geometrodynamic' explanation of the universe: an open-systemed 'self' with a number of attributes, each argued from first principles. These include self-valuation, self-interest, self-realisation, self-maintenance and intrinsic interconnectedness: this suggests a self-organising system with a quality of responsiveness. Mathews and Davies are two who have described the universe as a nested series of systems, or nested system of observer systems respectively, and Mathews labels the ecosystem-nested 'organism-in-its-environment' as the proper unit for study, not individuals or families. Bohm's voice adds to those who attribute ecological, social and other crises everywhere evident to the Atomism of the dominant Western paradigm and lack of a wholistic approach. Reality is unpredictable, dynamic and complex, not predictable, static and linear.

Links are seen here, with the earlier mention of metaphysical archetypes (the atomist/substance pluralist - holist/ substance monist) dichotomy; and with later sections on Complexity and Hierarchy Theories. If everything is interconnected and systems are nested, we should wonder how that works, and ideally, have a way to approach this in human community education and design work.

That different rules apply for different scales of reality becomes apparent, but dynamism is universal. The character of subatomic reality is fundamentally dynamic: a restless dance, a constantly inter-transmuting matter-energy field of multiple dimensions and strange characteristics, a dynamic web of relatedness. Capra emphasises the switch from seeking

probabilities of things to an inherent issue of probabilities of relationship. It is a microcosm reminiscent of Eastern concepts of constant creation and destruction associated with the wheel of life and the formation of the universe. Particle and wave are Complementary aspects of each subatomic unit, and these come to represent the paradox of simultaneous presence of structure and relationship so important at macroscopic scale.

Complementarity, a new approach to Epistemology, which Bohr saw as a special kind of Relativity, is inherently inclusive, and seeks to balance the tensions between whole and part, general and local, individual and group, tangible and intangible, measurement and meaning. It questions the traditional scientific claim to objectivity, demanding that the context and intention behind all human activities be included with any measurements. These are two, incommensurable aspects of a single entity, not two different entities, and focus on one without the other is an incomplete description.

Heisenberg's Uncertainty Principle, upon which the original propositions of Quantum Mechanics were based, is reinterpreted contemporarily by Kosko as an indicator for the presence of complexity, and Uncertainty is explained as the operation of orthogonal relations between paired incommensurate aspects of measured entities. This is also the core Subsethood Theorem of Fuzzy Logic. Complex reality involves orthogonal relations between multiple variables, needing chaotic mathematical descriptions, and these chaotic conditions apply at all scales including the subatomic. Conceptual conflict is resolved by the Prigoginian idea of a realm where order emerges from a complex interference field between complete randomness and determinism. This realm is described below as the 'Edge of Chaos'.

Extension of quantum concepts by Bohm and Zohar insists on the application of contextualisation, the 'both/and' linkage of parts and wholes. Concern with part-whole relations links with Hierarchy Theory and Unified Ecology. Allen et al take Pattee's extension of Complementarity to biological and social structures, into Ecology, with the (not uniquely macroscopic but) macroscopically helpful distinction between rate dependent and rate independent aspects of entities.

The subject of Complementarity is further extended to recognise the general principle of the Synergy of Complements. Aristotle's Law of the Excluded Middle, has been most inappropriately applied to complex systems, with serious social consequences. Quantum Complementarity is seen as a special case affecting Science (as a dualistic hemi-system, discounting values) within a number of Anti-Aristotelian approaches, that seek to avoid either/or, dualistic thinking and deal

with the grey along with Probabilism's black and white, competing extremes. These include Fuzzy Logic, Sabelli's Union of Opposites, Xu & Li's Complementary Opposition, the contemporary process thinkers of antiquity Buddha, Lao Tsu and Heraclitus, and János' Teleonics. The latter, a process-based systems approach, is structurally and functionally similar to Hierarchy Theory. Conflict can be seen as a signal to go up-scale to seek a system definition that includes both conflicting elements and can see them as homeostatic complements or generators of creativity and system change. [*Mollison's "The problem is the solution"*].

This subsection concludes with a short discussion of types of Pluralism. Ecological theorists advocate Conceptual Pluralism, which can be seen as an intellectual expression of Complementarity or inclusiveness. This provides support for the later use of the inclusive ecological approach to complex systems through Criteria of Observation - a concept borrowed from Allen & Hoekstra in Ecology and extended to human settlements.

An extension on applications (Volume II) explores examples from a range of disciplines, the purpose being to illustrate linkages and coherence between subatomic concepts mentioned in this chapter, and the ordinary world at macroscopic (including microscopic) scales. These disciplines include Education, mind-related arenas (Psychotherapy, Neurophysiology, Cognitive Function, , Hypnotherapy, Electron Microscopic brain cell structure), Social Philosophy, and human settlement related arenas (Urban Geography, Architecture/Planning, Integrated Holistic Urban Research), and Health.

6 ORDERING PRINCIPLES

I think that there is a good chance that the study of the early universe and the requirements of mathematical consistency will lead us to a complete unified theory within the lifetime of some of us who are around today, always presuming we don't blow ourselves up first (Hawking 1988: 178).

The whole history of science has been the gradual realization that events do not happen in an arbitrary manner, but that they reflect a certain underlying order, which may or may not be divinely inspired. It would be only natural to suppose that this order should apply not only to the laws, but also to the conditions at the boundary of spacetime that specify the initial state of the universe ... There ought to be some principle that picks out one initial state, and hence one model, to represent our universe ... One such possibility is what are called chaotic boundary conditions (Hawking 1988: 129).

That chaos abounds, hardly anyone would deny. However, a universe of nothing but chaos contradicts common experience ... organization does exist amidst the confusion, and is often seen to spread. As the scale of observation increases, new organizations appear with behaviours that in a real sense are autonomous of any description at finer resolution. Over the course of a few weeks, changes in an ecosystem are highly influenced by the DNA strands possessed by the community. Yet over thousands of years, the genetic makeup of a biome is shaped by the larger environment and by the history of ecosystems configurations (Ulanowicz 1986: 166).

6.1 WHAT IS NATURE LIKE, THAT WE MAY ALIGN WITH IT?

An internally consistent explanation of order requires a concept of the fundamental nature of matter. Bohr's Complementarity Principle reminds us that we can come little nearer to Ontology than our epistemological filters allow. The fundamental particles and fields as listed in **Table 20: BICM: Reality - The Puzzle of Fundamentals** are differently interpreted according to views on substance. An Atomist (Substance Pluralist) approach will keep delving deeper and deeper into the structure of matter, diagnosing particles, components and forces connecting them as far as technology will allow: a 'Chinese boxes' or 'turtles all the way down' approach.^{1,2}

Substance Monism, on the other hand, as in the quotations from Capra in the previous section, will see connections and relationship at core and everywhere beyond, matter and energy constantly inter-transmuting, intra- and inter-scale; everything is fundamentally connected to everything else and ephemeral, and one proceeds to work up from there, explaining the emergence of apparent separateness through a theory of Ordering Principles. The Aristotelian hierarchical, organismic model of the Earth, with a place for all elements and each element in its place, and which was replaced by the atomistic view of the Industrial Revolution, hovers as an historical reference point for the revival of integrative thinking, yet it too has a building block Metaphor.

¹ About 90 years ago, a little old woman approached William James after a lecture on the solar system, to correct him: "The earth does not revolve around the sun, it rests on the back of a great turtle." ("and what does the turtle rest on?") "It rests on another turtle ... It's turtles all the way down." (Wenz 1988: 69).

² The detection by particle accelerator of the 'exotic meson', a hybrid of quarks and gluons, was reported in the Adelaide Advertiser 2 September 1997: 9). Subatomic particles known as baryons and mesons are made up of even smaller bits called quarks and anti-quarks. They are held together by gluons.

The spacetime concept of Special Relativity Theory emphasises connectedness, as explained by Mathews. Table 20 demonstrates that spacetime itself is an emergent phenomenon. Yet commonly, the individualistic fetish acknowledges a theoretical but mostly irrelevant spacetime, focusing on the apparent Atomism of Cartesian reality, discounting essential connectedness at human scale, and anthropocentrically treating that as reality's centre (much as pre-Copernicans saw Earth as central to the Solar System). As Hierarchy Theory explains (Allen & Hoekstra), relative disconnection rather than connectedness is the most important for understanding the working of complex eco-logical systems.

There is a fundamental universal connectedness as best we can tell, mediated by the particles which may emerge through string harmonics, to carry the four fundamental forces, but beyond that, through the fundamental energy ground. Survival has required that structures be protected from impacts that might otherwise flow destructively through the whole system. Organisation into relatively disconnected subunits has enabled the building of hierarchies and the organisation of systems with relative stability. The keystone condition for such disconnection is expressed by the Pauli Exclusion Principle, which dictates that 1/2-spin particles, of which all matter consists, can not have identical position and velocity: having mass is equivalent to staking out a unique position. This constrains particle behaviour and enables the formation of discrete entities, ultimately atoms and compounds, otherwise there would be attracted collapse into particles of enormous density, or persistence as a dense but roughly homogeneous stochastic soup (Hawking 1988: 72). Particulate components are constantly affected by subatomic level exchanges, collisions, emissions. and other events, and the force field distances between particles are orders of magnitude larger than the particles themselves.³

We are reminded of universal connectedness at macroscopic scales by biospheric events, such as climate change, and those processes that eventually carry pollutants (*inter alia*) to every corner of the biosphere, if produced beyond local absorption capacity: endless cycling of atomic and molecular entities proceeds throughout the planet and beyond. Transcending Science, the concept serves an important spiritual and metaphoric function, especially for those following the Ecological Paradigm.

For this dissertation, present argument supports the thesis of universal interconnectedness, from orthodox Quantum Theory, Chew's Topological Bootstrap (below) and Bohm's Causal quantum

³ Which leads one to speculate that we may indeed some day learn how to walk through walls.

interpretations, from an Einsteinian spacetime model and from an Eastern model. To quote

Capra:

The universal interconnectedness of things and events ... seems to be a fundamental feature of the atomic reality that does not depend on a particular interpretation of the mathematical theory. (Capra 1983: 149).

6.2 FUNDAMENTAL ORDERING PRINCIPLES

Davies, who uses spacetime as a fundamental reference point, mentions "the unidirectional growth of clumpiness of the universe" and agrees with Penrose that it probably has Fundamental Principle status, but cautions that there is more to it than that: the tendency to self-gravitation and thus self-structuring and coherent ordering according to the Second Law of Thermodynamics ('gravitational entropy'), is not the same as organisation, which is much more complex and has qualitative aspects (Davies 1989: 136).

This distinction is followed up below in the section on self-organising systems. Without becoming involved in the several potential explanations of the origin of the universe, that thought most likely in recent times has been the Hot Big Bang Theory. This is thought to be the origin of ultimate connectedness, where 10-20 billion years ago, space, time, energy, matter and its mirror image anti-matter, all appeared at once as the result of a vast explosion at ultra-high temperatures, followed immediately by rapid expansion and relative cooling, which even now is detectable as a 30°K above absolute zero, background heat radiation, throughout the universe.

High temperature accelerators, operating at extremely high energies, have demonstrated the probable process in reverse, by which the higher the temperature the less differentiated the forces and structure of matter. The Table 20 above, describes the four (possibly 5) forces discernable at low temperature, which coalesce at higher temperatures.

Coalescence of fundamental forces with increasing temperature is as follows: EMF and Weak Nuclear Force merge at 10¹⁵ degrees, energy of strong (SNF) & weak (EMF, WNF) interactions become equivalent at 10²⁷ degrees, Gravitation merges at 10³² degrees; at this point new theory is required of a Unified Superforce. The state changes for matter as temperature increases, run through: solid, liquid, gas, plasma (atomic structure lost, dissociating into ions and electrons), nuclear breakdown (uniform mix of protons, neutrons, electrons), quark soup (proton & neutron breakdown into quark species -muon, tauon; leptons - electrons, neutrinos, photons), particle blurring, spacetime breakdown, primitive substratum (?strings), disappearance of Laws

of Physics (Barrow 1991: 122-32, 130-4; Davies 1989: 122-5, 124, 128-9). Davies speaks of the "pleasing confluence of the physics of the very large (Cosmology) and the very small (Particle Physics) which has done much to support the Big Bang Theory and the idea of an inflationary (expanding) universe.

The fundamental initial symmetry of the universe at its creation is thought to have been subject to chaotic processes and loss of symmetry⁴ ever since.⁵ Theoretically matter and anti-matter would annihilate each other on contact. Yet one finds such phenomena as radiation, the production of two photons for every proton-anti-proton annihilation, minute decay rate asymmetry between protons and anti-protons, asymmetrical transformations between quarks and anti-electrons and vice versa, or electrons and anti-electrons into anti-quarks and quarks, and other unspecified anti-symmetry processes related to local temperature and density conditions. Changes in the Ordering Principles (the four fundamental forces) for matter and energy which emerged with cooling, are thought to have initiated the separations which allowed a material universe to persist (Barrow 1991: 114-5, 134-5; Hawking 1988: 82).

This marks the origin and irreversibility of the non-equilibrium world which appears theoretically at submicroscopic level and is perceived by us macroscopically as gradual movement of the system towards ever greater levels of order under the fundamental constraint of entropy, which puts a direction on energy transfer processes at all scales. Essentially, dynamics, representing order under the influence of the subatomic forces mentioned above, confronts thermodynamics,⁶ which describes constrained collective behaviours of large numbers of particles, in a dance that Prigogine regards as probability-driven (ie chance, random) (Prigogine & Stengers 1984: 285-90). We saw above that the presence of order contradicts wholly random explanations, which Bohm resolves by proposing that Deterministic Chaos separates order and Stochastic Chaos (Bohm & Peat 1987: 134). This leads to Bohm's theory of 'Implicate and Explicate Ordering'.

Barrow's reference to self-consistency as the ultimate ordering principle can be related to the radical explanatory Physics of Geoffrey Chew, known as Topological Bootstrap Theory (TBT) (Barrow 1991: 78) Capra describes Chew's 'Bootstrap Philosophy' as the "... final rejection of the mechanistic world view in modern physics ...", that "... not only denies the existence of

⁴ 3 symmetries were proposed and believed correct until work done 1956-1980: C: laws same for particles & anti-particles; P: laws same for mirror image situations (eg left & right isomers); T: laws same for reversal of time. The weak force does not obey symmetry P nor C; the Laws of Physics don't follow symmetry T (Hawking 1988: 82-3).

⁵ **Link: Chaos Theory.**

⁶ Prigogine proposes a new entity the hypnon to deal with the incoherence of Classical elementary particle concepts at equilibrium, attempting to unite dynamics with thermodynamics.

fundamental constituents of matter, but accepts no fundamental entities whatsoever - no fundamental laws, equations or principles..." (Capra 1985: 263); and further:

Physicists have now come to see that all their theories of natural phenomena, including the 'laws' they describe, are creations of the human mind; properties of our conceptual map of reality, rather than of reality itself ... necessarily limited and approximate" (Capra 1985: 250).

No nuclear particle, each being a bound state of the others, can be called fundamental. This philosophy includes the implication that the speed of light and infinite entropy may not be absolute barriers, as presented by the Cartesian-Newtonian-Einsteinian spacetime models, and action at a distance (non-local correlations as in Bell's Theorem) may be accommodated (Pred & Pred 1985: 469-70). Again, spacetime is seen as a remnant of the Cartesian 'real' world, and must not be seen as fundamental. With the advent of far more sophisticated deep-space probing technologies, greatly enhanced computer memory and the feedback from solar system exploration, the late 1990s have seen rapid further advances in the understanding of many spacetime conundra, and the opening up of whole new sets of questions, well beyond the scope of this work.

6.3 BOHM'S IMPLICATE ORDER

Honner sees Complementarity as an organising principle, a type of Causality or Relativity (Honner 1987: 57). While most of the other approaches to Quantum Theory have originated in mathematical modelling, the work of David Bohm and his associates, largely discounted by those of more formal approach, started with theory and provided mathematical proofs secondarily. Brody and Bohm both explore the linkage between formalisms and the informal level of Quantum Theory: they spell out the informalisms without alienating the formal. Bohm assumes wave functions to be real and the explicit Classical world to unfold, or become Explicate or manifest, from an invisible 'Implicate Order'. **Table21: CM: Bohm's Causal Interpretation of QT - Selected Features** summarises key points.

Bohm worked to integrate an interpretation which includes and transcends both Realist and Positivist concepts, includes non-local hidden variables, relativity and Classical mechanics, and the Copenhagen School's approach to Complementarity. Not only this, but he took a broad, wholistic view of reality, which takes on the 'dangerous' areas of mind and consciousness, creativity and the social realm, and develops a coherent approach to the concepts of universal ordering and change (refer Bohm 1965;1980: 172-213;1985;Bohm & Hiley 1993;Bohm & Peat

1987). He linked the usually linear Quantum Mathematics into an interface with Complexity (equations for multiple particles rather than just single ones). Bohm explained the operation of chaos dynamics at quantum scale. For these integrative reasons, supporters of an ecological world view would probably agree with Bell in giving Bohm their support, and indeed many are now discovering and (posthumously) revering his work.⁵ Pribram's work on holographics has high compatibility with Bohm's, and this is often referred to by the same group (Ferguson 1982: 15; Weber 1982; Wilber 1982b: 1).

Pribram's concept of a holographic universe, where each 'cell' carries information about the whole (as distinct from being able to fully reproduce the whole, as is often claimed by New-Agers), proposes that the human brain also has a holographic structure wherein information is stored in a network of connectivity, plastically deformed by signal transmission into patterns, as with a tape recorder. Patterns are re-evoked or gathered through energising particular circuits over wide areas of the brain, by attributes (such as lines, edges, colours, curves) rather than having a 1:1 mapping⁸ which faithfully records spacetime contiguity (Weber 1982: 44-6). There is a large recent literature on neural functional representation and also on Psychoneuroimmunology which will not be explored here, but brain function is frequently mentioned by researchers in the fields of Complexity and Ecology.

Early work by Wilber Penfield which informed Berne's initial Transactional Analysis Theory, demonstrated by Temporal Lobe stimulation in awake patients, that memories appeared to be accessible in temporal sequence, as multi-criterial recordings, (perhaps gathered from elsewhere by that lobe: all Ego States relevant to a given event are stored, or at least, accessed together). These recordings apparently played a part in organising subjective experience (Penfield 1952: 178-98). This phenomenology, in effect a Theory of Psychological Ordering, has been applied with remarkable success in TA-Gestalt Psychotherapy. The work of Ramachandran *et al* focused on the mediating role of the Parietal Lobe⁹ in hemispheric functioning (Ramachandran, Levi, Stone, Rogers-Ramachandran, McKinney, Stalcup, Arcilla, Zweifler, Schatz & Flippin 1995) and aligns with applications in education. **Link: BP5.5: Applications of Quantum Theory Complementarity.**

⁷ Those with whom I have discussed Bohm and who are aware of his work certainly do, but I have not confirmed this more widely.⁵

⁸ The "Correspondence Theory of Truth" (Weber 1982: 45).

⁹ Anatomically adjacent to Temporal.

The holographic,¹⁰ interpenetrating nature of the brain is used by Bohm to explain the 'holomovement' character of his proposed Implicate Order. This is the 'most primitive' form of ordering (unrelated to location in space or time), even though there may be a temporal relationship in terms of adjacent unfolding. The ultimate reality will consist of many such orders in parallel or interpenetrating. The key point is the need to reverse the conceptual order: The Classical universe is our human scale, but not the fundamental ground of reality - it is our foreground, but not the ground. According to Bohm, the true ground, or holomovement is beyond human comprehension, thought and technical apparatus, is real but not manifest, and is atemporal. It has immense energy, far greater than that imbued in the total known matter in the universe, and its boundary appears to be where space becomes undefinable and the gravitational field disappears (scale of 10-33cm) (Wilber 1982a: 48, 50).

The enfolded becomes explicate and confers dimensionality in space and time, through two levels of density. "All entities are forms of the holomovement" (: 52), and "reality is whatever man [*sic*] can know, by definition" (:53). However the concept of the Implicate Order reverses this latter to claim that the Implicate Order is reality, and the equations and formalisms, the perceptions and interpretations, the measurement systems for space and time, Scripts and Frames of Reference, are imperfect and often conceptually confused attempts to construct reality, and have the purpose of ordering the reality perceived, to attain prediction and control. They are not 'the truth', and reality is not confined to the measurable (Wilber 1982a: 52-4, 56, 59).^{11,12}

... we say the fundamental movement is folding and unfolding. Whereas the fundamental movement of Descartes is crossing space in time, a localized entity moving from one place to another (Weber 1982: 49).

We are only equipped to perceive some aspects of an unfolded entity by virtue of our perceptual apparatus, enhanced sometimes by instruments, and can not comprehend the whole enfolded order through our limited systems. In the Cartesian system, all elements are contiguous in spacetime, whether considering the atomistic elements (particles) or the continuous flow between them (fields), and there is an assumption that the whole is potentially manifest either directly or through instruments. This is thus an ordering that occurs after the entity has become manifest, and does not address internal relationships in the same way as enfoldment does (Weber 1982: 48-9, 44-104).

¹⁰ The hologram is a 'snapshot' of an electromagnetic field at a particular point in time. The holomovement is the total ground from which all such snapshots may unfold and become manifest (Weber 1982: 51).

¹¹ Note relationship to postmodern theory on multiple constructions of reality.

¹² "Man [*sic*] is not a passive receiver of stimuli coming from an external world, but in a very concrete sense creates his world" (Childs-Gowell 1979: 53, quoting Lederer, 1968).

Bohm gives a number of examples of his concept of unfolding, likening the relationship of the unfolded to the source, to that between a droplet and the ocean, where the ocean is present in and acts on and through the droplet, and yet is unapproachable by it. Consciousness, (thoughts, psychological processes), all matter, all time, are material processes which lie within the Implicate Order, yet "lie in something immensely beyond that", (:62), and become manifest by unfolding. Thought, which reifies itself into a delusion of substance, is a small manifestation of a deeper mind in a way similar to the connection between matter and the enormous energy of the source (Wilber 1982a: 62-3).¹³

The first layer of unfolding is the subtle but still material, and high dimensional quantum level, like a cloud or ripple on a sea of empty, silent energy, which goes on to unfold manifest matter as the Explicate Order. The spacetime barrier is an emergent entity. Quantum Theory, which covers a multidimensional realm (of $3n$ dimensions, the n representing the context-dependent number of degrees of freedom per particle), describes the rules required for manifestation in the 3-dimensional Classical world, where matter becomes Explicate. Abstractions (non-real) are imposed by us as Ordering Principles, and include the atomistic approach to ordering, and thought in general, which acts as a filter on reality, and resists and limits change by manipulating reason, to support or certify ideas. Finally:

... if we accept the idea of the explicate order as the ultimate or whole of reality ... then it becomes absurd to think of human beings all becoming one ... [with] ... the universe as a whole ... [this] was a tremendous abstraction. ... following science itself we have been led to a view which is compatible with the wholeness of mankind [sic], or its holiness, if you want to call it that. Mankind has now splintered and fragmented into countless bits, not only nations and religions and groups, but each individual in families, isolated from each other; and within, each individual is in many fragments; and this tremendous fragmentation gives rise to chaos, violence, destruction and very little hope of any real order coming about. And now that is supported by the general view of everything, you know, that the basic reality consists of little bits, all outside of each other ... Atomistic ... if we look at science in this ... explicate way ... we say we are fragmented, but when we look at the material world we see that we are really totally out of line with the material world. There's no justification for our fragmentation in the material world whatsoever (Wilber 1982a: 71-2).

¹³ Evolution is not here thought of as progress towards an ideal goal nor even necessarily as change with improvement; it means change as such, in this context. Semantically it means 'any process of formation or growth; development', and should be distinguished from 'volution', devolution, involution and revolution. (L *evolutio* from *evolvere* to roll out, L. *voluta*, a scroll - The Macquarie Dictionary). The relationship to Bohm's unfolding of an Implicate Order can be seen here. "Development" is also semantically interesting (develop = bring out the capabilities or possibilities of, bring to a more advanced or effective state, evolution, growth, expansion: OF *voluper* to wrap). Thus 'velopment' would wrap something up, development would make the Implicate, Explicate.

6.4 ORDER-THROUGH-FLUCTUATIONS

... this order, which man admires as a supernatural effect, is sometimes disturbed, or changed into what he calls confusion : this confusion itself is, however, always a necessary consequence of the laws of nature ; in which it is requisite to the maintenance of the whole, that some of her parts should be deranged and thrown out of the ordinary course ... sometimes the seasons seem to have usurped each other's place, to have quitted their regular order ; sometimes the discordant elements seem to dispute among themselves the dominion of the world ; the sea bursts its limits, the solid earth is shaken ... pestilential diseases destroy men, sweep off animals ... nevertheless the whole of this afflicting confusion are necessary effects, produced by natural causes ; which act according to fixed, permanent laws, determined by their own peculiar essence, and the universal essence of nature : in which every thing must necessarily be changed ; be moved ; be dissolved ; where that which is called ORDER must sometimes be disturbed ; be altered into a new mode of existence ; which to his deluded mind, to his imagination, led astray by ignorance and want of reflection, appears CONFUSION (De Mirabaud 1840: 35).

In seeking to reconcile the observable order in the natural world with the Entropic Principle implied by the Second Law of Thermodynamics, Prigogine in the 1960s, came to realise that previous assumptions had seen atomic and molecular entities as being helplessly 'left to themselves', but that this was not the situation in the real world. Ordering Principles appear to organise the world as we understand it, and could hold the key to a deeper comprehension of our relationship with Nature.

In the real world atoms and molecules are almost never left to themselves ... they are almost always exposed to a certain amount of energy and material flowing in from the outside. And if that flow of energy and material is strong enough, then the steady degradation demanded by the second law can be partially reversed. Over a limited region, in fact, a system can spontaneously organize itself into a whole series of complex structures (Waldrop 1992: 33).

Prigogine and Stengers identify irreversibility itself as the mechanism that builds order from chaos, governed by the Second Law of Thermodynamics. Entropy is seen (starting with Planck) as an Attractor state.¹⁴ Thermodynamic systems far from equilibrium (FFE)¹⁵ have special characteristics which depend on principles that operate at every scale, an evolutionary paradigm which in their opinion, makes the emergence of life inevitable (Prigogine & Stengers 1984: 292, 121, 188).

Prigogine follows the mathematical modelling of this type of complex system, relating the stability threshold to bifurcations in system behaviour at 'thermodynamic branches'. The branching behaviour, which at the bifurcation point carries different options for stable and unstable paths, depends on the system's history. The bifurcation is mathematically and topologically described by Catastrophe Theory.¹⁶ Prigogine & Stengers note:

The state we reach depends on the previous history of the system. Until now history has been commonly used in the interpretation of biological and social phenomena, but that it might play an important role in simple chemical processes is quite unexpected (Prigogine & Stengers 1984: 161).¹⁷

¹⁴ **Link: Chaos Theory.**

¹⁵ **Link: Hypercyclic Systems Theory.**

¹⁶ **Link: HST: Bifurcation Theory; Catastrophe Theory.**

¹⁷ A situation that those who currently work to eliminate the teaching of history, may discount at our collective peril.

Fluctuations in a system, increasing markedly as the system hovers unstably near bifurcation points, become responsible for system outcomes. Very small changes in system conditions, at any point in the system, can be amplified by positive feedback, and spread through the whole system through a phenomenon known as 'nucleation' (the initial condition becomes an Attractor for further activity - for instance the urban multiplier effect, the rise of fashions, the seeding of clouds, rushes on market stocks, customer panic runs on banks). FFE systems including biological systems, feed on fluxes of matter and energy,¹⁸ unlike equilibrium structures which are 'immortal' once formed. This sets the scene for the possibility of radical change. At the same time there are inbuilt system constraints which limit positive feedback processes (such as resource or structural limits - matter or energy, the Laws of Physics, and in social contexts, mores, institutions, rules, laws, contracts, special relationships and so forth), and provide the pattern of the logistical (S-shaped) curve, which becomes a tool for understanding such systems (Gould 1993: 136-44, 164-6; Prigogine & Stengers 1984: 177, 186-7, 126, 207, 203-4). **Link: BP 5.10 (Mathematics).**

"Order through fluctuations" models introduce an unstable world where small causes can have large effects, but this world is not arbitrary. On the contrary, the reasons for the amplification of a small event are a legitimate matter for rational enquiry ... fluctuations do not cause the transformation of a system's activity (Prigogine & Stengers 1984: 206) *[emphasis added]*. **Link: BP 5.4 (Cause).**

At bifurcation points there is a dynamic flux between what Prigogine refers to as 'chance' (meaning statistical randomness¹⁹) and 'necessity' (referring to the system constraints, which include local conditions and the Second Law which imposes a direction on any change, and introduces time's arrow of irreversibility). Both these aspects are essential, a balance between 'Being and Becoming' (after Alfred North Whitehead). Closed, isolated, dynamic equilibrium systems are 'blind', unresponsive and reversible. Far from equilibrium systems have a dynamic coherence, which first appears at molecular level, but happens at all scales, and has been described for chemical, physical, ecological, economic and social systems (Peet 1992: 80; Prigogine & Stengers 1984: 177-190, 313). They are exquisitely sensitive to their histories and responsive to their environments, both in receiving the energy which they dissipate through their structures,

¹⁸ And information.

¹⁹ Or as Allen & Hoekstra indicate, often a runaway positive feedback process. **Links: Theory of Scale; BP 5.3 (Fuzzy Logic).**

and communication of information (what Allen *et al* call 'signal'),²⁰ which determines the direction of change (Prigogine & Stengers 1984: 95, 14, 197).

Prigogine & Stengers see a world of evolution, with isolated, equilibrium systems heading for disorder, while FFE systems evolve to ever-increasing complexity. Irreversibility for humans is a deep issue that involves the fundamental meaning of our existence, and our awareness of it stands as an indicator of our involvement with life (Prigogine & Stengers 1984: 297-8).

How can we bridge the gap between being and becoming - two concepts in conflict, yet both necessary to reach a coherent description of this strange world in which we live? (Prigogine & Stengers 1984: 209).

The relationship between Yin and Yang pervades the whole cosmos and is implicit within every interaction ... The relationship is one of the creative or destructive interaction of opposites ... Yin corresponds to all condensing, structuring and stabilizing factors. Yang corresponds to all dispersive, mobile, energetic and destabilizing factors ... Yin and Yang control and maintain each other: the balance between Yin and Yang define what we refer to as a system ... are inseparable and can manifest only as a dynamic process. Nothing can be Yang in isolation, any more than anything can be purely Yin (Townsend & De Donna 1990: 32-3).

²⁰ **Link: Theory of Scale.**

6.5 ORDER BEYOND THE SUBMICROSCOPIC

6.5.1 INTRODUCTION

Every act of research, design, development or implementation involves some sort of interfacing with Ordering Principles: our society and our own psyches are responding to tangible, physical constraints and intangible Ordering Principles such as frames of reference (including social mores, laws, Metaphor and language). The following sections review some of the known organising principles that are relevant to human well-being. We can not avoid impacts on ecosystems when we build human settlements. We can not avoid social impacts. The least we can do is minimise our impacts by intervening with discrimination. The best we can do is intervene in a partnership we all protect and celebrate.

6.5.2 MICRO-MACRO LINKAGES

O'Neill *et al* in their pioneering work on Hierarchy Theory in Ecology, trace the evolution of biological entities from atomic and molecular origins. They ascribe the hierarchical structure of ecosystems to evolution in open dissipative systems (O'Neill *et al* 1986: 101-122). O'Neill *et al* recall Prigogine and Nicholis' (1977) speculative reconstruction of prebiotic evolutionary events. Prigogine describes ordering processes from sub-atomic and molecular to slime moulds and insect colonies, to much larger systems such as cities (Prigogine & Stengers 1984: 181-207).

The enabling scenario reflects the order-through-fluctuations principle across many scales. It includes first atomic evolution, producing all the elements of the periodic table. Then it builds up complexity through stratified stability enabled by a hierarchical system: chemical evolution of molecular forms. This starts through initially accidental combinations triggered by fluctuations in an unstable system. These then compete for resources, with increasing total dissipation, and minimal structural dissipation made possible by the openness of the system (so external energy can be trapped), and the development of autotrophic molecules (such as chlorophyll, carotenoids and xanthophylls). Fluctuations in energy and dissipative advances lead to positive feedbacks which further destabilise the system, creating increasingly high levels of self-organisation over many transitions. Entrapment of energy into structure and eventual dissipation (as thermal), thus ultimately enable life (O'Neill *et al* 1986: 104-7).

The recent discovery in geological core samples (and possibly also as fossils in Martian rock) of 'nanobes', apparently alive entities in the 20-50 nanometer size range,²¹ is inviting a complete review of the definition of life itself, and its origins (Brady 1999: 20). A range of complex extraterrestrial organic molecules is now known to arrive from deep space as hydrocarbon-containing particles associated with meteorites and dust, including amino acids, quinones (similar to chlorophyll) and amphiphilics (initiating primitive self-organisation) (Bernstein, Sandford & Allamandola 1999: 33). Margulis and Sagan proposed the fortuitous incorporation of bacteria as a ground-breaking early step towards complexity in cell function²² (Margulis & Sagan 1987: 127-54).

Trying to explain Ordering Principles behind the mechanism of Genetics, Shelldrake²³ proposes the concept of a Morphogenetic Field: a field to which developing living beings respond as do television sets tuned to particular frequencies, manifesting physical form (Shelldrake 1981; 1989: 294). Indeed our sight and hearing senses are so designed. Prigogine & Stengers remind us of sensitivity to magnetic fields and gravity in animals, and speak of the influence of position in field, presence of 'morphogens' and concentration gradients noted in Molecular Biology (Prigogine & Stengers 1984: 172). The degree of intention of behaviour at gene level is controversial (for instance see Dawkins 1982).

The New Genetics should reveal whether such theories are necessary to explain observed physical developmental and evolutionary phenomena. Recent research supports a genetic explanation in animals: cellular secretory proteins account for limb development, orientation, symmetry and body form, mediated by the same or similar genes, right across the animal kingdom (Riddle & Tabin 1999: 54-6). The Organising Principles in this case, which determine dorsal-ventral, anterior-posterior and proximal-distal symmetries, are proteins ('sonic hedgehog') secreted by the posterior edge of the limb buds which appear along (lateral) ectodermal ridges. The ancient sonic hedgehog molecular signalling system has evolved several other roles in body formation and function (Riddle & Tabin 1999: 56, 58-9).

Kauffman's work in Molecular Biology illuminates the structure and evolution of genetic systems poised at the *Edge of Chaos*²⁴ (for instance see Kauffman 1991; Kauffman 1993; Kauffman & Johnsen 1991). **Link: Chaos Theory; Hypercyclic Systems Theory.**

²¹ This is a size range not previously thought able to sustain a definition of 'organism' under current understanding of organising principles.

²² Since supported by DNA sequencing Dr Joseph Wayne Smith, Research Fellow, University of Adelaide, pers. comm..

²³ Disrespected widely as a mad radical, notwithstanding his respectable career.

²⁴ **Link: Hypercyclic Systems: Self Organising Systems.**

Macro-biological ordering is described through the sections on Complexity, Catastrophe, Self-Organisation and Hierarchy. The 'technology' of ordering includes the time-hierarchical relations which allow the emergent phenomena of ecological systems, a 'Landscape Change Principle', that expresses a dynamic balance across hierarchies of space and time scales, producing an emergent 'landscape pattern' (Forman & Godron 1986: 87, 17), and in human psychological development, the personal Life Script with its 'Drivers' and 'Stoppers' or 'Injunctions', which operate psychologically ([Link: BP 5.2 Transactional Analysis](#)), have different styles and potential impacts on behaviour according to a developmental hierarchy, and produce an emergent 'personality'. These processes are mirrored in social evolution.

When undisturbed, the horizontal structure of a landscape tends to progress towards homogeneity. Moderate disturbance rapidly increases heterogeneity. A landscape can therefore be said to be in dynamic balance at a point in time; that is, it is subject to two opposing types of forces, development and disturbance. In such a balance, the most fundamental landscape characteristics – vertical structure, horizontal structure, and grain size – shift rapidly when one group of forces becomes predominant over the other (Forman & Godron 1986: 274).

6.5.3 PERSONAL, SOCIAL AND CULTURAL ORDERING

In addition to the influences and limitations of Physics and Chemistry, Far From Equilibrium system conditions at human scale include constraining effects, natural, and also now usually, human. Human social arrangements can themselves be interpreted as behaving like FFE systems, operating in a delimited, evolving Sustainability Space. **Links: Hypercyclic Systems; Fuzzy Sustainability Space; Criterion Indicators.** The constraints here again are a web of feedback loops that reinforce or balance the system. One set tends towards exponential growth and catastrophic behaviour at certain ranges (driven by positive feedback); another provides structures of resistance or damping (negative feedback) (O'Connor & McDermott 1997: 37-45). Applications used in management such as double loop learning (Argyris & Schön 1975: 18-19) have congruence with Ecological and Evolutionary Theory, and can be used in implementation of development projects.

It is proposed here, after Prigogine, that the chief human system structure is a complex, multi-scaled interference field (which I term an 'Attractor landscape'). The pattern established at submicroscopic scale appears to be carried through to macro scale and beyond. A mixture of tangible and intangible qualities ensure that the whole is invariably more than the sum of the parts. The Attractors and drivers (positive feedback) represent self-interested behaviour of living

or semi-living entities. This includes impulses to meet broadly defined survival needs and wants (physical, social, spiritual, psychological), the competing, conflicting or collaborative interests of all participating beings, climate, and physico-biotic context. Many now are potentiated or modified by technology.

Human behaviour interfaces with core ecological-type events and relationships, and health flourishes with meaningful contact with Nature (Burns 1998: 208). Climate, fire, disease and predation play their roles, modern Medicine notwithstanding. Human-generated impacts such as land and water pollution, genetic engineering, habitat destruction and climate change, are now arching back to operate as global scale constraints, increasingly felt both directly and indirectly at source, as the limits to growth, the much feared mega-constraint, are approached (for instance see Gardner 1996;Hamilton 1993;Hardin 1993;Meadows *et al* 1992;Meadows *et al* 1972;Smith c.1991). Ordering Principles are discussed throughout this dissertation, particularly in **Links: Hypercyclic Systems Theory: Feedback; Hierarchy Theory: Constraints; Criteria Community, Biotics, Organism, Feedbacks.**

6.6 SUMMARY: ORDERING PRINCIPLES

This section first seeks an understanding the nature of matter in the service of comprehending Nature. It does this to try to get to the root of the concept of Ordering Principles, which are seen to operate at every scale. A description of the fundamental particles and forces revealed by Particle Physics is presented in a large table in the Appendix. The fundamental concepts which underlie the subatomic realm are interpreted differently by Substance Pluralist and Substance Monist proponents, using a building blocks Metaphor ('reality is a building') in the former and a universal connectance Metaphor ('reality is an ocean or a web') in the latter. These Metaphors can be seen to be related to the ontological position of the proponent of the fundamental scale of reality: above or below the spacetime barrier.

A reason is offered for apparent Atomism at Classical scale: spacetime is an emergent condition which slightly overlaps and overlies the quantum realm of Particle Physics, where quite different rules apply - spacetime is not the fundamental ground of being.

The exploration touches on the Implicate/Explicate Order concepts of the late David Bohm, a physicist who attempted to bring Physics to bear on the crisis conditions of modern humanity, and who is often quoted by proponents of the ecological approach. It also iterates the conclusions of Prigogine, originator of the concept 'order out of chaos' or 'order through fluctuations', which may in the end be as close as we may come to a 'Theory Of Everything'. Prigogine's conclusions include the importance of irreversibility to evolutionary processes, and the identification of entropy as an Attractor state. The success of far-from-equilibrium systems lies in their strategies for overcoming this attraction. Concepts to be expanded in following subsections are introduced, all involving edge-of-chaos phenomena, such as Bifurcation, Catastrophe and poised states between being and becoming, and hierarchical phenomena.

The rest of the section shifts up-scale, linking in a socio-cultural extension of these ideas, and the internal (basic needs, personal Life Script, non-basic wants and proclivities) and external (physical and community laws, rules, Cultural Scripting: belief systems, cultural constraints) Ordering Principles of society and individual. The Theory runs as follows.

There is a ground of energy, which constantly inter-transmutes into matter under the influence of specific local (scale-sensitive) Organising Principles and the general set of Organising Principles that follow the Laws of Physics and govern the *Edge of Chaos* and Thermodynamics. One tendency of this system is to generate the emergence of ever-more-complex and energy-dissipative structures. These are not normally reversible as in equilibrium thermodynamic

systems, so they persist as changes which then under environmental feedbacks, interact with other such structures to produce further emergents and systems of emergents, thus constituting the Backcloth for Evolution, and a largely nested hierarchical structure. Such entities become visible and measurable directly in the Classical realm, which with spacetime, emerges at 10^{-33} cm.

This section starts with the concept that there may be some unifying set of Principles, or even a single Principle, that acts to organise the world as we understand it. Hawking, who mentions chaotic boundary conditions in this regard, does not spell this out in this writing. Prigogine & Stengers do so in some detail. This theme is followed up in later sections on Complexity Theory.

The research for this thesis has found reference to Edge of Chaos (Deterministic Chaos) phenomena arising in all contexts from the big bang, and through Subatomic Theory to the Classical realm, and Organising Principles also across all disciplinary realms examined. Here, determinism interfaces with apparent randomness: expansion and contraction, growth and constraint, behavioural freedom and psycho-social constraint, attraction and repulsion. This situation is seen to lie at the base of any theory of ecological approach.

In addition to the Laws of Physics, FFE systems at human scale have identifiable fluxes with positive and negative feedbacks modified by ecological conditions and human impacts and the Cosmologies and Metaphors that inform those. Ecosystems have their own FFE system conditions and constraints, with and without humans, including reproduction, predation, disease and natural resource limits (food, water, nutrients) for participating organisms, fire, climate and geomorphology.

Human social arrangements can themselves be viewed as behaving like FFE systems, subject to constraints or Organising Principles. Personal and community or social constraints in this case can be seen as intangible Scripting: taking the positive, reinforcing form of Drivers to Scripted personal or community survival, life, growth, procreation and the basic needs which support these, and the negative feedback, damping forms or filters of again, Scripted survival: Cosmology, Ideology, linguistic and other Metaphor, information, institutions, laws, rules, contracts and particular relationships. Humans are also and simultaneously ecosystem-bound, subject to natural and physical limiting factors as for ecosystems. Human-generated impacts such as land and water pollution, genetic engineering, habitat destruction and climate change become secondary Organising Principles (as in initial conditions for new systems) in themselves, as they modify environmental conditions in self-referential cycles.

If such a system of understanding is accepted, then the old-fashioned approach to cause-and-effect is in trouble. Complementarity indicates that an either/or position is unlikely to be helpful for complex situations. Transactional Analysis is suggested as a Social Science model that could be most useful in dealing with the human side of Ecology. Essays on Cause & Transactional Analysis appear in Volume II.

7 HYPERCYCLIC SYSTEMS THEORY (THEORY OF COMPLEX, DYNAMIC, FAR-FROM-EQUILIBRIUM, DISSIPATIVE SYSTEMS)

"I think there's a personality that goes with this kind of thing ... It's people who like process and pattern, as opposed to people who are comfortable with stasis and order ...every time ... I've run across simple rules giving rise to emergent, complex messiness, I've just said 'Ah, isn't that lovely!' ... when other people run across it, they recoil ..." [Arthur] was struck by a passage in which Lewontin said that scientists come in two types ... the first type [*Platonists*'] see the world as being basically in equilibrium. And if untidy forces sometimes push a system slightly out of equilibrium, they feel the whole trick is to push it back again ...the second type [*Heraclitians*'] ... see the world as a process of flow and change, with the same material constantly going around and around in endless combinations (Waldrop 1992: 334, 335 - Brian Arthur Interview).

7.1 INTRODUCTION

We are facing crises in all our systems, environmental, social and economic. As we have come to recognise the non-linear nature of these systems and to wish to approach them with an appropriate, non-linear framework, we are also faced with the need to understand at least the general Organising Principles for complex systems, and to develop a common language across the disciplines for phenomena that do apparently underpin them all.

The more we have dismantled our system constraints to facilitate the Market Libertarian system, the more 'successful' has this system become in the short term. But while all three are subject to the same systems conditions, the central Attractor systems for markets are in fundamental conflict with those of ecosystems and often also of social systems, so these are sustaining (or not), unprecedented impacts, to the extent that artificial constraints have not been built into the system. The instruments of constraint (negative and positive both), in human society include volition, policy and regulation.

Successful politicians appear to have an instinctive cunning in the manipulation of complex systems, which they use to their own advantage. The Systems Theory supporting this dissertation is available to and used by facilitators of the market libertarian system, who are becoming increasingly sophisticated at maintaining leverage, and fulfilling ideological ends by presenting a naïve public with double-bind decisions and feigning certainty around inherently uncertain system conditions².

¹ Ionian philosopher, 100 years pre-Plato. "... passionately and poetically argued that the world is in a constant state of flux" (Waldrop 1992: 335).

² Such as "you can have environmental protection, but only if we sell the national phone carrier", "you can have aid, but only if you make it worth our while economically (go into debt buying our services & products)".

But Treasury bureaucrats advise politicians and train them in their own image, and their decision-making models, while based on Systems Theory, are flawed by their narrow assumptions and their use of outdated, static or linear versions of the nature of complex systems. Confident use of economic language mystifies and renders civil society impotent, deluding both that everything is under control.

Decisions continue to be made by the uninformed, for instance in local government, with devastating environmental consequences, because the larger picture is usually discounted. Planners often appear too busy to think about such things at all. Developers mostly lie even further down the scale of understanding, and are very direct in their Capitalism. Urban designers lately use some of the terms but not always with understanding.

EPPs are experts in the negative impacts of the amoral market libertarian system, but are not usually in a political position to act directly on this knowledge, nor is their understanding of systems usually sophisticated enough to take this on if they could. NGOs and CBOs³ have occupied the niche available to them, which is equivalent to the sensor role in a co-evolutionary system, a key role that needs an equivalent familiarity with systems skills. As the idealistic German Greens have found, actually being in office requires so much compromise that their support has dramatically dropped and they may not survive. The UN Habitat II Conference in Istanbul 1996 was the first occasion when NGOs and CBOs, representing 'civil society', were included as 'partners'⁴ in the proceedings of such meetings.

O'Neill *et al* refer to the details of ecosystems considered as cybernetic⁵ systems ('self-organising aggregates'). The advantages of viewing systems cybernetically are several, although this is not the only way to organise the information. Advantages include: their ability to be considered as integrated wholes, with definable boundaries and relatively regular, macroscopic characteristics (such as nutrient cycling); the usefulness is scale-dependent, in that they tend to behave predictably across small bounded ranges, and their equilibrial character is different at different scales (O'Neill *et al* 1986: 44-54).

However the limitations include their unpredictable behaviour when open to perturbation, random connectivity and wide space-time scale ranges, their response being unstable due to positive feedbacks from low frequency oscillations in the system. Other problems include the

³ Non-Government Organisations, Community Based Organisations.

⁴ A very unequal partnership in fact, and not without severe misgivings from delegates from undemocratic countries like China and Nigeria, but a start.⁵

⁵ Cybernetics: The study of control and communication in systems, including information systems and feedback control systems (Lincoln, Boxshall & Clark 1982).

mechanistic mental models used in Engineering (if used for ecosystems). Traditionally, Engineering Theory tends to be additive and mono-scalar rather than wholistic, and to emphasise negative feedback in cybernetic systems. These ecologists by contrast, see biological system character not so much in balanced self-regulation terms as "a barrier-constrained runaway, positive feedback process". Their conclusion is that cybernetic modelling provides a partial picture of complex dynamic systems which is artificially restricted and varied with scale, so that Hierarchy Theory is thought to provide a better explanation of ordering principles for ecological complexity (Allen & Hoekstra 1992: 115-25).

The systems modelling used in management training and education (Harvard Business School), or by Meadows *et al* in their important 'Limits to Growth' work (same intellectual source), do not dwell on Catastrophe points, instability zones or 'Edge of Chaos' phenomena (Forrester 1971;1994;International Institute for Applied Systems Analysis 1992;Meadows *et al* 1992;O'Connor & McDermott 1997;Senge 1990).

With this in mind, the following sections deal first with the thermodynamic concepts which explain the presence of complexity, Systems/Complexity Theory. The following segment discusses Hierarchy Theory, which organises complexity into multiple scales through different types of organising principles. These sections seek to draw together the fundamental principles of this difficult area, in response to the continuing question "What is Nature like, that we may align with it?" Many linkages are indicated, with the Criteria of Observation under Unified Human Settlement Ecology (UHSE) in the penultimate segment.

7.2 ENERGY AND THERMODYNAMICS

7.2.1 INTRODUCTION

A significant and highly visible class of environmental approaches to sustainability involves the mapping through time, manipulation or redesign of systems that process energy and materials or resources (such as information). Einstein's famous equation $E=MC^2$, (remembering that the elements are fundamentally in dynamic relationship and the equation divested of its complex elements), lends a useful framework to a table indicating directions of concern to this segment (Table 22: CEES: $E=MC^2$).

Workers such as Lovins & Lovins, Boyden, Dovers, Peet and many others have promoted the concept of escalating consumption of extra-somatic⁶ or 'extra-mural' energy as paralleling and being the underlying problem in the looming biospheric crisis. A modified version of Boyden et al's diagram supports this argument graphically (**Figure 7: BICM: Human Energy Use: Global Totals**). Somatic energy is expressed as 1 HEE (Human Energy Equivalent), the energy needed to run an average adult human of moderate activity (Boyden 1990: 54). The secondary effect of molecular pollution including CO₂ emissions, is of most immediate concern rather than resource depletion.

This turns out to be a most accessible area for intervention in lifestyle change and implemented eco-design⁷. Energy efficiency was certainly the issue most adequately addressed by the Jerrabomberra Valley National Ideas Competition designers⁵ (Rounsefell 1994e: 37-8). **Link: Criterion Ecocycles.**

Ecological Economics seeks to locate human economic systems within the constraints of the biosphere (including but not limited to energy resources), rather than without. The use of energy flows as a unifying principle in environmentally-sensitive economic studies was promoted by Podolinsky, and Geddes (19C), Soddy (earlier 20C), Boulding (1940s) (1970s) and Georgescu-Roegen and Daly more recently (1980s to present) (Peet 1992: 85-6). Peet (chemical engineering), Buckley (Sociobiology), Boyden & Dovers (CRES, ANU, Human Ecology), McHarg (Planning), Odum (Ecology), Adams (Anthropology), Leopold (Environmental Philosophy and Ethics), Robert (organisational sustainability) and Tainter (Archaeology) enter the same field from other directions.⁸

More recently still, attention has turned to the dematerialisation of society, and materials flows have been found to be good surrogates for environmental impact and energy dissipation (Bouman, Heijings, van der Voet, van der Bergh & Huppes 2000: 195-216).

Many such applications are centrally informed by the Laws of Thermodynamics (for instance Adams 1988; Boyden 1979; Boyden 1990; Buckley 1977; Dovers 1990; Dovers 1994; Leopold 1995; McHarg 1992; Peet 1992; Robèrt 1996; Tainter 1988)⁹, especially the famous Second Law and

⁶ Energy requirements beyond that needed for running a human being.

⁷ Now the topic of leading edge conferences such as Canada's Innovative Housing series, resulted in major commitments to industry standards (for example Canada's R2000, also embraced by Japan in 1993), Australia's AMCORD Urban (Resource Document for Housing Development Industry) (Commonwealth of Australia 1995a). Now the sustainability strategy most familiar to the design professions, but still only timidly implemented (New Haven, Mawson Lakes, Halifax Projects).⁵ compared with Amory Lovin's demonstrated Rocky Mountain Institute work (see elsewhere).

⁸ This is by no means intended to provide an exhaustive survey of this literature, which is extensive.

⁹ Laws of thermodynamics (closed systems): **Zeroth Law** - If two bodies are each in thermal equilibrium with a third, they must also be in thermal equilibrium with each other (refers to closed systems and formalises other laws); **First Law** - Energy can neither be created nor destroyed, only converted from one form to another (total always constant); **Second** 192

its derivative concepts of entropy and negentropy, described below. The 'Second Law' has high, even mystical status with many EPPs, although one may speculate that real understanding is uncommon.

7.2.2 ENTROPY & NEGENTROPY

According to White, Mottershead & Harrison, Thermodynamics would be better labelled 'energy systems', or 'Energetics', as it has come to signify all energy forms, not just heat

(White, Mottershead & Harrison 1984: 10). The state and behaviour of systems depends on the nature of their boundaries. Three types are distinguished: isolated, open and closed. **Link: Criterion Ecocycles.** These are distinguished by different permeabilities of the boundary to matter and energy, as illustrated in **Figure 8: BICM: System Types.**

Isolated systems do not exist outside the laboratory. Closed systems are rare, but the Earth as a whole is often regarded as relatively closed (for instance The Natural Step Training Manual (Introductory Course: 6-7, 6-8 takes this assumption – open to energy but not to matter - as a given, in order to build a pedagogy on the Second Law).

But the important thing to understand about eco-social systems is that they are open to energy, materials and are specially sensitive to information. **Link: Chaos Theory.**

They counter entropy not only by being open to external energy sources (ultimately the sun – 'exergy'), using the chlorophyll of plants (micro and macro); they also trap and dissipate energy through their structure, release some in respiratory heat loss, exchange it amongst many co-evolved beings through food chains, building further, ever more complex structure, and in death and decomposition, release it again finally, as heat. The accompanying nutrients then become detritus cycle substrates. This energy process is known as 'negentropy', and the system as a 'dissipative system' (Begon et al 1990: 11, 682).

The maintenance of structural organisation in the face of through-puts of matter and energy is a critical characteristic of almost all environmental open systems (Begon et al 1990: 11).

This well-known process is summarised in **Table 23: BICM: Biogeochemical Services & Biodiversity**, which links the services provided to (and taken for granted by) living beings by these processes. The systemic aspects will be developed further below. **Links: CDS, SOS; Criterion Ecocycles.**

Law (entropy law) - All physical processes proceed in such a way that the availability of energy involved decreases (any transformation degrades energy, degradation to heat is irreversible, heat won't flow from cold to hot bodies, a quantity of energy has once-only availability) [*this is reversed for extremely high magnetic fields & temperatures, as on the sun*]; **Third Law** - The entropy of an ideal crystal at 0 degrees Kelvin is zero (unattainability of absolute zero, an absolute physical limit) (Peet 1992: 32, 33, 36, 44).

The processes central to these ecosystem services are illustrated in **Figure 9: BICM: Ecological System: Energy & Nutrient Flows**.

By the Second Law of Thermodynamics, entropy, a potency measure of heat energy, always maximises in closed systems, and refers to ordered systems, not organised ones (Adams 1988: 72-3). Baggott points out that the Second Law of Thermodynamics is about irreversible (unidirectional) changes [*one reason why time is not reversible*]. Entropy is about probability, a measure of transition from a less to a more probable state, while the "amazingly ordered structures [*which*] can be formed in systems far from equilibrium" involve transitions, according to Chaos principles, from the probable to the very improbable (in terms of ordered, spontaneous probability) (Baggott 1992: 174-5). In effect, energy in a closed system always eventually degenerates to the unavailable heat form, and disorder increases until thermodynamic equilibrium (system death) is reached. Ordered non-living structures in open systems behave as for closed systems (assuming the Earth to be effectively closed), in that they follow a principle of entropy maximisation and their behaviour is simply described mathematically.

Evolution appears to select for complexity, implying ever increasing energy dissipation (Adams 1988: 113-5, 178; Capra 1982: 331; Davies 1989: 120). The human ability to process extrasomatic energy (Boyden 1990) has proved devastatingly successful, and now threatens our biosphere through side effects.¹⁰ Increased complexity is very costly biologically, but gives great survival advantages. In this context, pollution represents degraded, wasted and technically unavailable energy (Peet 1992: 114-5).

The industrial revolution represented a phase change, the emergence to a new level of complexity which related directly to the human harnessing of hydrocarbon fuels to an array of new technological developments such as transport, agricultural and industrial machinery, and communications. Odum's **Table 24: BICM: Odum's Energy Analysis of Civilisation** demonstrates a society's dependence on having an energy surplus for ongoing growth, maintenance and flexible function: energy supply is a core constraint (Organising Principle). He likened this to an ecosystem's constraint by resource availability, arguing that under disintegration, energy is withdrawn from specialisation, into survival. Regeneration must then be initiated with generalised species (Odum 1970: 229-35). Tainter in 1988 (:118, 123) argued that industrial societies had reached a point of diminishing returns, and needed a new energy source

¹⁰ Population explosion (enhanced agricultural productivity but soil loss, salinity and nutrient depletion), pollution, climate change, resource depletion, habitat loss.

if they are not to follow the famous collapses of history (Hawken et al. 1999; Mollison 1988; Tainter 1988; Todd & Todd 1994).

7.2.3 ENERGY FORMS, PERTURBATIONS, DISSIPATION, AND TRIGGERING

To understand information in energy terms, it must be seen as an aspect of energy dynamics. It is a consequence of perturbations; that is, an environmental change stemming from work done by energy dissipation. Irrespective of what a perturbation may be like, if it has any impact at all it leaves information on some receiving form ... This is a somewhat different perspective from that taken in "information theory" ... While both energy and information are asserted to conform to the law of entropy ... The two are almost always handled as independent factors in modelling human social systems ... The thinking ... has evolved as two separate frameworks ... Information succeeds in stimulating, igniting, moving, and more generally triggering energetic activity because, and only because, it is also an energetic activity (Adams 1988: 79-80).

Adams¹¹ presents and analyses in detail an energy theory of integration, based on Prigogine's concept of an 'energy form' entity, which includes and thus integrates ordinary energy concepts, with energy as matter (for example fuels), and social energies with response-triggering potential, for instance behaviours, ideas and writings (Adams 1988).

Dissipation is the system of processes or "mechanisms by which energy forms and their components are selected, fragmented, discarded, and reconstructed into new forms and by which information is created both in human beings and in the environment." (Adams 1988: 64). That is, dissipation of energy accompanies change in energy forms, and other energy forms are affected by 'trigger-release' or 'trigger-flow' as dissipative events spread through the system (Fay 1995: 390). Adams refers to the humanities as 'free floating triggers', which have the ability to trigger human nervous systems, without the ability to determine the outcome of such impact, nor the ability to reproduce themselves (Adams 1988: 172-3). All human behaviour may by this thesis be analysed in energy terms in so far as it is viewed as participating in a complex dynamic system (CDS).

Buckley, an associate of the Synergetics movement, in proposing a Nonequilibrium Social Thermodynamics, does not cite energy as a unifying principle, but says:

Individuals are inherently energetic, motivationally active beings whose drives and actions are shaped and channelled or dissipated by ... sociocultural structures ... organized social life is essentially an inter-psychic information flow system which sustains or changes these structures. Since many scholars see a close relation between information, entropy, free and bound energy, and structure and order, it would appear that the ingredients are present for the development of a theoretical framework [*a social thermodynamics*] ... to understand better the dynamics of societies ... (Buckley 1977: 257).¹²

Perturbations may arise from without or within a system, and the system is normally able to trigger self-protective responses through homeostatic mechanisms. Such systems are never

¹¹ Basic training: Anthropology.

¹² Transactional Analysis was originally described in terms of the 'Cathexis' of energy through the Ego States. While this is no longer a key focal area, it did form the theoretical basis of the *Cathexis School* of TA, which has been very successful in Reparenting schizophrenics and other serious mental disorder clients.⁵

static, but exhibit a dynamic equilibrium. Instability is generated by the impact of perturbations, usually with dissipation increased in response, to control and dampen irregularities. Internal reordering may be forced by excessive fluctuation, with the system moving to a new state organised around quite different dynamics and triggers¹³. These types of dynamics were noticeable when the recent 'Pauline Hanson phenomenon' disturbed the complacently 'two-party' Australian political scene. Perturbations are seen from this framework as the principle mediators of self-organisation, the relativities between perturbation, energy and system connectedness being a direct and ongoing challenge to the bonding and order internal to the system. Adams proposes this as the locus of social evolutionary emergence in dissipative systems. The major categories of response of complex systems to perturbation will be returned to under CDS below.

Self-triggering is the essence of positive feedback, and is defined as "the class of processes whereby dissipation in one part of a system leads to releasing dissipation elsewhere in the system, either directly or through a chain, such that the form of the entire process is replicated" (Adams 1988: 67-8).¹⁴ From the continuum of possible relativities, Adams selects two idealised types for discussion: generalised (direct, dynamic) self-triggering and specialised (centralised) self-triggering.

The generalised form operates on itself with no central control mechanisms or memory, as with candle flames once lit, tornadoes, river silting and co-evolution¹⁵. Human-related systems often take the centralised form, which while not necessarily intentional, has a memory mechanism and often becomes regulatory in character like the operation of social structures, gangs, tribes, communities of interest and markets. Adams calls this a 'coordinate' system, wherein individual components (namely, people) behave relatively autonomously and the system is an emergent entity of different character. Coordinate systems in society form the substrate from which hierarchical structures emerge, particularly the specialised regulatory sector (Adams 1988: 69-72). Once in place this is a self-replicating entity, which in occupying its contextual niche, is relatively difficult to displace.

¹³ **Link: Chaos Theory: 'Attractors'.**

¹⁴ Adams cites and explains (in order to justify his own term) the terms of various authors who have proposed a similar concept: '*autocatalysis*' or '*cross catalysis*' (Prigogine), '*positive feedback*' (systems theorists), '*homeostasis*' (Cannon), '*Schismogenesis*' and '*circular chains of determination*' (Bateson), '*cybernetics*' (Weiner), '*feedforward*' (Rosen), '*mutual causality*' (Maruyama) and '*coevolution*' (Pianka)[Norgaard] (Adams 1988: 67-8).

¹⁵ I would not include co-evolution in this category as the genetic makeup of the participants contain genetic memory systems and each forms part of the other's environment, in a way acting as reciprocal memory for each other. Perhaps one could define the physico-chemical properties of the elements of non-living entities such as tornadoes as a type of memory at a different scale, in which case a generalised triggering system is really a non-organised, non-coordinated, deterministic chaotic arrangement, with no collective memory, and without the tendency to centralised coordination and complexification brought to a system by the participation of living beings.

Such emergence is often initially a response to common threat.¹⁶ An uneasy balance results between cooperative (internal) and often hostile (external) relations, as well as an internal sorting according to specialisation and differential abilities to control resources within the group, which becomes stratified into 'quasi-species'. Resources themselves have differential symbolic value. The regulatory sector is itself subject to self-organising forces and dual self-triggering (simultaneous attention to internal power/resource control and self-reproduction issues and to those of its specialist role), both of which require energy resources and memory functions. Generalised self-triggering processes will continue to produce other structures which may come to compete with or resist the regulatory sector (as have special interest groups and market structures such as multi-national corporations) (Adams 1988: 72).

Following Dawkins' 'survival machine' (the organism's role on behalf of the gene) and Boulding's 'spaceship Earth'¹⁷ (the planet's role on behalf of humanity), Adams coins the term 'survival vehicles' (SVs), which are exemplified by mechanical SVs (cars, houses), tools, social organisations, mental models, central nervous systems, families, political parties and communities of interest. Adams describes an emergent hierarchy of structures, self-organising at each level; a core, 'coaxal' structure¹⁸ common to all primates, supports a higher level emergent from culture. A range of secondary¹⁹ or auxiliary SVs complement but may come to compete with the regulatory sector (Adams 1988: 177-89).

Different strata will have different inter- and intra-holon²⁰ relations, for example the device of exchange is beneficial to small group members and is self-selecting, while being competitive externally. The marketplace represents a major self-selecting extension of the human social organism wherein a great deal of mutual triggering occurs. It depends on surplus and ever-increasing quantities and complexity of energy forms.

Adams suggests that the domestication first of plants and animals, (ultimately Agriculture), then the dominance of other people through social hierarchies, (domestication includes humans as implements), marked the transition from primitive primate dominance patterns to expanded social power and enhanced survival and social/cultural reproduction through a vast increase in energy potential and suppression of the human tendency to dominate each other directly. He

¹⁶ For example the takeover of income taxation powers by the Commonwealth of Australia during World War II has not been restored to the States.

¹⁷ This phrase is attributed by Sieden to R. Buckminster Fuller in 1951 (Sieden 1989: 127).

¹⁸ For humans, major macro-structures such as nation-states, sizeable contra-structures, business conglomerates.

¹⁹ Agencies, firms, police, political parties, secondary political vehicles, activist coalitions, clubs and so on.

²⁰ A holon is an embedded ecological unit containing a group of entities operating at similar frequency. In the above context perhaps 'socion' would be an appropriate term. **Link: Hierarchy Theory.**

sees societies as self-organising systems of self-organising sub-systems in a constant state of flux where some forms are preferentially selected for.

The AusIndustry business networking system, and science/technology parks²¹ are examples of deliberately seeding self-triggering SVs which by linking smaller businesses into larger, co-evolutionary structures, become able to (dissipate more energy through their collective structure and thus) participate in business at a larger scale (the ultimate aim being to improve Australia's balance of payments by triggering increased flows (exports of goods, services, money)). Regional scale business incubator arrangements are another example; school parents' committees another.

De-stabilisation by interference with a coordinate system's memory function (for example by downsizing, defunding and sacking middle management, outsourcing)²² is a commonly used strategy by which the regulatory and management sectors undertake 'creative destruction',²³ shift to new organising principles ('restructuring') and consolidate their position.

7.2.4 ENERGY AND SOCIAL SYSTEMS

While current energy audit is limited to physical energy flows, the field of Energy-Form Flow Analysis is undeveloped as a practical strategem and is not used routinely at present in industrial or domestic application. Odum has long since developed a system of energetics and energy network language, which he sees as a lingua franca for eco-socio-economic situations. His symbol conventions for analytic power diagrams include energy and matter. But he does not focus on the socio-cultural aspects except in verbal analysis of his power diagrams. He uses these to analyse a wide variety of energy systems: the standard ecological webs; food chains and compartments; the demonstration of functional parallels between human settlements of different degrees of sophistication; parallels between cities and ecosystems (coral reefs) and complex agricultural systems that incorporate human and ecological features (Odum 1970: 20-25, 37-42, 103-138). Odum advocates, without actually demonstrating how, the mapping of economic, social and political power flows (as separate entities) in the same way as for physical and chemical ones, using comparable units of kcal/m²/day (Odum 1970: 54).

Green, in an unpublished manuscript, has taken some of the ideas of Buckminster Fuller and devised a detailed globalised economic system based on equal, strictly limited annual

²¹ As taken over and developed in Adelaide by MFP Australia (Science Park Bedford Park, Technology Park Mawson Lakes).

²² For instance Australian Broadcasting Corporation 'under new management', 2000.

²³ See Holling's 'Infinity Loop' below.

distribution of a globally-calculated energy capital, with complete freedom but strict monitoring of how it is spent (Green 1998). After experience with large-scale planning in the service of survival and destruction in World War 2, Fuller²⁴ proposed a 'World Game',²⁵ an educational exploration into the harnessing of such energy and commitment of resources to supporting life and well-being. Other ideas have been, *inter alia*, a globalised energy network for universal benefit and to rationalise day-night differences in peak use,²⁶ and a World Resource Inventory, which Fuller started and thought could be computerised for global resource management (Sieden 1989: 377, 201).

While we are preoccupied with simple energy efficiency issues, and normally consider energy, materials and ideas as separate realms, integration of these, as demonstrated by Fuller and Adams, holds potential for the implementation of a cooperative society at global scale, with vast improvement in efficiency – should we be so persuaded.

In the meantime we have Lovins *et al* offering the first practical bridge attractive to business: a metaphor that calls the new sustainable system 'Natural Capitalism' (Hawken *et al* 1999). **Link:**
Criterion Feedbacks: The TNS 'Funnel'.

²⁴ 1895-1983, "... architect, inventor, cosmic chronicler, philosopher and poet" (Foreword, Norman Cousins in Sieden 1989: vii).

²⁵ One of the many experiences available at Rio de Janeiro at the Global Forum, 1992.⁵

²⁶ A mission promoted by Global Energy Network International (GENI).

7.3 COMPLEXITY & CHAOS

7.3.1 INTRODUCTION

The Changes is a book
From which one may not hold aloof.
Its Tao is forever changing -
Alteration, movement without rest,
Flowing through the six empty places,
Rising and sinking without fixed law,
Firm and yielding transform each other.
They cannot be confined within a rule,
It is only change that is at work here.

*I Ching*²⁷

'Complexity Theory' as used here refers loosely to the area of exploration, explanation and manipulation of complex dynamic or adaptive systems (CDS or CAS). It may include related and derivative concept areas like Mathematical Physics (Quantum Theory, Relativity Theory), CDS Mathematics, Chaos Theory, *Edge of Chaos* Theory (Deterministic Chaos), Fractal Theory, Catastrophe Theory, Evolution Theory, Self-Organisation Theory, Far-From-Equilibrium Thermodynamics, Set Theory (for example Fuzzy Logic, Q-analysis), the systems-based Psychologies (Transactional Analysis, Process Work), Hierarchy Theory, and Unified Ecology. As such it is difficult to approach this constellation of theories, since they all hang together, each is a potential lifetime's work in itself, and none has primacy. It is also difficult to achieve a balance between providing an adequate description of their main features and their linkages while at the same time avoiding both over-simplification and over-detailing. I have tried to achieve this by excluding their mathematical descriptions and proofs almost entirely, and by providing a working knowledge of their structures and meanings at least as they may apply to the broad reconceptualisation of human community and human settlements through an ecological paradigm.

This theory was already visible and quite clearly defined as 'systems thinking', when Capra published "*The Turning Point*" in 1982²⁸, although it differs in character from the Systems Theory of the 1960s, which mainly took a linear, equilibrium approach to complexity (based on a machine metaphor: 'input plus output with a process in between' as in a factory).

Table 25: CM: Characteristics of Systems Approach (after Capra) summarises the elements presented in Capra's chapter "*The Systems View of Life*" (Capra 1982). Capra's text notes the

²⁷ Quote from I Ching (Book of Changes) (quoted in Capra 1983: 123; and in Kaufman 1983: v; Wilhelm 1968: 297).

²⁸ This book, advised by Simonton (Wholistic Health), Groff (Psychiatry, Psychodynamics) Henderson (Economics) and Lock (traditional Asian Medicine), and intellectually indebted to Bateson, Bohm, Chew, Schumacher and others, alerted many social scientists to the emerging paradigm and the implications of releasing the old mechanistic metaphor for a new ecological one.

inter-related but differently mechanised phenomena occurring across many fields, the hierarchical quality of resilient complex systems, the Complementary nature of relationship and the emergent characteristic of integration (a different logical type emerging from a lower level Backcloth). **Figure 10: CM: Principles of Systems Thinking** comes from an Internet source, which set up a discussion on Systems Thinking. This emphasises the hyper-connectivity of complex systems.

On the whole, orthodox Architecture and Planning²⁹ appear not explicitly to have taken mastery of this type of thinking as a Pedagogy, but there is an emergent cross-disciplinary application field, for instance: University of Canberra³⁰ (Birkeland 1995;1998), academic Architecture (University of Melbourne) (Wright 1995), urban Economic Modelling (Batty 1991), Economic Geography (Krugman 1996), Ecological Economics modelling (Costanza et al/ 1993), Evolutionary Economics (Day & Chen 1993), Economics (Arrow 1988;Rosser 1991), and Environmental Management (Allen 1989;Slocombe 1993b).

Thus each of the headings in this and the following subsections has a literature which essentially links up all the others, so that the field may be thought of and is presented (for example) as 'non-equilibrium' or 'far from equilibrium' (Allen & Hoekstra 1992;Kay 1991;Wright 1995), 'evolutionary' (Adams 1988;Friedman & Rowlands 1977;Kauffman 1993), 'thermodynamic', 'emergent' (Alexander,Silverstein,Angel,Ishikawa & Abrams 1975;Blau 1987;Varela 1988;Yanitsky 1984), 'self-organising' (Grzybowski & Slocombe 1988;Haken 1983;Kauffman 1993;Krugman 1996;Prigogine & Stengers 1984), 'autopoietic' (Maturana & Varela 1988), 'negentropic' (McHarg 1992), 'dissipative' (Adams 1988;Allen 1989), 'sociobiophysical' (Grzybowski & Slocombe 1988;Slocombe 1993a;1993b), 'biophysical' (Boyden 1990;Peet 1992), 'chaotic' (Anderson 1988;Asmussen 1986;Gleick 1987), 'complex' (Casti 1994;Emery & Trist 1973;Haferkamp 1987;Rounsefell 1995a;Tainter 1988) and so on, depending on the author's primary focus.

It is argued here that the need for urban designers is not to learn the specifics of Chaos and Complexity, but, being aware of their ubiquitous and heretofore mysterious presence, to develop a 'Magnetism' Metaphor, and use it in approaching Backcloth design for individuals and

²⁹ Department of Architecture, University of Melbourne had postgraduate students including Wright who were taking a direct interest in complexity theory and evolutionary design in 1995. The Catalyst '95 Design and Environment Conference "Rethinking the Built Environment", University of Canberra, ACT, published 2/63 papers (Wright & Rounsefell) on this specific paradigm. The Catalyst '97 Conference Proceedings had one paper directly on Systems Theory (Kerans),and one whose case depended directly on it (Rounsefell, Traeger & Maitland), and contained a definition of ecological design or ecodesign as "an integrative, multi-lateral approach to problem solving which constitutes a dynamic synthesis of imagination and systems thinking" (Birkeland 1998;Kerans 1997;Rounsefell,Traeger & Maitland 1997). Many papers reported implementation, not how to do the thinking.

³⁰ Centre for Environmental Philosophy, Planning & Design, Faculty of Environmental Design, University of Canberra, ACT, Australia.

populations. **Links: BP 5.3 q-Analysis; Criterion: Indicators: Fuzzy Sustainability Space; Confluence: A New Type of Development.**

Urban Design practitioners often claim to deal with complexity by attempting to use its terminology, to avoid linear thinking, to observe and copy nature, to use 'systems thinking' or by seeking an 'organic' approach to design and development. Environmentalist and Sustainable Agriculture literatures are fond of pointing to the unsustainability of monocultures of all types. Complexity, emergence and systems thinking are referred to in both of these, along with academic, conference paper and intentional community writings (going back to the 1970s, and with a resurgence in the early 1990s), (for instance Allen 1982; Allen 1977; Allen & Hoekstra 1992; Brown 1997; Conroy & Litvinoff 1988; Dahinden 1972; Degenhardt 1979; Dobson 1991; Eklund, Sun & Thomas 1994; Emery & Trist 1973; Gaspar & Gould 1981; Henderson 1991; Kunstler 1993; Luhrmann 1993; Mollison & Slay 1991; Naess 1989; OECD & IEA c1993; Pearce 1993; Roddan 1994; Rounsefell 1995a; Seneca & Taussig 1979; Shiva 1991b; Spellerberg & Hards 1992; The Group of Green Economists 1992; Thompson 1991; Trainer 1991; Ward 1994; Young 1991).

However writing on the actual practical application of such principles has only started to emerge in recent years (rooted perhaps with McHarg in the 1960s), especially in Strategic Planning, Landscape Architecture, Ecological Geography, Landscape Ecology, Human Ecology, Environmental Engineering, Permaculture, EcoCity/Community Planning and Design, national Habitat II Agendas and special literature, and unimplemented concept plans such as those drawn to the Jerrabomberra Valley National Ideas Competition (for instance Allen 1989; Arthur 1990; Bailey 1996; Bissonette 1997; Chertow & Esty 1997; Costanza 1991; Ellen 1982; Engwicht 1992; Forman & Godron 1986; Foulsham & Rounsefell 1994; Gunderson, Holling & Light 1995; Haila & Levins 1992; McHarg 1992; Mollison 1988; Prugh *et al* 1995; Rolén 1996; Rounsefell 1995a; 1995b; Sainsbury 1994; Slaughter 1996; Spirn 1984; Synectics 1994; Van der Ryn & Cohen 1996; Walter *et al* 1992; Wright 1995).

Avant guard EcoCommunity Builders, who embrace complexity, often seek answers to complexity in simpler settings, not seeking mathematical understanding, but collecting patterns. They visit historic or primitive cultures to understand how a more sensitive partnership with Nature (and each other) may work in a modern context. This is particularly noticeable with the EcoCity movement, which went to an African village (Yoff, Senegal) for its 1996 EcoCity III Conference, and Curitiba, Brazil in May 2000 (Register & Peeks 1997). Other notable examples are Christopher Alexander and his 'Timeless Way Of Building' through 'A Pattern Language'

(Alexander 1979; Alexander *et al* 1977; Alexander *et al* 1975), and Permaculture, which originally drew on native knowledge and is now in some cases, bringing an expanded form of that knowledge back to LDC communities (Morrow 1993; 1997). The mechanistically-minded have tended to stay with their faith in Technology and trust their computers and cash registers to deal with complexity instead. Ironically³¹, the Free Market and the Internet, both postmodern, anthropogenic Self Organising Systems (SOSs), provide readily available lessons in complex system principles.

7.3.2 THE NATURE OF COMPLEXITY

Complexity is not necessarily related to the number of components in a system (although most natural systems have many components), but rather to the relationships between them (O'Neill *et al* 1986: 41),³² and 'complex' is not synonymous with 'complicated'.³³ Ecologists Allen and Starr believe that the nature of human perception is to organise observations into hierarchical patterns and that complexity implies hierarchy. They define a complex system as "... a system of behavioural interconnections wherein the higher levels constrain and control the lower levels to various degrees depending on the time constants of the behaviour" (Allen & Starr 1982: xiv).

Horgan, in implying complexity to be a "sham" questions the ability of researchers to create a unified theory of complexity since there is no agreed definition. But he supports his position by listing not competing definitions as claimed, but a series of well-known complex system attributes: entropy, capacity to Surprise, fractal fuzziness, systemic order rather than randomness, hierarchical diversity, grammatical universality, thermodynamic depth (dissipative structure), high computational solution time, high computer memory requirement and informatic mutuality (between system parts). He refers derisively to Lloyd's list of "31 definitions" including the last five above (Horgan 1995: 77).

Krugman offers three definitions of complexity: systems with complicated feedback; the Science of 'emergence' (after Anderson³⁴: higher scale properties which emerge from collections of lower entities, which are in no sense extrapolations of lower level characteristics); and self-organizing systems (Krugman 1996: 2-3).

³¹ The Collins Dictionary of Economics contains reference to neither systems nor complexity (Pass, Lowes & Davies 1993).

³² In genetics, a complex character is a phenotypic character transmitted to offspring as a constellation of more than one gene, while the noun 'complex' is used in taxonomy when separation of individual taxal units is uncertain, thus 'species complex' (Lincoln *et al* 1982: 54). In Astrophysics and Quantum Mechanics, a complex space is a specific concept with the characteristic of even (real) dimensionality (Penrose 1996b: 110).

³³ Complex: "Made up of various interconnected parts" (Collins English Dictionary, Australian Edition): most dictionaries emphasise the interconnectedness implied, and have 'complicated' as a secondary (quaternary) meaning. The former is implied in this dissertation if not otherwise stated.

³⁴ Nobel laureate physicist, 'father of the field'.

Explanations of complexity described in the literature are listed in **Figure 11: CM: What is it? Explanations of Complexity**. These descriptions and definitions start to flesh out a concept of the structures and relationships which will be described below. A composite, working definition of such a system, some elements of which are explained below, might be:

A complex dynamic system is a Catastrophe-prone, multi-parameter (medium number) system open to flows of matter, energy and information, that responds to information more sensitively than to energy, in non-linear ways, operates far from thermodynamic equilibrium, is self-organising by mutual triggering with its environment, has a frequency constrained hierarchical, fractal structure with decentralised controls through which it captures and dissipates energy, and is poised in dynamic equilibrium at the *Edge of Chaos* (Deterministic Chaos).

While the theoretical roots of dynamics go back to the 17th. Century, modern Dynamic Mathematics was initiated by Poincaré in 1882 and achieved mainstream recognition in 1950 (Abraham & Shaw 1992: 192). Abraham (:87) acclaims Chladni's discovery of the limit cycle through musical experiments as "an abstract analog of the discovery of the wheel". Attention to the chaotic, unstable dynamics underlying most natural phenomena, with extreme sensitivity to initial conditions, was first drawn by James Clerk Maxwell in the context of free will.³⁵ Even the design of formulae in the study of chaotic systems constitutes an initial condition, with the result that the outcome of processes rather than the description per se becomes the area of focus, and the significance of pattern recognition is suddenly manifest (Barrow 1991: 123-4).

CAS Theory concerns the special kind of ordering of non-linear and self-organising systems with many variables or dimensions which may be multiple or fractional (fractal). CAS mathematics is an approach to scientific description of these systems. This theory applies to many non-living natural systems such as galaxies, the weather, dripping taps and turbulence in water, being in fact the rule in Nature rather than the exception (Barrow 1991: 125; Casti 1993), and also to living systems or their derivatives, such as animal populations, predator-prey relationships (Abraham & Shaw 1992: 82-5; Allen & Hoekstra 1992:214-229; Schaffer 1985: 85), plant and human communities and eco-systems (Allen & Starr 1982; O'Neill *et al* 1986), nervous systems and neural networks (Coveney & Highfield 1995: 136-148; Whyte, LL 1968) and Economics (Anderson, Arrow & Pines 1988; Krugman 1996; Ormerod 1994; Rosser 1991).

The notion of simple laws representing complex phenomena is a driving force behind CDS research, reaching its zenith under mathematical physicists, whose search for a Theory of Everything (TOE) relates to Organising Principles. The most fundamental Attractor states are thought to be Entropy, the Irreversibility of Time and thence the fundamental forces and fields.

³⁵ Second half of 19th Century, Cambridge.

The Pauli Principle³⁶ expresses the most fundamental Repellor state (Barrow 1991: 136-61). [Link:](#)

Table 20: Puzzle of Fundamentals.

The following sections overview a basic version of this Theory.

7.3.3 COMPLEX ADAPTIVE SYSTEMS AND CHAOS THEORY³⁷

... the connectionist ideas show how the capacity for learning and evolution can emerge even if the nodes, the individual agents, are brainless and dead. More generally, by putting the power in the connections and not the nodes, it points the way toward a very precise theory of what Langton and the artificial lifers mean when they say that the essence of life is in the organization and not the molecules. And it likewise points the way toward a deeper understanding of how life and mind could have gotten started in a universe that began with neither (Waldrop 1992: 292).

7.3.3.1 MEDIUM NUMBER SYSTEMS

TFH Allen *et al*, describe three general types of mathematical system that may be discerned:

small, medium and large number. These, each with its optimal mathematical tools, are summarised in **Table 26: BICM: Mathematical Approaches to Different Number Systems.**

Medium number systems represent the special mathematical territory occupied by complex far from equilibrium systems, for which CDS and Set Theories, and Hierarchy Theory/Unified Ecology, are high resolution and high generality models respectively (after Costanza *et al* 1993). This area has properties that are related to fractal power laws, creativity, universal computation and the types of chaotic instability that are closely related to evolution and life itself. [Link: Hierarchy Theory.](#)

7.3.3.2 WOLFRAM'S BEHAVIOURAL CLASSES

While modelling complex self-organising systems, computer-emulating living systems and the origins of life in one-dimensional cellular automata, Wolfram distinguished four types of system behaviour: Classes I, II and III, or fixed point, periodic and chaotic behaviours respectively. These represent well-known Static and Dynamic Mathematiques³⁸, with a Class IV being proposed to account for a form intermediate to II and III. This latter is known as 'Deterministic' Chaos, to which writers refer in alluding to the 'structure of chaos' or '*Edge of Chaos*' (Lewin 1993: 48-9; Waldrop 1992: 86).

Table 27: CM: Wolfram's Behavioural Classes summarises these relationships. It demonstrates the importance of the observer's definition of system boundaries, which then determine the type of Mathematique used, and thus the outcome of investigation. If we persist in defining n-dimensional systems as if they were 4-, 3- or even 2-dimensional at our own scale,

³⁶ No two entities can simultaneously occupy the same spatial position.

³⁷ Also called Complex Dynamic Systems (CAS/CDS).

then we can expect to be surprised, often unpleasantly. **Links: Hypercyclic Systems Theory: Bifurcation, Catastrophe & Surprise, Self-Organising Systems, Synergetics; Figures 12-18 following.**

7.3.3.3 OTHER CLASSIFICATION SYSTEMS

Chadwick³⁹, who saw a systems description as a "relation between an input to a process and its output", (including extension to integrate outputs of possible subsystems arranged hierarchically), explained how Mesarovic's Set Theory could be used to formally define a general system (Chadwick 1971: 38). This was a definition typical of the Mechanistic Metaphor then extant, having an 'end-of-pipe' approach to systems. Some raw materials enter the machine and something different comes out. **Links Figure 49: Extended Metabolism Model, Take-Make-Waste Society.**

However system characteristics change substantially with complexity, and a number of attempts have been made to organise this information. Chadwick mentions Beer's simple 'everyday' matrix (**Table 28: BICM: Beer's 'Everyday' Classification System**), and Boulding's original 8-level hierarchical framework for systems descriptions: **Table 29: BICM: Boulding's Typology of System Complexity Frameworks (1956).**

Beer's classification reflects the Prigoginian chance : necessity interface, but seeks to separate and simplify them.⁴⁰ Boulding's classification is interesting in its switching from an apparently scientific attempt to describe the change in system character with increasing complexity, (similar to Wolfram's), to a reversion to terms reminiscent of the platonic Great Chain of Being.

The Mathematics of Complexity Theory (CDS Maths) allows geometric modelling of 'phase portraits' of dynamic systems in time series, and qualitative (pattern) prediction (Abraham & Shaw 1992). **Figure 12: CM: Becoming Chaotic** shows the evolution of uncertainty through experimentally forcing a system with additional dimensions. The set of all possible states of the system is referred to as 'State Space'. 'Hyperspace' refers to State Spaces of four dimensions and above, and presents representational difficulties in our four-dimensional world, which we normally depict on 2-dimensional surfaces. Trajectories on 'manifolds'⁴¹ - curved and folded surfaces - illustrate the paths through time, of objects in multidimensional fields *[lowest four*

³⁸ A point considered through time becomes a line.

³⁹ In an early attempt to bring Systems Theory to Planning.

⁴⁰ Most computer owners will be aware that although expected to work deterministically, computers are regularly subject to complex probabilistic behaviour (that is they crash in an unpredictable manner, the more so if using many software programmes at once). It is good practice to turn a computer off or reboot it regularly to extinguish developing error paths which may result in chaotically predictable Catastrophe (crash or lockup).

portraits in (f)]. These models are used in Subatomic Physics as well as at Classical scales (Barrow 1991: 190-93).

Table 30: CM: Aspects of Chaos reviews different field entities, their dimensionality and behaviour, and gives examples from a human settlement context.

7.3.3.4 THE EDGE OF CHAOS

Chaos is a subset of Complexity (Lewin 1993: 12, 48). It does not mean 'random'. Of the two types of Chaos, 'Deterministic Chaos' in a complex system, although unpredictable, has definite and intricate internal structure (Wolfram Class IV). 'Stochastic Chaos' does mean a random collection of variables without structure (Class III). CAS studies demonstrate that systems often hover in Deterministic Chaos at the border between predictable structure and complete randomness, and may oscillate between them (Gleick 1987: 69-80).⁴¹ **Link: Synergetics (phase change)**. The term '*Edge of Chaos*' originated at the Santa Fe Institute (USA). Workers there (especially Langton, Packard & Wolfram⁴²) refer to this realm as exhibiting 'universal computation', where information input has more effect than energy input (Lewin 1993: 49-51).

Crutchfield and Young (of DNA fame) demonstrated a phase transition from finite to infinite memory with maximisation of statistical complexity in this zone (Coveney & Highfield 1995: 275). It is the linkage point with Systems Theory, Hierarchy Theory and Complexity Theory (O'Connor & McDermott 1997: 26-58). It is the medium number mathematical realm where life and creative evolution, system self-organisation ('self-organising criticality') and complex computation tend to be selected for (Coveney & Highfield 1995: 275-6). The deterministically chaotic system has a natural drive towards creativity and complexity. This is the action zone of Prigogine's 'Order Out of Chaos' or 'order through fluctuations'. Here, irreversible thermodynamic change moves from an undetermined microscopic state of all potential possibilities, towards and finally emerging as an Attractor state. We see it macroscopically, and explain it in terms of maximum probability (Prigogine & Stengers 1984: 124). It is also Robert May's Zone of Periodic Bifurcation (Gleick 1987: 74-8), and Thom's 'Pockets of Compromise' of Catastrophe Theory (Rosser 1991; Thom 1977b; Wilson 1981).⁴³

⁴¹ Prof. Paul Davies 29/9/95 on "*The 7.30 Report*" Channel 2: sees the world as a manifesting a fascinating interface between order and randomness, chance and necessity. Uncertainty is exciting. While the exquisite sensitivity of chaotic systems to local and initial conditions makes them specifically unpredictable, the theory does at least explain what has passed.

⁴² Institute for Advanced Study, Princeton.

⁴³ **Link: Hypercyclic Systems: Bifurcation, Catastrophe & Surprise.**

In the natural world, bursts of creativity occur, followed by many extinctions as the results are tested for viability against the existing environment (as in the famous Cambrian explosion and Permian extinctions (Lewin 1993: 64-7), boom-bust housing and business cycles. international financial markets and technological revolutions. Even in computer models, self-replication occurs spontaneously, but some aspects of the validity of claims from computer models are under question (Coveney & Highfield 1995: 272-8;Horgan 1995).⁴⁵

Any such system is 'exquisitely sensitive to initial conditions', meaning that even though the equations for describing the system may be known, unless the exact starting conditions are known, which they usually are not, prediction is not reliable, as very small differences in information input can have very different outcomes due to the augmentation of minute differences through positive feedback (the so called 'butterfly effect'⁴⁶ and periodic doubling'). Chaos is predictably unpredictable (Davies 1989: 52). But the general pattern is statistically predictable⁴⁷ and a deterministically chaotic system is bounded through the operation of its Attractors, Repellers, saddles and separatrices, stable and unstable areas and Catastrophe points. That is, a vectorfield or landscape of these entities can be described, the elements of which have overlapping fields of influence (Allen & Hoekstra 1992: 292), so that an outcome emerges from the complex interactions that take place at different rates ('interference field').

Figure 13: BICM: Vector Fields illustrates the representation of a system trajectory emerging from ('flowing in') a vectorfield, as used in research. Vectors are drawn tangential to their curved surface origins. **Link: Catastrophe Theory.**

7.3.3.5 ATTRACTORS & REPELLORS

Mathematical (for example Poincaré transformation) procedures on some time series (data measured repeatedly over a period of time) to convert it into two dimensions for easier viewing, reveal patterns called 'strange Attractors' ('chaotic' or 'fractal Attractors', 'deterministic noise', 'low-dimensional chaos') (General Symposium on Biology as the Basis for Design 1988: 213-4;Gleick 1987: 142, 196;Ruelle 1988). The mathematical behavioural classes mentioned above (fixed point, *[line]*, oscillatory or periodic *[limit cycle]* and chaotic *[strange]*) exhibit similarly-

⁴⁵ A territorial battle appears to be in progress between such UK workers as Coveney and Highfield, who have the famous Belgian Prigogine's support, and members of the Santa Fe Institute, USA. It is difficult for the outsider at this point to evaluate such arguments, as this requires a high level of specialised mathematical training. Coveney (aligning with Crutchfield, Young and Mitchell), questions such concepts as universal computation in cellular automata (CAs), but acknowledges that Deterministic Chaos does have definite and "exquisitely organised" structure and concedes that "some CAs *[Complex Adaptive Systems]* are in principle capable of universal computation (but never proven) (Coveney & Highfield 1995: 271-8).

⁴⁶ Not to be confused with the 'Butterfly Catastrophe'.

⁴⁷ Since the pattern never exactly repeats itself, it can be known exactly what will not be repeated, even though an exact outcome can not be predicted.

named Attractors and Repellors (Abraham & Shaw 1992: 58-353) are illustrated in **Figure 14: CM: Field Entities**. These can be single or multiple, and have the property of pulling systems into never-quite-repeating patterns ('complicated aperiodic behaviour' after Ruelle), to which they revert after disturbance, or incorporate perturbations to produce new patterns. It has been found that all chaotic Attractors have a fractal microstructure (Abraham & Shaw 1992: 317-22). It has been suggested that chaotic or strange Attractors should be referred to as 'fractal' Attractors, since 'chaos' does not distinguish between Stochastic and Deterministic Chaos, and creates confusion (Varela 1988: 213-4). Strangely, no universally accepted definition of a strange Attractor exists (Arrowsmith 1991: 69).

Thus for any complex system a State Space can be imagined, wherein large numbers of hierarchically constrained variables interface (constrained by environmental forces - frequency, physical, spatial, informational or socio-cultural/legal, and optimal ranges of expression for each). They are attracted towards or repelled from certain ranges of expression by system Attractors and Repellors (Organising Principles), are vulnerable to instability, Bifurcation or Surprise in some combinations, and their outcome can be seen as an emergent reality with the interference field qualities of a holograph (Tornqvist 1981: 119).

7.3.3.6 EXAMPLES

Examples of chaotic Attractors are found in studies of measles epidemics and lynx population fluctuations (Schaffer 1985). Fuzzy Cognitive Maps and 'Attractor neural networks' exhibit Attractor patterns (Coveney & Highfield 1995: 138-9; Taber 1991). Well-known urban phenomena such as housing and economic cycles, retailers competing for consumers and transport operators vying for customers, behave in ways which yield to the type of analysis presented for predator-prey population relationships, which have limit cycles with periodic Attractors (Allen & Hoekstra 1992:216-7; Wilson 1981: 46-8). **Figure 15: CM: Attractor Basin in Ecology** illustrates the value of this model in explaining the consequences of ecological imbalance between host and parasite (or predator and prey, or seller and buyer).

Schaffer's studies on measles found periodicity at one scale but Deterministic Chaos with a strange Attractor operating at another. The situation may become chaotic and unpredictable if multiple variables are considered, yet the simple regularity of an emergent limit cycle is deceptive, as it only constitutes the emergent truth at a scale, not its scale micro-structure nor its context.

7.3.3.7 COMPLEXITY AND ECONOMICS

Ormerod demonstrates the inadequacy of a classical simple economic time series approach to an issue like unemployment, which is based on a linear, mechanistic world view, a mistaken belief in a necessary underlying connection between unemployment and economic growth, (which he demonstrates to be false), and a striving for a mythical single point of equilibrium. **Figure 16: BICM: Analysis of Nonlinearity** explains some approaches used by Ormerod for nonlinear analysis (Ormerod 1994;1998).

By displaying the same information as connected scatter plots over the period from 1960-1993, Ormerod compares the different responses of a number of countries to the shocks incurred by the oil crises of 1973-4 and 1980 (**Figure 17: BICM: Limit Cycles in Economic Systems**).

These chart Attractor cycles of different strengths and magnitudes which reflect the impacts of this serious economic system change. In most of these countries, the pattern was for the shock to shift the whole system to a new Attractor, usually at a higher level of unemployment. These responses could be explained through a knowledge of the particular local conditions of the countries concerned.

In the Swedish case, a low (approximately 2%) unemployment rate remained under the influence of an extremely strong Attractor, withstanding both oil shocks, but collapsed into an exponential rise in unemployment which corresponded to the financial liberalisation of the Swedish economic system in the early 1990s. A new Attractor has so far failed to emerge, and the system remains unstable and unpredictable. The problem with the linear thinking of Neoclassical Economics, according to Ormerod, is that a great deal of energy is invested in trying to minimise the magnitude of the cyclic extremes, when the real problem is that the system has settled around an Attractor at an undesirable level (Ormerod 1994: 138-61).⁴⁸

Policy levers ('carrots' and 'sticks') which influence economic and other behaviours without direct coercion, are in fact powerful social Attractors and Repellers because of the significance of money as a surrogate for survival and social status. Money is the core Attractor for a Financial Capitalist system. This is a potential design application, and provides a somewhat different interpretation of a well-established and effective practice.^{49,50} An understanding of Attractor

⁴⁸ Grandiose recent announcements by politicians and economists claiming to have eliminated economic cycles remain curious to this author's ears.

⁴⁹ Application of this principle must be at the scale of the driving system. Thus national governments pretend they are in charge of their economies, but the controls have moved up-scale with economic globalisation, so will need international collaboration to effect significant change to local impacts from that scale. For a unified national approach to conservation issues, it does not make sense for the only institution with the ability to overview the country as a whole to hand that function over to the parts (the States) as different (usually less idealistic, economically driven) responses are likely when the periphery is at the same time starved of funding. A conserver society would reduce the scale of its definition of health and success, so that without removing trade altogether, it would define its success by its ability not to import or export carrying capacity (also see Jacobs 1984).

Theory is crucial to the embrace of CDS Theory as an approach to urban and social systems, as assumption of periodicity, stability or linearity where chaotic conditions actually constrain the system will ultimately create misconception, and usually confound predictions and forward estimates. The well-criticised tendency of Classical Economics to exclude or marginalise 'externalities' is a case in point. In any case, EPPs believe the system needs to shift onto an Attractor centred on Biocentric and social Values: not a direction likely to emerge from million- and billionaires at the 'top end of town'.

7.3.3.8 OBSERVER EFFECTS

As system definition has strongly subjective aspects, and equilibrium in a complex system is relative and may vary with scale, chaos may be a low-predictability phenomenon visible only at high resolution (Costanza *et al* 1993: 550). Figure 19: Bifurcation below illustrates this point: what you see depends on your viewing position along the system path. This indicates that a particular system may have an optimal scale for investigation for our convenience, but the connectivity and complexity can not be discounted, or we have just returned to Reductionism.

Link: Hierarchy Theory.

When environmentalists and EPPs speak of human society's being 'embedded in Nature', or hierarchy theorists speak of 'nested' systems or wholistic perspectives, they ultimately refer to this extremely complex but largely invisible tangle of field entities: the difference between the parts and the whole. If nothing else, and no matter how ignorant we are of the specifics, this knowledge warns us to be extremely cautious and selective in our use of Reductionism.

Thus if there are only two entities of interest, one may define their interaction system very simply, with a high degree of predictability, but for this combination and context only. This is particularly so and particularly reliable with non-living entities, solid at human spacetime scales. However in reality, systems with living components, such as organisms or ecosystems, do not have conveniently small numbers of relevant variables when considered as a whole (organism-in-environment), even if their parts are accessible to more limited description or their functions can be subsumed under key variables: non-optimal conditions for component variables do 'rigidify' and entrain the system (the 'weakest link' phenomenon). **Links: Synergetics; Figure 15:**

Attractor Basin in Ecology. The notion of simple laws behind complex phenomena is well-

⁵⁰ Fuzzy Cognitive Mapping (FCM) indicates however that policy intervention may have counter-intuitive outcomes, especially when important variables and other scales in a complex system have been discounted - a fact no doubt familiar to policy professionals.

known as a CT characteristic, culminating in the ideal of a Theory Of Everything (TOE) (see Barrow 1991).

7.3.3.9 STRUGGLING WITH DIMENSIONALITY

Sometimes in an ecosystem, with some variables more important than others, as with predator-prey relationships (Abraham & Shaw 1992: 92; Schaffer 1985: 85), or some aspects of economic or housing cycles (Krugman 1996: 68), one may model the system with low-variable complex mathematics⁵⁰, but high dimension systems are far less well mapped. Catastrophe Theory maps surfaces of up to about 6 variables (2 State, 4-∞ Control). **Links: Subatomic Scale: Quantum Theory; Catastrophe Theory; Self-Organising Systems: Kauffman.** Quantum Theory, covers 3n dimensions, n representing degrees of freedom per particle (context-dependent) – commonly 6, but potentially infinite⁵¹. QT describes the rules for manifestation in the Classical world, where matter becomes Explicate, and intuitive dimensions are three (four). Above this, most humans become disorientated, and rely on pattern recognition to comprehend Complexity.

7.3.3.10 DESIGN APPLICATIONS

Attractors may operate not singly but in constellations (for instance in the same community there may be several economic subsystems operating simultaneously. Some Attractors and Repellers are latent. The difficulty here is that only those extant are detectable directly, with those lying in potential spaces of the complex dynamic field are difficult or impossible to predict. One may guess what lies latent through studying history, understanding basic needs and drives of biota (humans included) or understanding Attractors. An historical approach would need to see past systems in terms of the Constraints and Attractors operating at those times.⁵² Design work in such a field requires an appreciation for pattern, for positive and negative feedbacks, and an ability to link these to weave a Supportive Backcloth that will attract and hold the emergent entities required to be present. This is probably the best we can do as designers at this stage on knowledge, but it is not an impotent position.

Alexander's work on patterns in human building and settlement layout actually represents a system for weaving for human communities, a nurturing and strongly attractive Backcloth from multiple, interconnected patterns, which supports personal, family, communal or institutional

⁵⁰ Such as Lotka-Volterra equations used to represent predator-prey relations.

⁵¹ Hilbert spaces are infinite-dimensional versions of Euclidean Space (Classical geometries), invented in the early 20th Century to underpin the Quantum revolution (Bohr, Heisenberg, Dirac) (Barrow 1991: 191).

⁵² See Hierarchy Theory.

wellbeing, depending on the scales addressed (Alexander 1979; Alexander *et al* 1977; Alexander *et al* 1975). **Links: Tables 84, 85; Plate 17.**

A similar principle underlies the work of Bill Mollison, who 'invented' Permaculture with David Holmgren and others in the mid 1970s. In this case, the patterns and plant associations appreciated and implemented by indigenous societies over the long term, have been observed and emulated, along with a careful observation of patterns in Nature. An integrated, ethical approach, first to human community in Sustainable Agriculture, and more recently, to Urban Design and lifestyle, including urban food production and forestry, seeks to build a supportive backcloth for the evolution of what he calls 'guilds'⁵⁴ of plants and animals (including humans) working in harmony. Mollison takes this knowledge and blends it with other strategies of importance to biospheric long term wellbeing (such as energy, materials, water management, social cohesion), taking into account the time and motion aspects of daily life in the placement of design elements. Over all, one could interpret his strategies as attempting to build an Attractor Landscape, to attract and support humans and local ecosystems into long-term sustainable and productive patterns, allowing for future evolution, and repelling unwanted entities, such as weeds (Mollison 1988; Mollison & Slay 1991).

This Attractor Landscape concept has also emerged in the study of ecosystems (described below), and it has been shown that the outmoded static equilibrium concept (which inexplicably persists in statements about 'climax vegetation', even in Permaculture)⁵⁵, should be replaced by a concept of 'optimal operating points', a dynamic equilibrium which shifts to optimise survival, according to the field of parameters presented to the system. The quality of Attractor Landscapes varies considerably. While a system (such as an urban habitat) may exhibit residual function, it clings improbably to a grossly impoverished version of its potentiality. Without due human consciousness and specific nurture (such as artificial provision of ecological services like nutrients, water, protection from predators, assistance with pollination, provision of appropriate biotic companions), a weak Backcloth may give way to dysfunctional forces (species death, weed invasion, collapse of food production). Wild Nature is repelled by the urban system to a catastrophic degree.

⁵⁴ The ecological term 'guild' refers to functional redundancy, where one niche may have a number of species which may perform a particular function. If one species disappears, varies seasonally or somehow becomes unable to perform its usual function, other species in the guild may take over. Mollison's concept of a guild is a collaborative group or team of entities which by their complementary functions provide ecological loop closure. Mars defines guild as "harmonious assemblies of several species around a central element (either a plant or animal)": [*a natural version of Industrial Ecology*] (Abraham & Shaw 1992; Mars 1996).

⁵⁵ (Mason 1998: 55). I would speculate that Mollison introduced Permaculture at a time when the climax vegetation concept was in active use, and has been repeated as dogma ever since.

In 'people situations', the Systems Theory used in the Organisational Development literature, while not taking account of Catastrophe Theory, still has relevance in terms of the systems thinking and personal mastery necessary for the application of complexity principles in everyday life. In particular, the concepts of balancing and reinforcing (negative and positive) feedbacks, and an appreciation of the difference between short-term and delayed feedback processes (single and double loop learning above), are effectively used to gain leverage in approaching organisational problems (Senge 1990: 84-102).

7.3.3.11 PATH DEPENDENCE

The OECD was concerned with 'path dependence' in urban systems (Neilson 1993; OECD 1990)⁵⁶ in its wish to shift cities to more sustainable practices. Sunk capital and existing dominance structures are powerful social Attractors. The 'Barriers to Urban Ecology' (above) emerge as the Repellor side of this vectorfield. High-dimensional webs of connectivity are driven by short-term financial incentives for a few, and financial or physical survival, ignorance, fear, pleasure, comfort (and lack of motivating discomfort) or greed in the many.

During my work with JVNIC I constructed a table that explored what policies would have to change at three scales (national, regional, local) in order to reverse car dependency. The table extended over four pages, and clearly demonstrated the 'Synergic Satisfier' (Attractor) nature of car use. **Links: Criteria: Organism, Population: Needs-based Planning, Max Neef: Satisfier Theory.**

Complexity Theory seems to imply that we need revolutionary change to a new Attractor set in order to achieve sustainability as defined by EPPs and other Biocentrics. Evolution by adding eco-social constraints to Capitalism, changing it completely (to 'Natural Capitalism' as proposed by Lovins *et al* of the Rocky Mountain Institute), may give us time to reconsider. 'Hydrogen Economy', or 'Energy Capitalism' (as proposed by Green above), will take longer (Hawken *et al* 1999).

⁵⁶ Restricted documents.

7.3.4 FRACTALS

Properties such as recursiveness (self-reference, fractals - self-similarity across scales), self-organisation and emergence, are seen at the *Edge of Chaos*. Chaotic Attractors have phase plots ($x[t] * x[t-dt]$) which are fractals (Costanza *et al* 1993: 549).

Fractals are system attributes which have partial dimensionality (for example a dimension of $n=1.x, nx/y \dots$ or nn - often a power law - rather than $n = 1, n = 2, n = 3 \dots n = x$, where n represents dimensionality and expressions usually appear in differential algebraic equations). These repeat their patterns deeper and deeper into their detail (self-similarity), across a range of frequencies⁵⁷. Fractals and their expression as patterns are now familiar in the public realm, mainly manifesting as gift wrapping and computer art, and exceedingly common in Nature. We recognise these patterns in Nature as structures, in snowflakes, corals, trees, leaf forms, rivers, arteries and lungs (Schroeder 1991: 103-109). The observation of such symmetries has led to such statements as 'God is a mathematician'. Their recursive character is best demonstrated by measurement in a unitless dimension (Costanza *et al* 1993: 550). Proportionality is maintained across many scales, as also with power laws themselves.

Self-similarity may be discrete (for example organ pipes, Russian dolls, Chinese boxes, some commercial labels⁵⁸, log-periodic antennae and the basilar membrane of the human ear); continuous (mollusc shells, scale-free applications such as stretch stockings, log-spiral superconducting antennae); strict (deterministic: many mathematical and musical applications, Cantor Sets⁵⁹), asymptotic, (often only approximately so: for example damping in stringed instruments, oscillatory or limit cycle phenomena, Deterministic Chaos), and probabilistic (diffusion-limited aggregation in multifractals as in crystal growth; multifractals on fractals used in analysis of information loss over time in entropic chaotic systems)(Schroeder, 1991: 200-205).

Figure 18: CM: Fractals illustrates some of these linkages with the Mathematics of Nature.

Power laws may be invoked as "endless sources of self-similarity", for example the theory has been found to hold in explaining city structure, the size and probability of meteorite collisions with earth, terrestrial animal length relative to number of species present, energy dissipation/weight of warm blooded animals, Psychophysics and Psychoacoustics (ratio scales for

⁵⁷ In fact dimensionless self-similarity (even Newton's Universal Law of Gravitation) is now known to be bounded over finite domains, a relationship which is related to distance. To explain this, some 'imaginative' workers have proposed a 'fifth force' in addition to gravity, electromagnetism and weak and strong nuclear interactions (Schroeder 1991: 105-107).

⁵⁸ For example the once-familiar John Bull rolled oats package which pictured John Bull holding a JB rolled oats package with a picture of John Bull holding a JB rolled oats package ...

research into perception of loudness, brightness), explanation of gamblers' (mis)fortune and stock market variability, ubiquitous Catalan numbers underlying counter-intuitive results in apparently random series,⁵⁹ aesthetic value in art or music,⁶⁰ scale modelling in Acoustics (major advances in concert hall acoustic design with applications to noise abatement), and decay functions in different types of noise, which has applications across many disciplines (for example sound walls on highways) (Schroeder 1991: 63-79, 101-119, 121-133, 146-7).

As mentioned, reduction in fractal dimension of landscape patterns is an indicator of low dimensional human activity processes, simplifying landscape features through uniformly scaled land closure and transport system design (Allen & Hoekstra 1992: 56-66).

Table 31: BICM: Applications of Fractal Theory gives examples of fractal applications in physical, physiological, ecological, urban, economic and other systems. Fractals may be dimensionless (Cantor), fat (nonzero dimensions), multiple (from small numbers to a full spectrum of exponents), or intimately intertwined (Schroeder, 1991 :178. 183, 189, 194-210). Fractal dimensionality ratios may be useful as human impact indicators (see Figure 18(a) and Criteria Landscape and Connectivity, UHSE).

⁵⁸ Self-similar middle-third-erasing set with zero length and uncountably many members (Schroeder 1991: 15-16, 161-175).

⁵⁹ The chance that accumulated heads will be greater than accumulated tails is not 50% but the "Catalan number"

$$N_{2n}(2k) = \binom{2n}{n} \cdot \frac{1}{n+1}$$

where $2k$ measures no. of occurrences of heads>tails, $2n$ =no. of tosses, $N_{2n}(2k)$ = no. of possibilities for outcome heads>tails, measurement independent of k (Schroeder 1991: 147).

⁶⁰ Birkhoff's Theory of Aesthetic Value says: (simple language) artworks are pleasing and interesting if they avoid both excessive regularity and predictability and excessive Surprise; (mathematical language) "the power spectrum of the function should behave neither like a boring 'brown noise', with a frequency dependence f^{-2} , nor like an unpredictable white noise, with a frequency dependence of f^0 ... what most listeners like best ... is music ... in ... a spectrum that varies according to f^a " where (as with most music, old and new), the exponent a lies between 0 and -2 (Schroeder 1991: 109).

7.3.5 BIFURCATION, CATASTROPHE AND SURPRISE

7.3.5.1 INTRODUCTION: WHAT IS DISCONCERTING ABOUT CHAOS IS THAT IT IS UNPREDICTABLE

In the early 1960s, Ed Lorenz, a meteorologist from MIT, was experimenting with some computational models of the atmosphere ... he discovered what has now come to be called the butterfly effect ... the purely deterministic laws governing weather formation are unstable in the worst possible way. As a result, they allow minuscule changes at one location to percolate through the system so as to bring about major effects somewhere else (Casti 1994: 89-90).

Much of the dissertation to this point refers to opportunities to reappraise our conceptual approaches to complex systems. All the approaches mentioned above have their mathematical foundations, which mostly go a considerable distance towards explanation. The question of unpredictability is problematic for a control-obsessed society, which is one reason for mainstream avoidance of the issue. **BP5.6: Predictability in Complex Dynamic Systems (CDS)** explores this a little further.

The extreme sensitivity to initial conditions does not apply to any but strange Attractors, meaning that when such a system is in a limit cycle ('up against its constraints', it will be predictable. In unstable phases (being drawn asymptotically towards an Attractor from outside the system or driven exponentially away from a Repellor or when switching Attractors or constraints)⁶¹, it will not be predictable quantitatively, but the pattern may be. This is Holling's 'creative destruction' phase, which may even be stochastically chaotic. **Link: Figure 28: Holling's Infinity Loop.** If one chooses to define one's system in reductionist ways, perhaps assuming a limit cycle during a creative destruction phase of system instability, the result will not be satisfactory, and may produce unwelcome Surprises. This is a 'tuning issue' in development.

Schaffer & Kot challenge the whole science of Ecology, which has traditionally described populations with single species difference equations and linear and equilibrium concepts. It has, they say, treated Chaos Theory as irrelevant. The point made is that while periodic patterns may be discerned in (say) measles incidence, lynx or thrip population figures (easily traced to weather, season and so on), dramatic fluctuations ('noise') outside these patterns indicate the primacy of chaotic motion attributable to environmental forcing. When two populations are moving on different chaotic Attractors the interaction coefficients of both are moving also, and definition of their effect on one another becomes undecipherable. Likewise, unless the initial conditions are known at the outset and the research time scale encompasses the ecological time scale of the ecological Attractors involved, then even competition, food webs, trophic pyramids,

⁶¹ Note the analogy to magnetism.

fitness and adaptation become elusive to field research (Schaffer & Kot 1985: 348-9). The hope is expressed that a reappraisal will be undertaken, and that out of this "will emerge a version of Ecology that is at last able to confront the data" (Schaffer & Kot 1985: 349).

The following sections discuss Bifurcation, Catastrophe, and Surprise. They emerge from different disciplines, but refer to the same phenomena. The usual approach to systems thinking ('Surprise-free thinking') founded on a desire to control, with a Machine Metaphor, is distinguished from Surprise-seeking approaches which rejoice in experimentation and continuous learning.

7.3.5.2 BIFURCATION THEORY

We concentrate on the finite-dimensional case, dynamical bifurcation theory (DBT). The classical bifurcation theory (CBT), may be developed in a similar fashion. Unfortunately, we will not be able to indicate the fantastic importance of this theory in applications. Our view ... is that the response diagrams of these bifurcation events are our most important source of models for the dynamical processes of nature ... see the seminal works of Thom and Prigogine (Abraham & Shaw 1992: 489).

Catastrophe Theory arises from one branch of Bifurcation Theory, and both use Topology. They both attempt to diagram or mathematically explain the behaviour of a complex system in state space. Bifurcation is often diagrammed as a forked or multi-forked path on a Cartesian graph of state : parameter variables, as a separatrix between two Attractor basins on multidimensional manifold diagrams, or as a catastrophic fold in a topological surface. **Figure 19: CM:**

Bifurcation illustrates a periodic doubling (fractal) bifurcation pattern in a system trajectory, which can be thought of as a line traversing a complex surface (Topography), indicating several possible paths at any Bifurcation Point (Catastrophe Point). Bifurcation Theory (sometimes known as Complex Catastrophe Theory), subsumes Elementary Catastrophe Theory (ECT) (Thom 1977a: 633). The Figure also explains bifurcation as a pattern of system behaviour signalling Edge-of-Chaos conditions.

Bifurcation Theory (BT) is as old as dynamics. Its modern developers (since late 19th C) have included the famous Poincaré and Liapounov (Abraham & Shaw 1992: 445), a Russian group in Gorky working on Chaos since the 1950s, incorporating Lorenz (1970s) (Gleick 1987: 76), but the best known is Thom, who recognised the importance of structural stability in morphogenesis (Abraham & Shaw 1992: 335; Thom 1975; Thom 1983), and May (1976) in Ecology (Gleick 1987: 80). Since Poincaré's work, two types of Bifurcation Theory have evolved in parallel: the Dynamical Finite Dimension Theory based on ordinary differential equations (DBT) and the Classical (CBT), the latter being the most important for natural systems modelling and based on partial differential and difference equations, and developed by Thom and Prigogine especially

(Abraham & Shaw 1992: 489). DBT has three types: subtle, catastrophic and explosive Bifurcations. While DBT has not been developed for natural systems, in addressing harmonics, musical instruments, pendula and similar, Synergetics (see below) it demonstrates that functional mathematical analogies often exist between inanimate and animate or 'physical' and 'natural' systems (Haken 1983: 351-3). More recently the proponents of partial and ordinary differential equations have reunited through globalisation of their theory (Abraham & Shaw 1992: 445).

7.3.5.3 CATASTROPHE THEORY

7.3.5.3.1 Introduction

Where Chaos Theory deals with the 'magnetic' infrastructure of complex systems, including 'unstable manifolds', Repellors and saddle points, Catastrophe Theory (CT) specialises in explaining surprising or unpredictable system behaviour arising from those unstable regions. Catastrophe Theory is "a mathematical approach for dealing with qualitative discontinuities, for example a change from one stable state/equilibrium to another, in a dynamic system." (Goodall 1987: 56). "The underlying mathematics of Catastrophe theory relies on the techniques of Differential Topology ..." (Wilson 1981: 1).

The typical ECT (Elementary Catastrophe Theory) system description has a Control Manifold and a Behaviour Manifold which contain the space of the system and its behaviours. The system surface is partitioned into functional regions (Amson 1975: 177). It describes the jump behaviour in CDS of system trajectories in state space, which is due to the existence of more than one potential system definition at critical parameter values or 'Catastrophe Points' in the zones of instability: the 'Pockets of Compromise' referred to by Rosser (Rosser 1991: 16). Once a system has jumped to another surface (Attractor), it may be unable to return, as its potential energy has been used up⁶² (the 'Hysteresis Phenomenon'), and it will usually be 'entrained' in this state, at least at first. **Link: Synergetics.** This Phenomenon (*inter alia*), denies the economic assumption of substitutability in living systems.

Thom described elementary Catastrophes and noted that they could be finitely classified at least for co-dimensions ≤ 4 , by 1963 (Zeeman 1977:497-8). **Table 32: BICM: Catastrophe Theory (CT) of Complex System Behaviour - Basic Assumptions** lists basic assumptions of the Theory.

⁶² This is important knowledge in situations where miners or loggers (for example) may claim ability to fully restore the damage they do. But regarding regrowth vegetation as fair game is also problematic, as regrowth is 'better than nothing'.

His limitation of systems to four dimensions was to enable space-time studies of physical or biological systems (for example Embryology, Population Studies and Linguistics (Thom 1975). Amson found that (as required for Urban Studies), control variables could be as numerous as necessary but become extremely unwieldy to analyse⁶⁴ (Amson 1975: 220;Wilson 1981: 88). Behaviour manifolds should be limited to 1-2 state variables.⁶⁵

Catastrophic Bifurcations occur in association with static, periodic or chaotic Attractors, although Elementary Catastrophe Theory (ECT) which is well-defined mathematically, was based on fixed point Attractors (Abraham & Shaw 1992: 511;Casti 1994: 53). Catastrophe involves a discontinuous shift of a system from one Attractor to another at a 'Catastrophe point' in the complex field, often with the complete disappearance of an Attractor and its basin: a stable Attractor may become unstable (a Repellor), two Attractors may collide (pairwise annihilation), or a system may destabilise as it approaches a saddle area or separatrix, and suddenly jump to a completely new set of controls if it crosses the threshold to the territory of the Attractor on the other side (Abraham & Shaw 1992: 511;Wilson 1981: 43). **Figure 20: CM: Topology of Catastrophe Theory** illustrates the type of manifold used in ECT, with an visual example of application to common problems.

To set up a geometrical surface of this type one first has to identify one or two (or more for more complex systems) state variables to define the surface, and then up to four control variables which act as Attractors and Repellors in the system: The type of surface folding is characteristic for different input and output numbers (they are named for the appearance of their projections on a two-dimensional surface), and can be extremely complex, especially at higher dimensions. **Table 33: BICM: Regulating Conventions for Catastrophe Modelling** and **Table 34: BICM: Amson's Control Manifold Classification** show conventions for Catastrophe Modelling and a classification of control manifolds.

Thus Catastrophe Theory emerges out of Bifurcation Theory. It may be expressed in equation form, vectorfield manifolds or studied through the folded surfaces of complex multi-dimensional Topology. ECT (and CT) defines 'conflict regions' of instability on the surface. Families of possible functions operate at every point of such surfaces, and respond very differently to very small changes in system input, some stably and some unstably. Local maxima and minima are actually Attractors and Repellors to the system. For some system input values, there is a sudden shift of the dynamics in state space, the pattern of which will depend on the number of variables

⁶⁴ With the advent of modern computation this issue may be worth re-pursuing in urban studies.

in the system and the relativities of minima and maxima. Thom classified an original 'Magnificent Seven' elementary Catastrophes, which were extended to twelve by Amson (Amson 1975: 185). **Figure 21: CM: Elementary Catastrophe Portraits** tables the seven, and lists their variable sets and illustrates the Control Manifold patterns for the cuspid and butterfly types (Wilson 1981: 29;Zeeman 1977: 27).

7.3.5.3.2 Is this Science?

As Catastrophe Theory evolved in the 1970s, it was regarded by Thom as a language, a descriptive and explanatory tool for studying morphogenesis, not as a predictive one (Thom 1977b: 32), especially in the social and behavioural sciences:

... in social sciences ... the hope of finding quantitative modelling of Catastrophes is very slight. When narrow-minded scientists object to Catastrophe Theory that it gives no more than analogies, or metaphors, they do not realise that they are stating the proper aim of Catastrophe Theory, which is to classify all types of analogous situations ... In as much as Catastrophe Theory develops into a formal syntax of (pluri-dimensional) Catastrophes, we will be able to go from a purely verbal description to an abstract, topological morphology which we will be able to handle with purely formal, algebraic tools. Hence we ... reduce the arbitrariness of the description ... *[which]* ... is the proper definition of scientific explanation. (Thom in Zeeman 1977: 637).

Mitchison rejected this as a definition of Science: he claimed "mystical or magical" non-formalisable explanation is aligned with observer subjectivity, and unscientific. Thom responded that such concepts as "God, entelechy, order, complexity, programme, force, message, information, meaning, spirit, randomness, life ... authority, collectivity, sense of history, conflict, consciousness ... etc" were all transpatial (non-local) and long-range. They were used in the mathematical and social sciences unwittingly in ways that deluded the user with "fallacious explanatory power". Thom felt that one could "clear all sciences of these old, biologically deeply inrooted concepts", the "cleaning of intuition", by using Catastrophe Theory, which would then enable the "spatio-temporal ordering of events in living matter" by geometrical manipulation (Zeeman 1977: 636-8).

This is thus a strategy that deals with the Complementarity gap, not by integrating the rate-dependent with the linguistic (rate-independent) realm of meaning, but by 'cleaning up' the latter in order to achieve better 'science' by redefinition into rate-dependence (expressed as differential or partial differential equations which focus on rates of change).

CT has been misunderstood by some mathematicians who have either hailed it as enlightened or denounced it as misleading and ineffective, a strangely extreme response that Casti puts down to territorial behaviours and disagreement with the premise that the qualitative is inherently

⁶⁵ Otherwise singularities develop. Singularity (from Cosmology) indicates a breakdown of calculations due to the emergence of infinity values.

valuable. **Table 35: BICM: Criticisms of ECT** summarises Casti's statements of and his answers to the main criticisms (Casti 1994: 46-48, 80-84).

Casti claims that Physics is a special case of Biology, rather than the reverse (Casti 1994: 78-80). On the one hand, Physics can be represented accurately by ECT equations of process, and predictions made accurately. The Biological Sciences have few such equations, but where they exist, accurate predictions are possible (for example in hydrodynamic flow, and anaesthetic delivery systems). On the other hand, where mathematical representation is not wholistically possible, where it can be assumed that similar mathematical structures underlie the process (for example human individual and societal behaviours), Casti recommends (with cautions about the number of assumptions required), the 'metaphysical way' of Catastrophe Theory.

In a wholistic context, these procedures do no more violence to the 'big picture' than other reductionist selection procedures, and perform a valuable service in explaining and alerting researchers to expect local discontinuities and the coexistence of stability and instability in a single system: they identify patterns of system behaviour and thus may be qualitatively predictive. Other advantages include assistance in indicating what to look for in research, with assembly of large models, suggestions for short cuts, drawing attention to possible structure when data jumps, hysteresis or divergence appear and to identify critical parameter values for 'What if ...?' scenarios in planning (Wilson 1981: 63-5).

The chief relevance of this theory for human habitat systems is the need to understand that this is the type of system extant, and complex systems thinking is essential for decision makers and also the public that does or does not support them. An enormous task awaits us: in discovering new ways to learn how to interface with such systems in our ordinary lives. The intention of this theoretical section is to support this process. See **BP 5.7: Applications of ECT** for more technical discussion, beyond the scope of this work, but which includes a table on urban applications and further notes on use.

7.3.5.4 SURPRISE

There has been considerable preoccupation in the literature of the last two decades with the nature, dynamics and prediction of Surprises, which are the practical face of the Catastrophe phenomenon (for instance see Clark 1986; Holling 1986). Predictability, to which we cling, and uncertainty, appear to be polar opposites. Foresters, fishers and miners all demand long-term

uncertainty, appear to be polar opposites. Foresters, fishers and miners all demand long-term 'certainty' of resource supply, which Economic Fundamentalist governments are inclined to grant. Ecologists and climate modellers are concerned about such commitments in the context of increasingly unstable global climatic, economic, social and environmental conditions.

The 'butterfly effect' (Gleick 1987: 8-31), and the terms 'Catastrophe' and 'Surprise' are now often referred to during the course of lectures and papers on environmental matters. The increase in extreme events predicted for climate change now appears to be in train, to the Surprise of those who denied its possibility.

Surprise is a term used by environmental managers and modellers as they seek practical ways to assist policy-makers. It consists in the "... external shocks, nonlinear responses, and discontinuous behaviour so typical of social and natural systems" (Clark 1986: 31) or "... possible future uncertainties, crises, Catastrophes ..." (Timmerman 1986: 435). It represents the less dramatic French meaning of the word 'Catastrophe'.⁶⁵ Timmerman quotes Shackle's definition of Surprise and then subdivides it into four degrees of increasing intensity (**Table 36: CM:**

Surprise: Classification by Severity):

... Surprise is that dislocation and subversion of received thoughts, which springs from an actual experience outside of what has been judged fully possible, or else an experience of a character which has never been imagined and thus never assessed as either possible or impossible: a counter-expected or else an unexpected event (Timmerman 1986: 448).

Surprises may originate externally, internally or as a result of interaction between system and environment⁶⁶. **Link: Self Organising Systems.**

The classification, nature and management of Surprise are much discussed in "*Sustainable Development of the Biosphere*" (Clark 1986;Holling 1986;Timmerman 1986). Timmerman ascribes the condition of Surprise to the prevailing 'Equilibrium Mythology', which determines assumptions as to what is considered surprising. He points out that while past Mythologies were derived from a concern to interpret society through analogy with Nature, the prevailing modern Western Mythology originated internally, from the "... self-regulating, and self-sustaining world of Economics" (Timmerman 1986: 437).⁶⁷

⁶⁵ Elementary Catastrophe Theory refers to specific mathematically-described forms named by Thom in French, which does not carry the same aura of calamity as the word in English. Nevertheless failure to deal with the element of Surprise in ecological affairs, especially in a context of environmental instability, may well prove the common English misinterpretation prophetic.

⁶⁶ This can be re-stated as 'Surprises may originate at higher, lower or the same scale as the observation is made'. **Link: Hierarchy Theory.**

⁶⁷ Thus Economics operates as a machine: an input-output system indifferent to its environment, but which takes in resources and creates emissions and wastes in an internally-driven manner. The second loop learning still not dawning on our economic gurus is that the ecosystem housing the economy is indifferent to the reasons for these inputs and outputs, only reacting to their presence.

Timmerman defines a hierarchy of severity in Surprise terminology and a general classification of sources (**Table 37: CM: Surprise: Classification by Source**). Brooks' 'Typology of Surprises' appears to be based on ignorance factors: misreading of rate/trend scales ('Surprise-free thinking'), and 'sudden' comprehension of existing conditions' (**Table 38: CM: Surprise: Classification by Type**). His Surprise classification attempts to link technology, human institutions and social systems (Brooks 1986: 326).

Batty sees Surprise as arising from focussing on aggregate data instead of the continuous change and diversity of micro processes (Batty 1996: 473-4). Douglas and Wildavsky see risk perception as a sub-cultural construct: inability to cope with all risks results in selection by different societal groups of specific risks to focus on (characteristically money, survival or power). Events occurring outside this risk structure would then constitute a Surprise (Douglas & Wildavsky 1982: 32).

An important purpose of the IIASA⁶⁸ Biosphere Project (1985+) was to investigate the potential of alternatives to 'Surprise-free' (linear) models and projections; as a complement to 'Surprise-free thinking', and to define the limitations of the current zero-order approximation approach which attempts to average out or isolate discontinuity⁶⁹ from long-term trends (for example discounting the significance of 'outliers') (Brooks 1986: 327).

Timmerman regards Surprise as a valuable diagnostic tool, and recommends research to trace historical Surprises in natural and social systems, their space and time scales, and the responses of these systems as they attempt to adapt or otherwise respond. In particular he recommends study of the contribution of the Mythologies he identified to the outcomes of management, especially those inappropriately simplified systems (industrial and other monocultures) where instability and collapse were induced by the overconnected character of the system (Timmerman 1986: 449-50).⁷⁰ Tainter goes some way in this direction in describing the interface between Control Hierarchies and the economic systems of past civilizations, as a persuasive explanation of collapse, where the system was driven past the point of diminishing returns at existing technological limits (Tainter 1988: 119, 123).

Timmerman also sees Surprise as a consequence of the interactions between events and the mythological frame of reference behind the interpretation. He takes an anthropological

⁶⁸ International Institute of Applied Systems Analysis.

⁶⁹ The strategy of discounting 'outliers' (in order to attain neat results) is sometimes unfortunate where this is done without understanding why the entity is outlying in the first place. An outlier may be a clue to a new concept or a warning. In another context, an affirmative focus on outsider individuals in group and public consultation situations will often lead to rich rewards in mutual understanding, backcloth assessment and event ownership, and may pre-empt legal conflict and other expensive activities in Planning.

approach based on Northrop Frye's 1957 *Anatomy of Criticism* and Mary Douglas' Group-Grid Analysis (Douglas 1982; Timmerman 1986: 445-9), and goes on to trace the history, nature, economic school proponents, religious correlates and prescriptions for action associated with the various Equilibrium Myths prevailing through historical time (**Table 39: CM: A Mythology of Surprise**).

Figure 22: CM: Douglas Cultural Bias Analysis (Group/Grid Analysis): Douglas Cultural Bias Analysis (Group/Grid Analysis). Her matrix maps high and low across collectivist/individualist and structured/unstructured categories. This is a Cultural Theory of Surprise that identifies which of four conflicting cultural 'packages', is in force in any period, and by defining the system extant, thereby explains who will be Surprised when Reality becomes undeniable (Douglas 1989: 259-66). She asks the questions "Is it credible that the biosphere is in danger?" (yes) and if so "What should be done?" (Douglas 1992: 266). Her own bias is towards an idealised hierarchical model, since constraint is needed, this bias being the 'rejected Other' in the current situation. Douglas has little to say about the 'good society' herself, but does identify competitiveness with other biota as central to our problem. Her colleague Ostrander goes further, adding a Transcendent category, to which Idealist EPPs would probably relate themselves⁷¹ (Ostrander 1982: 28-9). **Link: Criterion Community: Clues to the Convivial Society: Links from Intrapersonal to Larger Scales.**

Douglas also challenges sociologists to stop representing the Dominant Paradigm, to open themselves to the reflexivity her framework provides, illuminating and declaring their particular bias, and to join Anthropology in attempting to define an appropriate cultural model for 'the good society'.⁷² (**Link: Criterion Community: Clues to the Convivial Society**). Douglas, her colleagues from Social Anthropology and research ecologists, have discovered correlations between these categories and several other entities, which form internally consistent packages for cultural explanation, trend prediction and action. These include: Myths of Nature (Nature capricious, only robust within limits, fragile, robust), cultural patterns (Group/Grid combinations), attitudes (fatalist, centralist controller, catastrophist, cornucopian expansionist), social values, Surprise types, environmental rhetoric and investment patterns.

Using this framework, the mainstream presently endorses the Entrepreneurial (opportunistic, independent, few Constraints, little social support: low Group, low Grid). This seems to have two

⁷⁰ This point is explained more fully under Hierarchy Theory. In brief, if the components are directly connected to each other through a non-complex system structure, resilience is markedly diminished, and any perturbation is free to flow throughout the system, with a real risk of system collapse.

⁷¹ See footnote on Table 'Mythology of Surprise'.

components: a large-scale group that collaborates with the hierarchical bureaucracy (big business), and a co-opted group from the unsupported majority that is now forced into an entrepreneurial role for which it has little talent, but sees no alternative (small business: low Group, high Grid). The Sectarian sector has become a refuge for the disenfranchised, collecting economically-strapped and other activists groups, fundamentalists and millenarians; ESD environmentalists are shifting out of there into regulatory or entrepreneurial sectors, negotiating green improvements within those biases; EPPs seek to transcend all of this by aligning with people inclusively and healing Nature. The redundant un- and under-employed low Group high Grid sector is rapidly enlarging as technology improves and productivity increases. With the advent of Corporatism, the role in governance traditionally held by the regulatory sector has been taken over by the entrepreneurial sector under the name of 'the market' and 'small government'. That is, we still have a Dominance Hierarchy, but the top level is non-human and amoral, and indifferent to eco-social distress.

Timmerman's assessment is that the 'Resilience Myth' harnesses the potential epiphanic nature of Surprises (providing understanding, but short of system destruction: a diagnostic tool), which would be appropriate as a context for an experimental discipline, perhaps termed 'Stress Ecology'. **Link: Table 49: Views on Equilibrium & Environmental Management.**

Outcomes may in the end be less surprising if more attention were paid to the mechanism level of function, at least one hierarchical level below that of the aggregates usually modelled, to a longer time scale (thus paying attention to higher, 'contextual' scales), and to the linguistic side of the Complementarity probe. In other words, Surprise is often the legacy of discounting,⁷³ a fact well known to psychotherapists - not listening properly to the available signals because the frame of reference does not include the outcome discounted.⁷⁴

In any case, Surprise should be structured into all ecological management policies, plans and strategies at all levels (Timmerman 1986: 437-44). This is echoed by Clark, who questions the value of prediction on the grounds that complex systems are inherently unpredictable, and if they were not, politicians would rarely be genuinely interested in real prediction, but rather would seek figures which support strategies that benefit themselves. (Clark 1986: 15). Similar advice is offered to environmental managers by other authors (Holling 1986: 131; Kay 1991: 491).

⁷² This chapter of her book was originally a paper presented to German Sociologists (Douglas 1989).

⁷³ A Transactional Analysis term: denial of the existence, significance or ability to influence, of problematic aspects of self, other or situation.⁵

⁷⁴ This is a common problem in human relationships where 'Surprise' events can be seen in retrospect to have been announcing themselves for a long period or evident in behaviour preceding the crisis (say of an extramarital affair, embezzlement or pathological gambling).

Holling's views on Surprises extend to his 'Infinity Loop' model, described below. **Links: Far-From-Equilibrium Systems; Holling's Infinity Loop.**

Casti concludes (after Wittgenstein) that our inability faithfully to model the real world, using any language (including computer, mathematical or other symbolism) is the deep reason for the emergence of Surprises (Casti 1994: 84).

Another useful interpretation of Surprises is 'Social Trapping'. "A Social Trap is any situation in which the short-run, local reinforcements guiding individual behaviour are inconsistent with the long-run, global best interest of the individual and society" (Costanza, 1987: 407-8 after Cross & Guyer 1980; Platt 1973; Teger 1980). These are long-loop (delayed) emergent situations arising from actions based on short-term expediency. Examples include the appearance of salt in cleared agricultural land some 80-100 years after clearing, or in cities, the appearance of the menace of salt damp, hazardous waste, nuclear threat, wetland erosion, urban sprawl, habitat destruction, destruction by tourism. The causes (non-linear) include feedback delay, ignorance of reinforcement issues, reinforcement change over time (sliding reinforcement), externalisation of reinforcement (externality traps), adverse individual effects on groups (collective traps) and combinations (hybrid traps). Solutions include taking an ecological approach plus effective public policy including education, regulation and dealing with misleading short term incentives (Costanza 1987: 407-8). Dealing with Social Traps through superordinate authority or religion are expensive and non-universal. If through education, all participants must be educated. Converting traps to trade-offs is Costanza's best solution, and he gives several examples (Costanza 1987: 409-12). But Lovins claims that if a 'win-win' solution can not be found, the problem has been mis-stated.⁷⁶

I would argue that while our models can never come closer to reality than our perceptions, and while some Surprises may come from our inability to model complexity for prediction while believing we can, far more Surprises come from discounting the importance of overt and easily available signals (and well-understood history) all around us (especially rate-independent aspects), while demanding objectively measurable research subjects that fit our preconceptions.

Redefining refers to the mechanism people use to maintain an established view of themselves, other people and the world (frame of reference) in order to advance their scripts. It is the internal mechanism people use to defend themselves against stimuli which are inconsistent with

⁷⁶ Interview July 2000: Lovins ('Natural Capitalism') appears to be running on Progressive Equilibrium combined with a Resilience Myth. See www.rmi.org/.

their frames of reference and redefine the stimuli to fit in. Its three components are discounting, grandiosity, and thinking disorders (Schiff 1975: 55).⁷⁶

We also fail to involve those affected by our decision making, and fail to notice or take responsibility for our impacts, since we are highly selective in the signal we allow to penetrate our personal bias (Douglas & Wildavsky 1982: 9). We are disinclined to take responsibility for others or situation in a context where Individualism and competitiveness are seen as high order values. Western adversarial legal systems, scapegoating and the 'blaming game', are top-rating activities of politicians and the visual and printed media, along with advertising and marketing in all their forms. They constitute manipulation of the realm of meaning or interpretation, as distinct from discounting it in favour of mechanism, which is a separate avoidance behaviour.⁷⁷

It is further argued that progress will not be made in eco-social areas until the rate-independent aspects are accorded equality in decision making and personal expression with the rate-dependent, being expressed in their own terms instead of through futile attempts to mathematise them or translate them into economic values, as with recent attempts to 'value the environment'.⁷⁷ Dr. Eva Cox in the 1995 Australian Broadcasting Commission Boyer Lectures strongly recommended the preservation and redevelopment of Social Capital, and supported a government role in protecting the social backcloth. Intuitive recognition of gross Complementary imbalance is also a probable source not just of Surprises, but of the perception of emptiness, shallowness and meaninglessness increasingly associated with modern consumerist lifestyles and the social/lifestyle impacts of Technology (Cox 1995; Saul 1997; Theobald 1992; 1997a).

It can be argued that the proper role of a democratic government is to eliminate Social Traps (no more and no less) while maintaining as much individual freedom as possible. This can be accomplished most effectively by turning the traps into trade-offs that can be handled within the current market system as modifications to the cost of potentially entrapping activities. Social Traps abound in environmental issues because of the abundance of imperfectly owned and common property resources ... we must make the protecting of the environment as economically attractive to individuals in the short run as it is to society in the long run (Costanza 1987: 412).

7.3.5.5 A NONLINEAR APPROACH TO QUALITATIVE RISK ANALYSIS

Atkin (the inventor of q-Analysis) takes a completely different approach to Surprise (Atkin 1981: 360, 361-2, 364-5). He distinguishes [*note the relationship to Complementarity Theory*] between

- **o-Surprises**, which are linear events (1-dimensional), unexpected on the basis of Probability Theory, which is quite inadequate to explain most personal, social, urban and institutional events, since it

⁷⁶ Schiff founded the 'Cathexis School' of TA; her Institute developed a controversial Reparenting process for psychotics.

⁷⁷ For example Environment Institute of Australia's seminar "Environmental Valuation" (13/5/1996) invited participants to struggle with the difficulty of this, without drawing conclusions as to the impossibility of the exercise: for Complementarity, a different form of description is obligatory by definition.

ascribes equal likeliness, and randomness to alternative outcomes and has no way of exploring connectivity, and

• **p-Surprises**, (a Gestalt concept), emergent events made up of o-events self-organising in a higher-dimensional space and 'suddenly' emerging into the scale of observation as an unpredictable complex p-event (p-dimensional event where $p > 0$ [usually $p \gg 0$]). Examples range from a chance meeting of old friends to low risk disasters such as nuclear accidents.

In seeking a measure of Surprises, Atkin suggests looking at the 'reachability' of a particular p-event from another 'base' event by eliciting the number of paths between the two. The Surprise value of the event of interest is then expressed by the connectivities; zero connectivity (no chain of p-connection) representing the extreme case where the event can not occur. Direct connections are not surprising. The largest number of disjoint q-chains (chains of indirect connectivity where only the origin and destination events are shared) gives an indication of Surprise value, and is larger where the original event is high-dimensional. **Figure 23: CM: Connective Structure for p-Surprises** describes the basic elements of q-Analysis and illustrates a disjoint q-chain.

Atkin goes on to present formulae with evolving definitions of Surprise value, develops an appropriate algebra which among other things demonstrates a formula for additive Surprises and demonstrates Probability to be a special (trivial) case (Atkin 1981: 362-4). In the case of 'low risk with disastrous consequences' events, the conventional view⁷⁸ is blind to the "structure of the event space". In the event of disaster, Atkin says, "The only people who are surprised, since ordinary people relate to possibilities, not probabilities, are the probabilists who have .. seen the event space as only a set of o-events (although Probability Algebra gives one the illusion that this is not the case)" (Atkin 1981: 364-5). The answer to this is to ask questions about sequences and connectivities and track structural change (changes in connectivity) resulting from series of changes from initial state complexes of high dimension. Only with this understanding and disconnecting the q-chains can a zero-Surprise backcloth be developed (where this is desirable).

More recently, a strategy has been developed of 'Incident Analysis', which analyses adverse event chains in hospital clinical practice, with a view to early intervention (pre-empting preventable litigation), preventing similar incidents in the future, and correcting systems rather than persecuting individuals. This was based on existing checking systems in aviation, and has been adapted and developed by Professor of Anaesthesia and Intensive Care, Bill Runciman of Royal Adelaide Hospital and University of Adelaide, and now adopted as an Australian, national scale, Incident Management System, under high security.⁷⁹

⁷⁸ Qualitative Risk Assessment (QRA) comes under this heading.

⁷⁹ On hearing this news, one immediately wonders how the security system was designed.

7.4 SYNERGETICS & PHASE TRANSITION

Synergetics arose in the late 1970s with the goal of describing the self-organising behaviour of macroscopic far-from-equilibrium systems through a generic mathematical model that enabled inter-disciplinary communication (Haken & Mikhailov 1993: 33). It has particularly focussed on tracing analogous phase transitions in systems as various as Physics, Chemistry, Biology, Ecology, Sociology and Economics (Haken 1993: 5). Synergetics has three approaches: micro (Chemistry, Biology: follows order parameters and writes evolution equations for the parts); macro (studies for example Brownian movement, entropy); and phenomenological (studies order parameters near their instability points) (Haken 1993: 5-7). Areas of interest might include language, organising rituals, democratic laws, civil societies becoming nations, fashion and paradigms.

In essence, phase transition involves innovative, dramatic macroscopic system change at some parametric threshold to a new system with higher complexity (and dissipative potential), new rules, order parameters, Attractors, Repellers and system characteristics. These are referred to by physicists as 'phase transitions', by archaeologists as 'hinge points', by evolutionary biologists as 'punctuations' and by ordinary folk through expressions such as 'quantum leap', 'sea change', 'order of magnitude', 'paradigm shift', 'great leap forward' and 'great U-turn' (Lewin 1993: 20). The Chaos and Evolution literature also speaks of phase change. Synergetics is helpful in suggesting key areas for intervention and management of CDS.

Table 40: CM: General Elements of Phase Change summarises the general pattern of phase transition according to Haken (Haken 1983: 351-3). In particular, Haken found that in systems with many subsystems, (physical and non-physical far from equilibrium systems), when parameters changed (such as energy flux, chemical concentration and temperature gradient), emergent phenomena would be generated by the 'Slaving Principle'. That is, certain unstable lesser structures of the system known as ordering parameters, equivalent to the similar parameters in Phase Transition Theory, would 'enslave' (entrain) the other (stable) parameters and determine macroscopic system behaviour through the balance of their competition or cooperation. This allowed much easier study of the system due to massive reduction of the degrees of freedom⁸⁰ (number of variables relevant to system structure) (Haken 1977: 11-15).

Thus in a mixture of stable and unstable parameters in a system, the outcome is determined by the unstable ones. That is, new order is generated by instability (Prigogine's order through

⁸⁰ The concept of 'key variables' in Ecology or Sociology, or Ecology's 'keystone species', are not necessarily themselves unstable, but being 'glue' parameters, have power of release to destruction, creative or otherwise, in their disappearance. **Link: FFE systems.**

fluctuation). This applies to many everyday systems such as swinging voters, marginal electorates, 'squeaky wheels" (which 'get the oil'), the 'identified patient' in family therapy, the impacts of disease, ecological collapse, the creation of art, the chain 'only as strong as its weakest link' and the 'lowest common denominator' outcome. It also underlies the destabilisation strategy used by politicians and the power of fire souls (who are constant in their philosophies, but unstable elements in society as a whole). Unfortunately, Hitler, too, was a fire soul: the role is at issue here, not the ethics.

Haken reminds us that building block Metaphors make no allowance for Wholism: emergent behaviours assume that the parts are not the whole system. Wholism is about relationship, the synergy of many parts in open systems with great fluxes of matter and energy. Such systems are influenced or controlled from outside (for example by energy input) in a non-specific manner. **Link: Organising Principles.** The system is beholden to such 'control parameters'.⁸² But system ordering is derived from 'order parameters' which enslave the system through their instability and provide the opportunity for the system controls to switch. For adaptability, the system must be kept near its instability zone, and is very sensitive to small inputs there, especially of information. Systems slow down close to shifting to a new Attractor, and manage it in conditions of flux.⁸³ It is a common pattern for a homeostatic system to test all possible responses while quiescent, testing the functional boundaries (for instance blood pressure and heart rate vary widely, especially at rest) (Haken 1993: 8-10).

As modern humans we intuitively work to make our lives comfortable and predictable by addressing unstable and variable situations, controlling them through technology if we can, and have mostly succeeded, long-term Surprises notwithstanding. However this removes the creative, adaptive side of our equation with Nature, and we find negative outcomes wherever we look, but in particular this can be demonstrated for Ecological Management (Gunderson *et al* 1995; Holling 1995: 32-33) and Biotechnology (Garrett 1994 – *inter alia*; McMichael 1993: 61-3) (weeds, ferals, toxicity, soil depletion, new diseases, species jumps ...).

Synergetics uses Dynamic Systems Theory (DST) and Bifurcation Theory to explain and predict system behaviour at the instability point. It sees itself as linking DST and Statistical Physics. Having recognised "that the cooperation of many subsystems of a system is governed by the

⁸² Allen & Hoekstra end their "Toward a Unified Ecology" by proposing an implementation process for environmental management based on Checkland's 'CATWOE' protocol. This 'soft methodology' asks a number of key questions: 'who does the system serve?' 'what/who is the principle structure?' 'what does the system do?' 'What is the phenomenon of interest?' 'Who/what can close the system down?' 'What does the system take for granted?' (Allen & Hoekstra 1992: 312, 318-16).

⁸³ Hence the exaggerated El Niño and other extreme events of recent years, are likely to be warning that the Biosphere is in fact entering a zone of instability: a poised state.

same principles irrespective of the nature of the subsystems", Haken then searched for analogies across disciplines and found the following conformed to this pattern expressed in **Table 41:**

RRCM: Phase Change Across Disciplines.

A more recent work edited by Haken contains a number of sections applying Synergetics to everyday phenomena such as social systems, ant colonies and brain function (Haken 1993).

Mainzer in this volume builds a table of examples of self-organisation which points to the very wide relevance of these principles to society and Ecology (Mainzer 1993: 41). This is reproduced in **Table 42: RRCM: Self-Organisation in Nonlinear CDS**, which again indicates the potential for a Complexity Theory interpretation of a broad, cross-disciplinary arena.

Philosophically, it is important to see that order parameters are not reduced to the microscopic level of atoms, molecules, cells, organs and so on, of complex systems. In some cases they are measurable quantities (for instance the field potential of a laser). In other cases they are qualitative properties (for instance geometrical forms of patterns). Nevertheless ordering parameters are not mere theoretical concepts of matter without reference to reality. Actually they represent properties of real macroscopic phenomena like for instance field potential, social or economic power, feelings or even thoughts (Wischert & Wunderlin 1993: 69).

7.5 SELF-ORGANISATION

7.5.1 INTRODUCTION

The self-organising character of myriad physical, chemical, biological, ecological, evolutionary, economic and cultural processes is now recognised. This concept permeates all the Complexity Theory-CDS literature from Complex Mathematics to Chaos and Catastrophe Theories, Thermodynamics, Hierarchy Theory, Evolution Theory, Ecosystem Theory, Landscape Ecology, Human Geography, Biocultural Theory, Evolutionary Biology, Ecological Economics, Economic Geography, and individual and family Psychotherapy. It demands a rethinking of approaches to theory development and modelling in all disciplines concerned with dynamic subjects.

The difference between earlier linear approaches and those more recent, lies in the recognition that complex dynamic FFE systems are inherently self-organising and self-reproducing. They are either alive or partly depend on living beings, and they exhibit a Catastrophe-prone, restlessly stable and unpredictable selfness. **Link: Subatomic Theory: Mathews system of selves.**

In introducing a paper on this subject in Environmental Management, in common with numerous other authors, Hollick lists five essential characteristics of self-organising systems:

- Far from thermodynamic equilibrium
- Controlled by recursive application of internal rules
- Some (at least) rules nonlinear
- Positive feedback loops (amplify small changes)
- Energy exchange with surroundings to avoid entropy and maintain structure⁸⁴ (Hollick 1993: 622).

Their properties are further described as listed:

- Whole not deducible from parts, not predictable
 - Past-sensitive
 - Self-control within large scale constraints (holonic -see Hierarchy Theory below)
 - Evolution⁸⁵ (punctuated path, Bifurcation sensitive) (Hollick, 1993: 622-3).
- [• *Information sensitive*].

Self-organisation involves all the processes described herein, and further promotes understanding of the eco-social processes with which we are attempting to align.

7.5.2 AUTOPOIESIS (SELF-REPRODUCING SYSTEMS)

The work of Maturana (Neurobiology) and colleagues is regarded by certain sections of the ecological movement⁸⁶ as providing the physiological and cognitive underpinning to other approaches to self-organization. The merger of Biology, Anthropology, Communications, Psychiatry and Information Theory in the 1930s (largely through Batesons' having connections

⁸⁴ [Add Information exchange with environment built into structure].

⁸⁵ This inherently directional word means an unfolding (Shorter Oxford Dictionary).

with all these fields), saw the emergence of Cybernetics and new approaches to Epistemology and Self-Organising Systems (SOS) Theory. The Macy Conferences on Cybernetics in the 1940s and early work by Bateson, Forester, and McCulloch (MIT), preceded the work of Atlan (Parisian school of Self-Organizing Systems Biology), which was further developed by Maturana and Varela through the Santiago School of Cognitive Biology. In the 1980s cultural historian and Founder and Director of the Lindisfarne Association of New York, William Irwin Thompson, brought together a cluster of highly qualified scientists, Fellows of the Lindisfarne Association, including several of those mentioned,⁸⁵ to share their knowledge and explore the implications of a "new paradigm of wholeness" through the Lindisfarne Conferences (Thompson 1987a: 11-12;1991).

The thinking of these people bears the clear stamp of Postmodernism. For instance, Thompson, frequently mentions the importance of narrative, and of scientific narratives in particular (Thompson 1987b: 12). He introduces the first of two volumes of Lindisfarne Conference papers by quoting Heisenberg to point out the similarity between the work of Maturana and Varela, and Quantum Theory:

... we do not have any such thing as a 'science of nature'; rather, we have a science of man's knowledge about nature. We do not live in reality, we live in a series of descriptions of reality ... science ... is a human activity ... a subset of cultural history, and not the other way round ...The concept of 'unity' becomes, therefore, an important perception that nature is made of processes rather than objects, and that these relational processes are always events within a domain of description by an observer. The sociobiologist looks for hard, irreducible objects that he can manipulate, but Heisenberg has said that the universe is made out of music, not matter (Thompson 1987b: 22-3).

He goes on to equate Cognitive Biology, the investigation of such phenomena, which is marked by a collaboration of consciousness with cognition, and which historically relates to Alfred North Whitehead's Philosophy of Organism, to Maturana and Varela's 'realisation of the living', and Bateson's 'Mind'.

Maturana is also regarded as an important euhemerus for Postmodern Psychotherapy⁸⁷, for instance by the Milan School of Family Therapy, Narrative Therapy and the new Social Constructionist versions of Transactional Analysis (Leyland 1988;Loria 1987).

⁸⁵ The philosophically or academically inclined. Most eco-proponents just busy themselves with solving practical problems on the basis of concern for an evidently damaged planet, rather than worrying about EcoPhilosophy.

⁸⁶ Such as Bateson (Cybernetics), Atlan (Biophysics - Cellular Biology and theory of Self-Organisation), Maturana (Neurobiology), Varela (often co-author with Maturana - Neurobiology, Epistemology, Cybernetics), Margulis (Biology, co-originator of Gaia Theory), Lovelock (Atmospheric Chemistry, inventor, co-originator of Gaia Theory), Oryama (Psychology, Information Ontogeny), Jackson (Botany, Genetics), Nancy Todd (author and Ecology journal editor), Ceruti and Evan Thompson (Philosophy), Henderson (futurist, economic analyst), Zazonc (Physics, Quantum Optics, Theory of Colour), Guerrero (Microbiology), John Todd (Biology, co-founder Ocean Arks International).

⁸⁷ This in itself has a number of underlying theories and versions (for example Narrative Therapy, Postmodernism, Social Constructionism, Constructivism), the essence of which is a new world view in which the secure psychic anchors of the past and the reassuring and forceful authority of experts, dissolves into a sea of individually interpreted meanings: a multi-verse instead of a uni-verse (Doan 1997: 129).

For Maturana and his colleagues, autonomy refers to the self-organisation of living or non-living systems, through specification of their own laws. Autopoiesis is proposed as the mechanism through which living beings become autonomous, the constant circular self-organization and self-structuring of such systems being the essential that distinguishes living from non-living. This 'beingness' implies a way of knowing, that leads Maturana *et al* to equate living with the term 'cognition' (with or without a nervous system) (Maturana & Varela 1980: 8-9). Mechanical and autopoietic entities strive for quite different ends: basically external versus internal (Fox 1995: 170).

'Self-referred' systems can be described solely by reference to themselves, the self-regenerating, self-renewing, self-producing of organisational structure and operation (antecedent to self-reproduction), such as the complex, self-regenerating dynamics and homeostatic behaviour of a house plant or a body organ (see also Fox 1995: 169-71). In such a system there is no separation between producer and product, being and doing, and the claim is made that the formation of autopoietic systems on Earth was inevitable once the necessary Backcloth existed. 'Other-referred' systems can only be understood in relation to a context (such as the static, pre-defined, designer-dependent artificial plant, made by an external agency, or mechanical devices).

Paradoxically, while a self-referred system has an inherent and structurally self-determined 'knowing' about how to 'be', and its range of response to external stimuli is so constrained, it remains in constant interaction with that context, and the characteristics of that context for which it has receptor-mechanisms will trigger such responses. The internal metaresponse to all these triggerings, preserves in turn, the internal organisation and structure (Leyland 1988: 358-60).⁸⁸ The essential inclusion of context in the description of such a being, the 'environ' mentioned above, implies embeddedness in a larger system, also self-organising, as described under Hierarchy Theory below.

System organisation and changes, while internally determined, depend on mutual triggering between system and context and/or between system and other SOS, by a complex interactional phenomenon called 'structural coupling'.

... a living autopoietic unity ... must be coupled to its medium: structural coupling is the building block of all human and animal interactional systems. The more complex the organism, the more 'structurally plastic' it is deemed to be: i.e. plastic in the sense of interacting with itself, its environment and other structurally plastic systems ... although the structure of the system determines how it will 'react' to a particular disturbance at a given instant, that interaction, in turn, leads to structural change which will alter the future behaviour of the system (Leyland 1988: 361-2).

⁸⁸ Link: Thermodynamics: Triggering.

Or as expressed by Maturana & Bunnell, explaining “something very wonderful” whereby any local perspective harmonises with all the rest, whether visible or not, integrating the whole coherent dynamic system:

All entities or systems arise in the conservation of relationships which define them, always simultaneously with the medium that makes this possible. As a result, system and medium necessarily arise in structural coherence as they arise together. Furthermore, system and medium remain coherent as they change together in the spontaneous flow of their interactions, or they disappear. This coherent structural change which occurs in the course of evolution of a system, in conservation of its existence, and in adaptation with its medium is called structural coupling ... In general terms, living beings always maintain coherence with all the changing circumstances that touch their living as a result of the dynamics of conserving structural coupling (Maturana & Bunnell 1998: 6).

This concept leads then to the differentiation between linear, causal thinking, which is an inherently local phenomenon, enabling effective local action (the ‘engineering look’), and analogic systems thinking (the ‘poetic look’), that “grasps the coherences in one domain and expresses these in another”. These Complementary ‘looks’ together “comprise the basis for local action in a systematically coherent manner”, and together constitute natural wisdom (Maturana & Bunnell 1998: 8, 8-9).

Maturana & Bunnell differentiate between wisdom, comprehension and knowledge.⁸⁹

Comprehension⁹⁰ relates the local to larger cosmos/biosphere/culture system through a right brain, multi-dimensional, systemic understanding. Knowledge is local, linear, and identifies causal relations, independent of system, a left brain style⁹¹. Wisdom, where present, integrates these two approaches to relationship configuration. It emerges spontaneously under conditions conducive to human well-being. That is, where an emotional attitude of love, as defined by Maturana, prevails in communities which value and preserve social capital, while aggression and competitiveness are not core values (Maturana & Bunnell 1998: 9).

While there is no doubt that other living beings communicate and many have quite complex languages, the special talent for language in humans takes communication potential to another level.

Amongst humans, many systems are formed, which through the establishment of a consensual domain, based on language, we call ‘family’, ‘club’, ‘school’, etc (Leyland 1988: 362).

“*The Tree of Life*” concerns itself with evolution, morphogenesis, metacellularity (the organization of second order autopoietic systems as nested hierarchies, with special focus at cellular/organ/simple organism scales), and the organisation of brain function, especially in terms of its structural plasticity (Maturana & Varela 1988: 47-49, 87). That the brain tunes itself to

⁸⁹ Perhaps the origin of the notice on a colleague’s door that announced “data is not information is not knowledge is not understanding is not wisdom”.

⁹⁰ ‘Double loop’ equivalent. **Link: BP 5.4 (Cause).**

⁹¹ ‘Single loop’ equivalent.

perceive a limited range of relevant stimuli, specifying what will be received, is labelled 'structural determinism' and has implications for a concept of cause (Maturana, 1988: 169). Stimuli for which the brain (and ears and eyes) is not tuned are not detected.

A similar situation holds in ecosystems, which operate at specific frequency ranges and ignore data coming at frequencies outside this range (see Hierarchy Theory)⁹². Maturana and Varela do not themselves see Autopoiesis as extending to social processes. But Adams reminds us that we are limiting discussion to dynamic self-reproducing processes only, not modelling the whole system, and a definition of "the dynamic processes of a unity to maintain and reproduce itself" holds relevance for society (Adams 1988: 63).

Autopoiesis differs from Functionalism in that it specifically focuses on the internal relations of production as a general model, the collectively self-triggering functional processes specified may not necessarily have an externally discernable 'function' as such, while the self-contained, self-reproducing character is emphasised. Maturana *et al* specify Allopoiesis where relations of production are externally controlled (for example with machines), Autopoiesis where relations of production are internal (organisms concerned only with self-reproduction) and Heteropoiesis where self is reproduced and other products or artefacts are also produced (for example humans - technology) (Adams 1988: 63-4).

Like Maturana, the recursiveness of informal ritual in daily life (habits, routines) is seen by Giddens as the material grounding of social activity. In constantly recreating itself from its own structural duality, ritual performs the vital psychological role of generating trust (ontological security) by effecting predictability, and by interposition between practical consciousness and the unconscious, which would otherwise dominate the conscious attention (Giddens 1984: 50).⁹³ This is also related to Goffman's analysis of 'co-presence' with which both Giddens and Transactional Analysis theory concur, in the opinion that routinisation (the Controlling Parent function in TA) releases energy for other activities.

⁹² There is clearly an intuitive understanding of these principles in social realms, as English at least is rich in allegoric or metaphoric reference to sensitivity to frequencies: for example 'being on someone's wavelength', 'in sync', 'in harmony', 'social discord', 'dissonance', 'too speedy'.

⁹³ [Routinisation] "...drives a wedge between the potentially explosive content of the unconscious and the reflexive monitoring of action which agents display." (Giddens 1984: xxiii, 50). While this description appears to subscribe to the rather dramatic Freudian concept of the unconscious as a seething and barely controllable mass of dangerous and irrational drives, Transactional Analysis offers a much calmer, more pragmatic and functional interpretation, which recognises the inherent reasonableness and survival function of pre- or un-conscious structures when viewed in context. Freud would have ascribed unconscious motives even to minor behaviours and gestures, which Giddens [:50] points out should be seen as 'processual' and governed not just by internal meanings but also by the social context. TA, 'body language' analysts and Process Oriented Psychotherapists would agree with this, and use these concepts in therapy training). Some of this content certainly looks dramatic on exploration (several modern schools of therapy now handle such work with great competence), especially in the 'body therapies' which involve high level emotional discharge, but by far the greater danger lies in blocking all safe modes of expression.⁹⁵

Transactional Analysis Theory exemplifies recursiveness through the (personal, organisational or cultural) Script functions. Here, the preliminary version of a life plan emerges in individuals from the uniqueness of elements at the interface between the individual's givens and his or her life experience over time, with internal conclusions or 'Decisions' about the self, others and life (generically described as 'Basic Position': a core Attractor of the Script set⁹⁴). While constantly being externally verified and internally updated, the major conclusions are usually in place by five years, forming the framework for the Script, and once this 'show is on the road', the individual normally expends considerable energy elaborating and defending it, and redefining incoming stimuli to fit. Where this is socially dissonant, therapy or other events can help the owner 'rewrite' the Script. Subsequent extreme events can dislocate the whole system onto a tenacious, new, negative Attractor ('post-traumatic stress syndrome'). **Link: BP 5.2 (TA); Criterion Community: Clues to the Convivial Society.**

Maturana *et al's* conclusions concerning love (defined as acceptance and affirmation of the parallel existence of others), which links into Basic Position Theory in Transactional Analysis, as the biological basis of social life, is discussed under Criterion Community.

7.5.3 FEEDBACK LOOPS AND NETWORKS

A central concept in Systems, Physiology, Ecosystem and Hierarchy Theories, is homeostasis. This involves structural feedback loops: a dynamic equilibrium concept. Loops have a stabilising effect on dynamic systems, and appear to promote resilience by virtue of multiple parallel connections (by flow diversity or functional redundancy). Ecological research has been misled (according to Ulanowicz), by using population levels as a surrogate for flow studies and "rampant confusion about the definition of information", which apparently confused information with uncertainty in an unhelpful way (Ulanowicz 1986: 83).

Loops are involved in the pulsating character of such systems, from microcosm to biosphere to macrocosm (Odum 1970: 19).⁹⁵ Systems models are essentially nodes connected by feedback loops, usually multiple, for instance Henderson's 'vicious circle' economy (**Figure 24: CM: Henderson's 'Vicious Circle' Economy**), with fast feedback loops (Henderson 1991: 96),

⁹⁴ The other two core Attractors are Stimulus (Recognition) Hunger and Structure Hunger, which in Bifurcation terms, may differentiate in three ways (Ego States). A set of 12 psychological Repellor systems (Injunctions) and 6 Saddles (Drivers: unstable, phobically initiated, intermediate behaviours) contribute to the emergent filtering entity, the Frame of Reference.

⁹⁵ Pulsation, a universal phenomenon, is fundamental to self-organisation, planetary motion, biospheric organisation, atoms (probability waves), molecules, organisms, perception (vision, audition), physiological function (biorhythms, breathing, heartbeat), human identity (speech patterns, handwriting, fingerprints, gestures, cosmological cycles), ecosystem cycling (matter & energy eco-cycles, seasons), life cycles (organisms, humans, civilisations, ecosystems -after Holling). "The reality around us is an ongoing rhythmic dance, and our senses translate some of its vibrations into frequency patterns that can be processed by the brain." (Capra 1982: 327-8).

Maruyama's qualitative and quantitative causal loops (**Figure 25: CM: Maruyama's Causal Loop Analysis**) (Maruyama 1994: 75), Fuzzy Cognitive Maps (**Link: BP 5.3: Fuzzy Logic**), STELLA educational software, Johnson's discussion of networks (Johnson 1995b), Ulanowicz' functional analysis of webs of subcycles (hence the term 'hypercyclic')(Ulanowicz 1986), positive feedbacks driving exponential growth (Meadows *et al* 1992: 237-53, 24-6), and IASA models (Shaw, 1992: 13}. **Link: BP 5.4 (Cause)**.

Maruyama emphasises causal loops as a critical aspect of CDS, as such loops may be change amplifying (the arithmetic is similar to algebra, where two minuses make a plus) (Maruyama 1994: 78). Maps like Henderson's are bewildering if approached from a control position. Playing about with *Stella* rapidly teaches how easily a poised system can respond by an avalanche (such as a species crash or a poisoning); one discovers how important it is to have a learning system for complex system management, and how important Constraints are.⁵

Cognitive maps and Fuzzy Cognitive Maps (FCMs are networks with signed or fuzzily defined arrows between nodes (Kosko 1991;Taber 1991). These latter, and also Odum-type power diagrams may usefully be presented as matrices, which assists in identifying potential linkages which may have been missed (Odum 1970: 21). .

In human (animal) Physiology it is well-established that a rich and complexly-intermeshed system of positive and negative feedbacks normally keeps an organism's internal environment within an optimal range. System constraint is normally ascribed to negative feedback. Positive feedback is equally important in non-equilibrium systems and has potential applications in Genetics, Ecology, Population Geography, Politics and Psychotherapy (DeAngelis,Post & Travis 1980: 8;Maruyama 1994: 75-87). System outcomes arise from the unstable interface between parameters with multiple tendencies. Potential positive feedback may lie dormant under constraint and only be revealed when system parameters change and constraints are modified or removed. This may create Surprises such as a drop in population density below a threshold with extinction of species through positive feedback mechanisms (DeAngelis *et al* 1980: 12).

In Psychotherapy the desensitisation of a constraining phobia may reveal an underlying Script issue of suicide ('*Don't Exist*' Decision)⁹⁷ which if not dealt with may become the new constraint system and release the positive feedback sequence.⁵⁹⁸

⁹⁷ The most serious of 10 Script Injunctions described in Transactional Analysis.

⁹⁸ Often referred to in (traditional) Psychology as 'breaking down an individual's defences'. The person's Script carries a Basic Position Attractor of 'society/people is/are not OK'. This attitude filters and interprets social events with negative bias and elicits negative response in others), which may cyclically reinforce a negative self-image and end in suicide.

In Medicine, the subtler levels of checks and balances are normally discounted in favour of higher level intervention, and this has been outstandingly successful despite a relatively high incidence of side effects,⁹⁹. however once a new condition is 'tripped', such as a cancer situation, positive feedbacks and new system rules often dictate a scale change (for example cell or organ to whole body), hence wholistic healers' insistence on 'treating the cause(s), not the diagnosis' which is an emergent phenomenon. Of great concern is the possibility that this may be the case with the Earth's geophysiological systems, which have been stated by Lovelock and many others to be in positive feedback already.¹⁰⁰

De Angelis *et al* describe four broad generalisations concerning positive feedback ('cooperative' systems):

1. Essential involvement in complexity-generating processes (both Lamarckian and Darwinian evolution).
2. Acceleration of change: Adams' Law of Acceleration (1918) - positive feedback process underlies accelerating rates of change (seen in human society, cultural complexity, productivity, knowledge acquisition, evolution in general); rapid transition from one state to the next.
3. Threshold effects (sudden change in system behaviour on crossing particular frequency thresholds (apparently due to internal or environmental parameter changes). [*Bifurcation behaviour*].
4. Fragility - proneness to catastrophic collapse in complex systems due to design for resilience which takes up external stresses but amplifies small faults above certain critical zones (Weinberg & Weinberg's Law of Collapse, 1975). Fragility to particular perturbation types may remove constraints and suddenly reveal unexpected networks of positive connectivity (ships' hulls - Griffith critical length; mechanical theory of self-supporting columns, also applies to plant structure; advanced economic systems; ecosystems - not obvious in all, but especially visible in tight co-evolved - tropical reefs, tropical rainforests - functional redundancy protects resilience) (DeAngelis *et al* 1980: 7-14). [*Text abbreviated*].

While for research or modelling purposes a system of feedback loops (a linear concept in itself) is usually described, the actual function in FFE systems is more like a network, even a unidirectional tree structure, interwoven with hundreds of simple direct cycles (no repeated elements) operating in constellations, with multiple parallel inputs and low frequency critical arcs which may be shared by a number of loops in a constellation (Ulanowicz 1986: 68, 63-80). Cyclic definitions are important but linear approaches are still useful in focusing on the non-cyclic aspects of systems such as the relations between two nodes (Ulanowicz 1986: 53).

⁹⁹ Side effects often arise from associated impacts on related subsystems, but since these are usually presented to doctors as lists, there is not a sound general understanding of any but the most obvious connectivities (for example autonomic effects of that system beyond an autonomic target organ). Increasing serotonin to treat depression may interfere with serotonin's role in blood clotting as mediated by the platelets. The next generation of drugs will be far more specific in activity.

¹⁰⁰ Lovelock's Gaia Theory has suddenly become acceptable to orthodox scientists through a name change to 'Geophysiology'. The 'Gaia Hypothesis' created an unacceptably New Age impression to which 'real' scientists were unable to relate. Lovelock further mentioned that James Hutton, the 'father of Geology' had recognised the superorganismic nature of Earth in an Edinburgh lecture in 1788, and had recommended that it be studied by physiologists. Restated on Earthbeat 5RN, ABC Radio National, 6/5/96. Like it or hate it, simply looking for Gaia can give new insights into the complex feedback systems that rule the planet ... despite its flaws, complexity studies ... are helping to make Gaia more plausible (Coveney & Highfield 1995: 235-6).

Simple multiple feedback is not functionally quite the same as network character, which is distributive and has peculiar dynamics. These include plasticity, the ability to behave stably by finding stable regions for constellations of Attractors (thereby creating structure), and a metadynamic learning principle that enables the system to hover in the critical *Edge of Chaos* region and oscillate between chaotic and non-chaotic regimes. Ulanowicz demonstrates that processes or flows are more fundamental to the description of ecosystem growth and development than thermodynamics, and argues for the evolution of flow networks as a universal explanatory principle for the evolution not just of ecosystems, but also of non-biological systems, in Economics, Fluid Dynamics, Meteorology, human and non-human communications, transportation planning, information processing and distribution policy-making (Ulanowicz 1986: 64). Indices of materials and energy flows have also been used with success recently in Ecological Economics, as a surrogate for environmental impact (Hinterberger, Luks & Schmidt-Bleek 1997). **Links: Criteria Connectivity and Ecocycles.**

Evidence of fractal Attractors (a force for creativity, sometimes a problem, but not inherently bad or destructive), exists in the immune system (which is now being explained as a network rather than an attack-defence system); the nervous system; and the olfactory mechanism of rabbits. Networks are predicted to explain Gaia Theory better than a simple multiple feedback loop model (Varela 1988: 210-214; Varela & Anspach 1991). The key notion is the Bose-Einstein condensate (all happening at once, in unison), as in neural networks and parallel processing, rather than a conventional computer model circuit which goes round and round sequentially as with digital computation. Recent advances in the ability to model such network systems appear to be succeeding in areas where Artificial Intelligence (AI) has manifestly failed in the past. Parallel processing and advances in analogue computation show promise for such representation in modelling, but are presently limited in the number of units physically able to be entrained (The Economist 1999: 10). Miniaturisation could enable rapid improvement of this type of arrangement. **Link: BP 5.3: Fuzzy Logic: Other Possibilities.**

Johnson¹⁰⁰, in a section of *"Networks in Action: Communication, Economics and Human Knowledge"*, supports his claim that the mechanisms underlying Network and Graph Theory are used intuitively for complex problem-solving, and are some of the most fundamental (Johnson 1995a: 25-31). This theory is highly accessible to people, since its language of nodes (dots, vertices), lines (edges, links), arrows (directions) and graphs (sets of edges and their vertices) is highly pictorial and the ability to grasp its symbology is evident from early childhood. Adults use

similar graphics (links, arrows, boxes) to represent design processes, computer algorithms and authority diagrams.

Johnson goes on to expand on the concept of connectivity. Tree structures represent partitional hierarchies well (divided into mutually exclusive parts), but not heterarchies (non-partitional, some components belonging to more than one classification simultaneously). Such relationships may be explored by theories of connectivity, including Graph and Network Theories. Q-Analysis provides a conceptual structure for analysis of connectivity, and thus of potential interaction, decoupling and transmission of effects along chains of connection. Many of these concepts have been developed with transport and communications in mind, but similar issues are raised under Hierarchy Theory in the context of ecosystem function and information ('signal') flows. Johnson warns of potential oversimplification of complexity by the use of pictures (for example the confusion of authority with power), emphasising the importance of striving for truth to the original (Johnson 1995a: 35-46).

Applications of this theory in eco-human interface problems may access a rich existing literature on Network Topology, over-capacity flow demands on a network, paths in networks (including shortest path), link composition, cliques and subgraphs (integrated subunits), cycles, multi-dimensional relations, lattices (egalitarian structures), the union and intersection of graphs (using Set Theory), and the differences between parts, wholes (with emergent properties) and the language used to describe them (Johnson 1995a: 47).

In conclusion, Johnson notes that these ideas have a background in well-known mathematical theory, are being used in the emerging fields of computer modelling and artificial intelligence, and offer much to the understanding of international economic systems, epidemic and crime control, environmental conservation, flows of goods and many other applications for highly complex problems.

This Theory forms the justification for later claims to the importance in planning, development, management and design, of incorporating learning systems, Constraints appreciation, sensitivity to poised system qualities and change amplification (see below), and seeking understanding of non-obvious loop connections.

7.5.4 SELF-ORGANISED CRITICALITY

US physicist Per Bak¹⁰² demonstrated two things of interest to this discussion. One, using an analog computer, simulated, one- two- and three-dimensional sandpiles.¹⁰³ It showed that complex systems evolve towards a state of 'self-organised criticality' termed 'poised states', where repeated perturbation would produce for equivalent stimuli, a range of responses from slight to total collapse, which could mathematically be described by a power law (fractal). The typical poised state could be an avalanche, an earthquake faultline (behaviour) or epicentre distribution, or a stock market crash. Others claim volcanic activity, forest fires, protein chain spirals, lung inflation (airway resistance), and helium isotope conductivity (Coveney & Highfield 1995: 188). This state has been interpreted by Santa Fe workers as occurring in the *Edge of Chaos* region. They found linkages to Catastrophe Theory on one hand and to the geological record of mass extinctions following the Precambrian explosion on the other (Lewin 1993: 60-61).

A cascade phenomenon ('domino effect') could be triggered by events of any size (including very small), with energy release inversely proportional to the frequency of the event (the Gutenberg-Richter Law - for example the 'hundred year flood' bemoaned by planning authorities).

A system in a 'self-organised critical state' is very far from equilibrium, resilient to disturbance, and gives out two 'power-law fingerprints' or 'signatures'. One is a fractal location in space (and sometimes time, as in turbulence), the other 'flicker noise' (1/f) of unknown origin, in time series (**Link: Fractals**). This is demonstrable in electronic resistors, hourglass sand flows, flows of the Nile, star luminosity (including Sun), economic indicators (Dow-Jones), cosmic matter, mountain landscapes and coastlines (Coveney & Highfield 1995: 183-5).

If sand is added continuously, one grain at a time, there are long static periods punctuated by bursts of activity, and increasing avalanche sizes with slope steepness. But at the critical slope, a critical state (strange Attractor operation) is reached where avalanches are of all sizes, erratic, unpredictable and inevitable. One more grain may set off a major avalanche event. **Links: Chaos, Catastrophe Theories.**

This is the pattern for population crashes, and the source of great fear amongst those EPPs who understand it, as they look around a biosphere that appears to be well on the way to a critical state of this type.

¹⁰² Brookhaven National Laboratory, New York.

¹⁰³ Now famous as the centre of argument as to reproducibility in real sandpiles (Coveney & Highfield 1995: 88-9).

This would suggest that in design projects, attention to the internal and external functional arrangements and hierarchical patterns of connectivity will be key issues for long-term ecological stability.

On a more mundane level, this approach is very helpful in designing transport systems, which are very prone to avalanches, blockages and secondary social impact, which is usually discounted by engineers, who create trouble precisely by thinking in hierarchies. **Link: Criterion Connectivity: Transit & TOD.**

7.6 TIME & CHANGE

7.6.1 TIME: A MULTI-DIMENSIONAL CONCEPT

Time is a complex concept with many facets, scientific and social. As an interval measure we use it to organise our daily and longer term activities. As a dimension we add it to other parameters in studying complex systems, but especially focus on four-dimensional models as representing our common space-time reality that we can follow as a succession of three-dimensional states (time series). In this sense time represents change or evolution (unfolding).

As a frequency or rate of return we approach the understanding of pulsating or oscillating phenomena and the organisation of the hierarchies which appear to structure ecosystems and in many ways, also social systems.

Complementarity Theory uses time (frequency) to distinguish between Complementary opposites through rate dependence or independence. The intuitive experience at human scale, of space and time as absolute, as for other scales, can only be investigated through relationships between events and the instruments used to measure them (Bohm 1965: 51).

Einstein established that space, time and matter were all relative (Davies 1995: 15, 102). Einstein and others have been interested in the warping of time by gravitation, and the relativities of time for space travellers. Prigogine, Davies and others have wrestled with the conundrum of the irreversibility of time (time's arrow) (Coveney & Highfield 1990; Davies 1995; Hawking 1988; Prigogine & Stengers 1984). In an isolated system, Prigogine argues at both Classical and Quantum levels, for a new type of Complementarity: a *Physics of Being* (reversible, time-symmetric) and a *Physics of Becoming* (irreversible, time-asymmetric, entropy-increasing) expressed by equations with reversible and irreversible parts (Baggott 1992: 176-8). He acknowledges, however, that reversibility is illusory, and related to theoretical idealisations which assume infinitely, impossibly precise knowledge of initial conditions, when attempting to predict the future behaviour of complex systems.

Time as a social process presents a further array of concepts. Past-present-future distinctions orientate Cosmologies, lifetimes, planning and diagnoses in Psychopathology.⁵ Jet-lag announces the body's confusion about time zones (Orme, 1978: 68); species (especially ranging animals) may co-spatially inhabit temporal niches with complete indifference to each other (Allen & Hoekstra, 1992: 154-7; O'Neill et al, 1986). Hypnosis, or the quality of present experience, can expand or contract time perception.⁵ Physical and biological rhythms dictate the

lives of all Earthly beings and contribute to the self concept of the conscious ones. The Dreaming concept of Australian Aborigines is an 'all at once' time sense with no Western-style sequentiality nor separation from future and creative past, a source of serious inter-racial misunderstanding (Orme, 1978: 74).

Metaphorically, time may be reified as a container (to be filled up, packed, be empty, be crowded, be taken over), a road (to be traversed, travelled, move forward in), a measure (timescales: clock time, goal time, time horizon, geological time), a resource or substance (to use, be invested, spent, have too little/enough of, have too much/too little on your hands, be spun out, saved, wasted, take more than your fair share of, be considered as money), a moving entity (which rushes by, passes quickly, stands still, needs catching up with) (after Lakoff & Johnson 1980). Time may be a measure of appropriateness (it's time to ... the right time to ... a just working day length) (Parkes & Thrift 1978: 122), or an activity label (personal time, down time, play time, meal time, quiet time). Ability to work with increasingly complex versions of time has been a feature of biological evolution (Orme 1978: 72-3).

Time as an issue demands attention from decision makers at all levels. The long-term has had increasing difficulty inserting itself into short-term economic and political agendas, the call for preservation of the capacity of future generations to meet their needs notwithstanding. 'Needs' is a tough issue now, *let alone* long-term. Communities are aware of an ever-accelerating rush to meet their perceived needs - the Red Queen (see below) running rampant (but in MDCs, most 'needs' are skilfully-marketed wants). Toffler's observations of 1970 are in many ways affirmed, as accelerating rates of change demand time compression (Toffler 1970). Older people are aware that time is increasingly fully packed and differently spent from 20 years ago, while some groups of 'neo-primitive' environmentalists and neo-Classical politicians seek to turn the clock back to simpler, less affluent times.

With a new consciousness of transition and change, and the discovery that efficiency is actually cheaper, new forms of architecture, design, planning, environmental management, economics and so on are emerging, which are interested in capturing the features of evolution, self-organisation and ecological principles. In UHSE below, I have used the term 'Rheotics' to capture this time baggage, in honour of David Bohm.

7.6.2 EMERGENCE

Emergence has been defined as:

The appearance of properties that are neither properties of any parts of a system taken in isolation nor resultant from a mere summation of properties of parts of the system.¹⁰⁴

or

order arising out of a complex dynamical system ... global properties flowing from aggregate behaviour of individuals (Lewin 1993: 13).

Emergence refers to a characteristic of self-organising systems whereby a new global order with new properties, rules and behaviours arises from the non-random interfacing of lower level components, which constitute the mechanism of the level above, and are in turn affected by the upper level. But one can not predict the global properties (Langton in Lewin 1993: 12-13). This is illustrated in **Figure 26: CM: Emergence in Complex Systems**.

Emergence is part of a creative and unpredictable process, and often generates Surprise, especially in systems where the control parameters and conditions for phase change are not known. In this region, chaotic régimes oscillate and new patterns may emerge through bifurcation or catastrophic processes.

A system responds to lower level instability (perturbation) by incorporating the perturbation into a new higher level system. Allen & Hoekstra give the excellent example of fire-adapted vegetation where at the lower level (smaller scale) fire is a specific hazard, but eventually for the higher level of the whole community, a situation emerges where fire is necessary for survival while still remaining a hazard for the individual stand (Allen & Hoekstra 1992: 82).

Examples of emergence are ubiquitous. An association of individual organisms at the lower level may emerge as a new system resistant to predators at a higher level (Lewin 1993: 13). Our misuse of antibiotics and neglect of the realities on connectedness seems to have set the conditions for new micro-organisms to emerge (as described in Gould 1993;McMichael 1993: 203-221). Consciousness may be explained as an emergent property of nervous tissue and chemical messengers (Lewin 1993: 13-15;Zohar & Marshall 1994: 41).

O'Connor and McDermott list common emergent entities, including life, tornadoes, temperature, pressure, computer software bugs, emotions, music, rainbows, culture, consciousness, team morale, clouds, health, laughter, dreams and pain (O'Connor & McDermott 1997: 8).

¹⁰⁴ Jurgens Pieterse, wholesys listserver wholesys-l@netcom.com/.

Psychotherapists, urban designers and q-analysts (Gaspar & Gould 1981; Johnson 1990b) rely on emergence when they analyse hierarchies of connectance or attempt to set up 'Backcloths' to nurture particular types of personal or social responses.

The capitalist economy emerges from Adam Smith's 'invisible hand' (the aggregate behaviours of consumers, producers, information, psychological drives). Marketing is designed to stimulate specific types of emergent demand by exposing audiences to product images which claim nonverbally to heal deep seated insecurities. **Link: Confluence: Transition: Table: Adam Smith's 10 Rules for Mindful Markets.** Education is designed to support the emergence of human beings with particular knowledge, learning and adapting styles. War is a predictable emergent from a particular backcloth (Casti 1993: 253-322). Politicians seek emergent support by engineering press releases, strategic interviews and other ways of 'looking good'. Organisations hold 'brainstorming' sessions wherein a chaos of wild ideas sets a creative substrate for the emergence of a group solution.

The harnessing of emergence is a key skill for eco-designers and allowance of time for evolution and emergence is crucial to design and other creative processes (**Links: Confluence: OCW Project; Process: Tools**). It is a central justification for major focus on Backcloth development at all scales of human settlement design, including building in *Edge of Chaos* processes and significant user involvement, for long-term liveliness and flexible adjustment.¹⁰⁴

7.6.3 STABILITY, SYSTEM STRUCTURE AND EVOLUTION

Current Complexity Theory as seen above, sees creative change as a result of fluctuations at the *Edge of Chaos* as the source of emergence of new entities. The dynamics of this balance between order and disorder have been studied extensively through Boolean networks by Kauffman, who has demonstrated by comparing high and low-connectivity networks, that a phase change in behaviour occurs suddenly to produce a high level of collective order and resistance to perturbation where each element is connected functionally by two inputs (Kauffman 1991: 67-9).

Beyond three connections, chaotic conditions apply unless Boolean switching rules of the OR type pertain (a 'canalising function'). In food webs, 'qualitative stability' is strongly related to patterns of connectivity, with stability best conferred by overall branch-chain structures and isolation of loops within subsystems. A social example could be the stability conferred by family

subsets within a larger society vs the chaotic conditions of adolescence. A whole society behaving like opportunistic adolescents, living in the present, confers massive instability. Most of our present ecological problems are the result of slow loops being set up by short-term activities (for instance 'extinction debt' in biodiversity and delayed salinisation). For random, homogeneous structures, one unstable element would destabilise the whole, indicating the need to explain the field observation of significant actual resilience and stability in the presence of numerous entities. Connectivity through (frequency) hierarchical structuring has been shown to confer resilience (whole system Lyapunov stability - to perturbation) when all the subsystems are nested and stable ('connective stability'). The same is true for ecosystems when arranged into holons (functional units operating at similar frequency) (O'Neill *et al* 1986: 130-34, 134-41),

Such structuring results in functional isolation of cells of activity, organised around one or more local Attractors, and resistant to all but large perturbations, only the largest of which can shift the system across to a different Attractor. Thus systems with high actual connectivity (many variables, strongly and/or directly connected) may be functionally low-connected due to structural 'gates' [my term].

Casti describes a q-Analysis q-Connectance and *Eccentricity Index* model for structural analysis of food webs¹⁰⁶ (Casti 1994: 187-89). Kauffman (Kauffman 1991: 68) uses Langton's (non-literal) analogy of likening network behaviour to the phases of matter: solid (ordered, 'frozen') - liquid (unstable, 'melting') - gas (chaotic). The liquid phase corresponds to the *Edge of Chaos* region, where parallel processing networks become capable of highly complex computation, communication (mutual impact on behaviours) obey power law (fractal) distributions, minimal perturbation causes 'small avalanches' of local change or damage, while rarer large avalanches represent communication from more distant sites: the characteristics of a 'poised system'.

Kauffman goes on to suggest that while Darwin explains evolution by the accumulation through mutation of successive minor variants,¹⁰⁷ the capacity to evolve is constrained by code compression, and not all systems have this kind of capacity. But living systems, characteristically poised, typically adapt in a punctuated fashion (usually gradual, sometimes rapidly). He goes on to hypothesise that cell types may be Attractors with the emergent property of stability, and demonstrates a number of mathematical relationships relating combinations of genes, cell

¹⁰⁵ At the *Innovative Housing* Conference (Vancouver 1993), two Canadian designers presented posters on the 'Grow Home' concept for low-medium income people. These are designed for easy internal change, and external additions as the needs of the residents change over life cycles (Friedman 1994; Pogharian 1994).⁵

¹⁰⁶ This takes a good grasp of connectivity, but in this simplified version which in fairness, I have not followed back to the basic science, does not here indicate any attempt to address chaotic phenomena.

¹⁰⁷ Equivalent to the 'tyranny of small decisions' and Cumulative Environmental Change in Planning.

numbers, DNA and so on, for which his hypotheses are borne out in biological systems research (Kauffman 1991: 68-70). Thus, while unstable elements (Synergetics below) may entrain others in transitions, stable elements may act as Attractors, around which the system finally settles. [Note analogy to society, and applications to EPP persistence, public consultation and education].

At a larger scale, Costanza *et al* seek efficiency concepts for Evolutionary Economics. They link the storage of information for transmission to new generations, the manner of generation of new alternatives, and the mechanism for selection of superior entities, with the general rate characteristics for the interest areas of Biology, Culture and the latter's subset Economics (Costanza *et al* 1993: 550-1). This is presented in **Table 43: CM: Evolution: General Paradigm after Costanza et al** Costanza raises a number of questions and challenges from the analysis (see Table).

Allen & Starr re-visit their discourse on Complementarity in order to apply it to Evolution. They differentiate two, Complementary aspects of evolution (Allen & Starr 1982: 57-66):

1. The rate-dependent, law (of Nature) driven, chance-based, mechanistic evolution of Darwin, which is backward-looking, records past changes in DNA and genetic drift, social, psychological or physical change.
2. The rate-independent, rule-driven (order-dependent), purpose and function-motivated, anticipatory evolution that enhances the survival opportunities of successful species through pre-adaptation. Biota may change before the new season starts, in anticipation, for instance.

An anthropocentric approach is presented by Buckley¹⁰⁸, who argues for a 'Non-Equilibrium Thermodynamics' of sociocultural systems, and for an evolution of strategies for evolution itself (Buckley 1977: 248-257). Kauffman also hypothesises the evolution of the capacity to evolve (Kauffman 1991: 64). Buckley defines evolution: "... evolution, from the chemical to the sociocultural level, is the gradual, more and more refined and extensive mapping of the relevant environmental variety and its constraints into the structure of the evolving system in the form of organising principles and coded information" (Buckley 1977: 248).

The gap between genes and behaviour has increased with increasing behavioural plasticity and flexible capacity for learning. Evolution has produced increasingly efficient environmental mapping and knowledge transmission strategies which can be classified as phylogenetic (Darwinian, genetic codes), ontogenetic (learning, neurophysiological codes) and sociogenetic (sociocultural normative codes).

¹⁰⁸ Reportedly a proponent of Eugenics and Social Darwinism.

Calling the criticism of Social Darwinism¹⁰⁸ “the fallacy of misplaced levels”, Buckley explains that the evolutionary analogy between Society and Biology does not break down as often asserted (because humans are only one species). At the appropriate scale sociocultural systems could well be classified in terms of species, genera and families (Buckley 1977: 254-5), just as individuals vary in psychological styles and survival strategies but these can be grouped into types (Mary Douglas’ work for example). Buckley traces the evolution of the human social bond (descending): a summary of his classification is found in **Table 44: CM: Evolution after Buckley**. Current painful, socio-political adjustments appear to represent a punctuation period in all three of Buckley’s evolutionary sectors.

On the scale of human society, a number of authors have spelt out a series of phase changes or ages, which represent the evolution and self-organisation of the larger system over the last few thousand years. **Table 45: BICM: Developmental Stages of Human Society** draws some of these together as a Backcloth for Criterion Rheotics. Evolution continues, and we are participants, irrespective of our ascriptions, Nature can be ‘red in tooth and claw’, and in its image, so can Markets. More than ever before, our fate rests with the Biosphere’s ability to keep coevolutionary pace with the rapidity of the change we are imposing on it.

7.6.4 CO-EVOLUTION & THE RED QUEEN

The second finding of Per Bak (self-organised criticality), concerns co-evolution. At large scale, the geological record pattern of ‘punctuated equilibrium’, of evolution in bursts followed by extinctions, (“repeated collapses of biodiversity”) (Lewin 1993: 64), suggested that self-organisation to the critical state (normal for CDS), may then be perturbed externally. This would reduce fitness of some species, triggering effects that alter the fitness landscapes of other connected organisms. In periods of fast evolution, low fitness pertains¹⁰⁹ and mutation events increase in an effort to improve fitness (implying an active engagement by living entities in evolution, not just chance). Environmental perturbation may lead more easily to mass extinctions in this state than during relatively static eras of higher fitness/resilience and low evolutionary processing. In low connectedness situations the perturbation is rapidly damped; for high connectedness, the perturbation is transmitted throughout the system, with chaotic (large) effects, and for intermediate, *Edge of Chaos* situations, small cascades or avalanches may be triggered, which latter become mass extinctions (Coveney & Highfield 1995: 233-4; Lewin 1993:

¹⁰⁸ Note: Sociobiology has been controversial over time, as many of its adherents support Eugenics, or are claimed to.

¹⁰⁹ Note the escalating bill for antidepressants, antihypertensives, all other medications, and youth suicide in this and other MDCs.

61-2). This is our present experience under 'Globalisation'. **Links: Hierarchy Theory; Criterion Connectivity.**

At the community level, the co-evolutionary relationship between contiguous species suggests analogies with nations and industrial organisations. The 'Red Queen' hypothesis (RQ) has been taken up by Kauffman in his work on coevolution and rugged fitness landscapes. Van Valen first suggested the term in 1973, quoting the Red Queen from Alice in Wonderland ("*Through the Looking Glass*"):

... it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that (Carroll 1960: 210).

the point being that species form part of each others' environments, so any evolutionary change in one may disadvantage another. To keep ahead, organisms participated in 'arms races', the ability to adapt quickly having evolutionary advantage (after Dawkins & Krebs) (Stenseth 1986: 132). Workers like Stenseth and Maynard-Smith were at that time looking for evolutionarily stable strategies (ESS) and assuming only individual selection to operate, with equilibrium and competition the norm "... if most of the members of a population adopt it, there is no 'mutant' strategy that would give higher reproductive fitness" (Maynard-Smith & Price in Stenseth 1986: 132: 123). It does not appear to have occurred to anyone to look for cooperative behaviour rather than or as well as the competitive.

A theory of non-invadability was proposed for communities with stable equilibria (environment stable), and conclusions were drawn:

- That mechanism can not be deduced from evolutionary patterns (notably the punctualistic fossil record)
- The Red Queen mechanism is plausible and may lead to RQ type evolution or stagnation, leading to a 'Law of Constant Extinction'
- In a persistently stable environment increasingly complex forms evolve
- The tropics are the 'cradle of most of the world's biota' but a bad museum due to higher biodiversity and thus extinction rates
- Environmentally unstable regions produce more evolutionary novelty
- With more work the RQ model was thought to be likely to explain convergent evolution (Stenseth 1986: 133-6).

Without agreement on Patten & Auble's (1980-1981) claim that evolution favours ecosystemic linearity, Stenseth suggests borrowing their concept 'environ': the unit of organism-environment coevolution as a new approach to evolutionary research.

The work of Kauffman and Johnsen in modelling and tuning 'rugged fitness landscapes' (after Wright) has indicated the importance of coevolutionary dynamics where abiotic environment and other organisms, all changing together, form the context for evolution, especially in molecular systems. His NKC model (N = no. of traits or genes; K = no. of other genes or traits with impact on fitness contribution of each gene or trait (epistatic linkages); C = traits in other

species with which each species interacts)¹¹⁰ enables study of the qualities of different levels of connectedness. It also displays the landscape-deforming effects of change in a component entity and coevolutionary adjustments as the components struggle to achieve optimal fitness.

Mutation in one component may or may not advantage other components. The richness of intercoupling of coevolving ecological systems and the tuning to 'Nash equilibria'¹¹¹, determines a metadynamic which in distributed ecosystems (interaction of only a few species), leads to a poised *Edge of Chaos* state prone to minor exogenous change, causing coevolutionary avalanches across the system, with power law distribution (Kauffman & Johnsen 1991: 467-9).

Kauffman in reviewing the conceptual outline of Evolutionary Theory, suggests that the existence of self-organisation of complex 'wholes', would overcome the mystery of inadequate time which pervades Evolution Theory.¹¹² Issues such as natural selection either of individuals or species are not here contradicted, but spontaneous order is offered to evolutionists to integrate into their theory (Kauffman 1993: 21-5). Ultimately, he sees his model of random grammars and interacting strings as a generic, applicable to functionally integrated and interacting (self-replicating¹¹³) systems of many types. These include: molecular, biological, neural (artificial intelligence: parallel processing neural networks), psychological (Gestalt Psychology, ego structure & conceptual webs), technological webs (technological evolution, economic goods & services) - which questions assumptions of Neoclassical Economics), and cultural (cultural coherence) (Kauffman 1993: 387, 394).

This work indicates the vulnerability of low-connected monocultures to catastrophic coevolutionary change, and demands attention to the evolution of spontaneous order, which is connectivity and environment dependent. Again: evolution did not stop with Darwin, but continues, we are now in a phase of vulnerable, accelerated coevolution, and coevolution involves the environ: the complex of biotic, abiotic and human components all in interaction.

¹¹⁰ A rugged fitness landscape can be thought of as a rugged plain with fitness peaks of different height and steepness. To move from one to another a transient decrease in fitness is necessary: an analogy for any major change to sustainability Attractors. Coevolving entities congregate at different local fitness peaks in dynamic inter-relationship. S = total no of species which interact. S_i = no of species affected when any species i interacts. Increasing epistatic linkages increases landscape ruggedness by increasing the number of peaks, increasing the steepness of the sides and decreasing the height (by introducing conflicting constraints). Altering C for one species skews the landscape for other species. Two versions of the model exist, one including Lotka-Volterra logistics for evolution of competition or mutualism (Kauffman & Johnsen 1991: 468-9).

¹¹¹ Local optimal fitness relative to the available genotypes and stable population density.

¹¹² There is a dissonance between the time taken for evolutionary mechanisms as proposed by Darwin, and the actual time available for them to have occurred. Thus Darwinian evolution can not be a complete explanation.

¹¹³ "... a string represents a polymer, a good or service, an element in a conceptual system, or a role in a cultural systems. Polymers acting on polymers produce polymers; goods acting on goods produce goods; ideas acting on ideas produce ideas." (Kauffman 1993: 387).

7.6.5 FITNESS

7.6.5.1 Fitness as Ability to Survive

It can be seen from the above discussions that fitness is a multi-scalar issue: each level of a hierarchy will have its local definition, and each will participate in the fitness of the entity as a whole. In the context of optimal eco-social survival, both the eco and the social must be taken into account. Fitness implies an ability to survive in a given environment, and becomes difficult to assess when the latter is changing in uncertain ways and feedbacks operate in both directions. The term was not intended by Darwin to apply to individual entities, but rather to whole populations.¹¹⁵ Parallels between ecological and economic/financial fitness (7.6.5.1-3) should be noted.

While ecological survival and the objective of emulating, restoring and conserving habitats and ecosystemic function, forms one concern of EPPs, the other major concern is human personal and social fitness, including personal (psychological and spiritual) growth, and intangibles like 'glue', so important to community' survival.¹¹⁶ Buckley points out that most human sociocultural systems have not in fact survived (Buckley 1977: 253).

Clearly, where basic human personal and social, and local ecosystem needs for optimal functioning can be established, the meeting of these needs is crucial for ongoing high level wellness in both cases. **Link: Criterion Organism.** This is the basis for the human and urban ecologist's demand that Nature be aligned with, healed and supported, and at the same time that the social climate be just and nurturing. Meeting these basic needs should also influence the selection of indicators, and needs-based Planning and Design. **Link: Criterion Indicators.**

While there is considerable elasticity, there are also quite sharp thresholds and the potential for low frequency perturbations initiated by activities in the present. Fitness is the flip side of sustainability, and we must always ask "fitness for what and whom?" If we fail to do so, the system will make its own decisions anyway, and go with the vectorfield.

As long as current environmental conditions are part of an organism's genetic history, adaptation may be possible by reversion to developmentally earlier functions: the less specialised the organism, the more available the strategy. If change is too fast, context replacement is impossible or redundant capacities are unavailable, extinction is likely.

¹¹⁵ Kirkpatrick Sale interview, "Deep Ecology for the 21st Century" #7, 5RN 1999.

¹¹⁶ Interviews at Findhorn, Scotland, established that the reason credited with the longevity of the community, was the obligatory weekly meetings where all issues and frictions were publically faced and dealt with in group ('Attunement').

7.6.5.2 Fitness as Ability to Maintain Dissipative Status

Adams redefines fitness as retention by an energy form of its capacity to maintain its dissipative status. By subordinating form to process in this way, a simple definition of sustainability follows: for genetic materials (reproduction), for individuals (biochemical maintenance), for information (linkage to an energy form, always dependent on its fitness/dissipative character for context), for culture (two completely separately evolved components, culture traits as substantive energy forms, and mental models with meanings, but what constitutes fitness in these cases is unclear) (Adams 1988: 124-6, 131). **Link: Models & Mindscapes: Application of Ecological & Systems Constructs to Human Systems: Ellen.**

This has implications for co-evolved entities (two or more, which partly provide environment for each other). A loss of dissipative fitness in one will impact upon others. Thus for a whole biosphere full of ecosystems, fitness would consist in an ongoing, collective, co-evolved, eco-chemical maintenance, as measured and responded to on the basis of system health indicators for ecological services. This highlights the conservation of all scales of biodiversity (and thus, habitat), as the *sine qua non* for sustainability in all human 'sectors'.

Adams points out that co-evolution has no requirement that reciprocal effects be equal, and describes a number of different patterns, and also problematic patterns of increased dissipation expended by the regulatory sector to minimise fluctuations initiated by lower eschalons in hierarchical human systems¹¹⁶ (Adams 1988: 138-9).

... natural selection is the process of survival of an energy form in the course of the self-organization of itself and of the larger environment ... biological natural selection can occur between any set of self-organizing "individuals" at any level ... the selective universe [is] a series of concentric, overlapping aggregates in which energy forms of varying complexity are constantly emerging, self-organizing, and being confronted with challenges to their dissipative integrity (Adams 1988: 129).

Development, by Adams' definition, is "the increase in per capita energy consumption in a society" (Adams 1988: 240). It is seen as a continuation of the pattern extant in human societies for 10,000 years. He warns:

All societies today are under both internal and external influences to expand their uses of energy. While how they do it is expressly part of their own self-organization, that they do it is creating a more demanding field for natural selection (Adams 1988: 242).

Put another way, increasing population in itself implies an increasing demand for dissipative structure directly and through material throughput. In a constantly-expanding, dissipative system, where dissipation suffers diminishing returns on energy efficiency from a particular source, (having taken up all feasible options for increasing efficiency), then either a new energy

¹¹⁶ No doubt the reason the populace becomes uneasy when governments use guard dogs and legislate for domestic military intervention in a society claimed to be democratic.

source of greater efficiency (implying more fuel with low pollution, pollution representing waste plus toxicity, which further limits material quality), is required if material structure is to keep expanding. Otherwise that expansion must be funded by replacing physical structure with virtual, or the expansion, the energy and the materials throughput will not be sustainable. For all these reasons, unconstrained economic (inevitably physical) expansion (as required by the Capitalist and Market Fundamentalist systems) is unsustainable, and *Homo economicus* is an endangered species, regardless of population. **Links: Theory of Scale: Dominance Hierarchy; Criterion Ecocycles.**

Another point concerning dissipation relates to specialisation: Increasing specialisation results in higher but very specialised dissipation. When a system collapses, it needs its generalists in order to re-tune it to the changing environment. I would argue that we have taken specialisation to such a level that our loss of the big picture is affecting our ability to respond effectively.

7.6.5.3 Fitness as an Emergent From a Supportive Backcloth

In design projects we need to turn all the above upside down and ask how do we design something to be sustainable and to last. Much of the time we are only guessing, and it will take the actions of the many to make a difference. Here again, the q-Analysis concept of 'Backcloth and Traffic' is helpful. In the end, the species we deal with have basic survival needs, they live in our environment and we all participate in a nest of ecosystems. Our task is to weave a Backcloth that supports the emergence of good health and survival of our clients and co-dependents, based on how systems work, and what they need. The Traffic that runs on our Backcloth is not just the human client and his or her project. The other biota and ecosystem are always our clients at the same time, however indirectly. They are Complementary in the Quantum sense.

Link: Criterion: Feedbacks: Fuzzy Sustainability Space.

7.6.5.4 Ultimate Fitness

However much we play with words, fitness and 'Sustainability' are about the web of life. Our actions are or are not *con-vivial*.¹¹⁷ Possibly the most interesting definition of 'Sustainability' I found was the following:

We cannot and don't want to guarantee persistence of any one system in perpetuity. We want to preserve the capacity of the system to change. Thus sustainability is never achieved once and for all, but only approached. It is a process, not a state. It will often be easier to identify unsustainability than sustainability (Robinson, Francis & Lerner 1990: 44).

7.7 FAR FROM EQUILIBRIUM SYSTEMS

7.7.1 EQUILIBRIUM AND ECOLOGICAL SYSTEMS

As mentioned in Energy & Thermodynamics above, living systems develop dissipative structures that maintain them far from thermodynamic equilibrium or system death. System integrity implies the ability of a dissipative system to maintain its structure or internal organisation in the face of external (sometimes internal) stressors, which may be abiotic, biotic or human (Kay 1991: 483). Kay outlines four available responses of such systems to perturbation ('stress-response'):

- Temporary unsettling with no operational change
- Shift to a different operating level using the same structure (for example population change)
- Emergence of new, extended or replaced structural parts: some new components (for example new species or energy/matter in web path)
- Emergence of a new dissipative system with completely different structure (Kay 1991: 489).
[* Collapse of the system].

Kay notes that since dissipative structures are inherently surprising, management strategies must always include coping with Surprise. Furthermore, ecosystems (or any dissipative system) must now have an anthropic component and recognise the dependence of present resilience on past impacts, both positive and negative (Kay 1991: 484, 489). In effect, past impacts become built in as part of the system structure (for instance fire régimes, watering/irrigation régimes), remaining legible to the trained eye, much as redundant proteins in genes and the nearly unique human inability to make Vitamin C are indicators for past conditions. This remains true in a human settlement context, and justifies the inclusion of ecologists in urban development teams and on planning staff – not shut away in local government environment departments.⁵

The developmental pattern of SOS is characteristically punctuated, tracing a path in 'state space'. An optimum operating point (OOP) which changes over time as membership parameters change, may be defined, but is not unique, as there will be many options for maintaining system integrity, some of which will coexist, with gradual loss of internal organisation. Sudden acceleration, quiescence and catastrophic change to higher-connected energy dissipation are all possibilities in such a system. This situation is diagrammed in **Figure 27: CM: System Responses to Environmental Change**.

There is an inherent difficulty in the quest to define 'sustainability' if system integrity is defined as "... ability to maintain its organization and to continue its process of self-organisation" (Kay, 1991: 484). As Kay says, several pathways, nonlinear, possibly discontinuous and multivalued, are available to ecosystems, and with each systemic shift, questions arise as to the distance between

¹⁷ Con = with; vivere = live (Latin, COD).

old and new operating points, the time taken to equilibrate, the stability of the new position and the location of the optimum point in relation to the original structure (hysteresis phenomenon) (Kay, 1991:487). Cases illustrating these points are summarised in **Table 46: CM: Kay's Cases: Stability & Equilibrium. Link: Holling's Infinity Loop.**

Kay defines a thermodynamic branch as "the path through state space followed by an ecosystem as it develops from (thermodynamic) equilibrium to its optimum operating point (OOP - that is steady-state, relatively stable equilibrium point in state space which is far from thermodynamic equilibrium) under normal conditions." (Kay 1991: 491). He differentiates this from Prigogine's definition that stops at the first instability point (rather than taking in the whole trajectory), as being suited to simple physical systems but not complex ones. He does point out that along with the environmental parameters, the equilibrium point (balance point of forces) is constantly changing in fact (that is, a dynamic equilibrium), but is easier to describe statically.

The issue of the stability of the equilibrium point is a function of the type of Attractor system in force. The usual Attractor types (point, cyclic, chaotic) are possibilities. Thus there may be relatively fixed-frequency cyclic stability [*assuming environmental constancy*]. Catastrophe Theory also applies, so there may be dramatic discontinuity at critical thresholds (Kay, 1991: 490-1). Kay's literature search for 'ecological stability' produced an array of approaches to the definition, and several lists of essential properties, summarised in **Table 47: BIRR: Ecological Stability: Definitions, Studies & Themes** and **Table 48: BIRR: Well-Behaved Systems.**

Clearly, for ecologists to intercommunicate appropriately, let alone participate in cross-disciplinary discussion, concept integration is imperative: a task that Kay attempts by broadening the definition. Holling also complains that many studies confuse stability and resilience, and that low stability can accompany high resilience (Holling 1986: 308). His definitions of resilience and stability appear to indicate an orthogonal relationship, balancing high variability with adaptation to change, with low variability with resistance to change, respectively. In EPP conversation, the two are often conflated or misunderstood.⁵

Holling prefers a [*Complementary*] qualitative definition, that includes not just a composite of dynamic stability/resistance concepts, but an attitude to complex systems. He feels this attitude should include a policy of maximising the zone of Stability (resistance to change) by allowing flexible adaptation (Resilience): evolution, self-organisation, internal homeostatic control, and the integration of the system into a larger whole. This would seem to be a good starting point for assessment of the sustainability of human interfaces with ecosystems. Holling's view of

Resilience focuses on two scales: global (Geophysiology) and local Surprise (Biogeophysiology). He presents a series of views on equilibrium (similar to those of Timmerman above), related management styles and their implications, are set out in **Table 49: CMES: Positions on Equilibrium & Environmental Management** (Holling 1986: 293-6).

As with the Timmerman Myths, EPPs would not all fit into the same category, but would generally follow Resilience and Evolutionary approaches.⁹⁵ This dissertation follows the Holling definitions.

7.8 HOLLING'S INFINITY LOOP

A synthesis of research studies in Ecosystem Science and Population Ecology has led Holling to propose a four-stage, ecosystem functional events flow cycle, which appears to hold for ecological, social, economic and similar Complex Dynamic Systems. This supersedes the traditional version of ecological succession as an inevitable progression to a mature or climax state and allows for cyclic or spiral evolution in complex dynamic systems, simultaneously linking with Hierarchy Theory (Holling 1995: 20-25). The elements are explained in **Table 50: CM: Holling's Infinity Loop Model Elements**, and the Model is presented in **Figure 28: CM: Holling's 'Infinity Loop' Model**.

The four stages correlate energy, and capital (nutrient/materials) storage, and system connectedness with the different stages. This model cycles through stages of exploitation, conservation, release (through 'creative destruction') and reorganisation (Holling 1995: 22).

These cycles occur on many levels of a frequency hierarchy, the pattern being similar from scale to scale. The conservative phases have slower return times than the others, and tend to be predictable, lower dissipation (more energy efficient), have more embodied capital (structure, materials, embodied energy) and have association with different types of biota in parallel with these stages.

Examples in human settlements would include the urban renewal process, political and business cycles, biotic life cycles, the Earth's ecological services, the development of businesses and organisations, regrowth of unmanaged cleared land, structural adjustment programmes in the third world and under Economic Rationalism, and anything subject to perturbations such as fire, flood, ferals or pests. The ecological approach attempts to honour these cycles, rather than over-ride them with linear strategies such as 'end of pipe' solutions to waste management or

chemical-based monoculture agriculture. Business recognises that sales of a product go through this sort of cycle, and understand that they have to reinvent or rebadge/repackage their product every few years to retain their market share, regardless of its quality or inherent usefulness.¹¹⁸

These phases have different frequencies (slow, fast). Accumulation and reorganisation of capital involves energy, carbon and nutrients in ecocycles, but other types of capital in other contexts, including information or knowledge. Importantly, the release and reorganisation phase involve chaotic conditions, which may manifest with widely differing and unpredictable levels of crisis or disturbance, depending on initial and environmental conditions. These patterns have been identified at all scales and across ecological, social, economic and organisational realms. **Links: Tools 3.11, 3.12.**

Table 51: BIRRCM: Key Variables & Speeds in Managed Ecosystems transcribes Holling's collation of variables and speeds, which he could substantiate scientifically in 1995 (Holling 1995: 27). This pattern has been proven for boreal forests, prairies, pelargic ecosystems and the Everglades wetlands.

Plants, animals and abiotic elements of ecosystems are subject to only a small number of key structuring processes which entrain the rest. Fast scales are dominated by fast things, for example geophysiology, fast-turnover grasses, leaves and small plants; animals. Larger tree parts and abiotic disturbances predominate at intermediate frequencies. Geomorphology and whole forests are slow influences. Identification of such variables for a particular place is the key to Restoration Ecology and Ecological Management (Holling 1992: 449-50; 1995: 26-8), and should be included in pre-development assessments, and integrated into long-term, regional landscape plans.^y In urban areas where the only option is restoration, these concepts must be built into the Backcloth, or time, energy, materials and personal effort will be wasted, as planted trees and re-introduced animals die.

Characteristic regular clusters in space and time can be identified: a 'lumpy' spatio-temporal arrangement of species across a landscape, that is represented and further explained in the space-time diagram in **Figure 29: CM: Holling's 'Lumpy' Landscape**. **Links: Hierarchy Theory; Criterion: Biotics.**

Biodiversity impacts are predictable from satellite imagery or land use plans, as to scale and type of entities subject to impact; for instance animals of particular body mass may be vulnerable

¹¹⁸ Kelly Geddes, Senior Manager, Canterbury Clothing Pty Ltd, personal communication, 1997.

(intermediate scales), or climate change impact on vegetation will be slower but far more extensive (Holling 1992: 449-50;1995: 26-8).

Thus the Infinity Loop model indicates the processes likely; spacetime diagrams help locate the spacetime scale, or extent of a constraint system and the likely victims of impact. It has also been taken as a basis for choosing appropriate styles of organisational and inter-organisational collaboration, learning, action and resource mobilisation, to match these different states (**Table 52: CM: Infinity Loop Collaborations**). It has been found that with appropriate organisational management, much of the unpredictability of the creative destruction phase can be pre-empted, capitalised on and minimised, if the system goals are achieved in other ways, and even allow a smooth, continuous, revitalising change without de-stabilisation (Westley 1995: 411-21).

'Adhocracies' have special survival talents due to their flexibility. A balance needs to be continually worked for as the cycles change, between minimising destruction (some may be a good thing), structure without excessive rigidity, openness to 'regenerative learning' (flexibility around changing Myths) while keeping a sense of direction, and steering between efficiency and redundancy. This process is enhanced by a nurturing and 'tweaking' or 'gardening' planning style that avoids controlling, appreciates diversity and 'orchestration', and acts on new ideas that may arise from adapting flexibly to active 'feelers' in the environment. These latter may be responsive individuals in professional networks, or employees at the 'coalface', often those at the bottom of a dominance hierarchy. Furthermore, effective management, low ecological impact and ecologically exemplary products and processes tend to go together (Westley 1995: 426-7).

The solution of a puzzle of ecosystem organization helped clarify what the attributes are that determine ecosystem sustainability ... a few simple processes seem to generate the great complexity and diversity ... ecosystems are hierarchically structured into a number of levels. Relatively few processes determine this structure, and each imposes distinct frequencies in space and time on the ecosystem over different scale ranges. They entrain all the other variables. Hence both sustainability and diversity are determined by the structuring variables of disturbance and renewal that control the lumpy geometry and the lumpy time dynamics ... they set the stage on which the other variables play out their own dramas (Holling 1995: 32).

... not only do dynamics in social systems create crisis in ecosystems and vice versa but also the same means must be employed to create organizations capable of managing ecosystem resiliency in their own right ... Barren, overly structured organizations create barren, brittle ecosystems ... The key to managing this similarity lies in the design of the details¹²⁰ within organizations and networks, where the grand order is found in small processes (Westley 1995: 427).

¹²⁰ For human systems, yes. For Nature, the design is there already.

7.9 SUMMARY COMPLEXITY THEORY

This section introduces Complexity Theory per se. It has many components, all inter-related.

We are only recently coming to recognise that these conditions exist, and that our customarily linear responses are potentially dangerous in a multi-dimensional world. Most socio-cultural systems over history, have not in fact survived.

Humans live in and are adapted to conceptualising, a four-dimensional world, and need extra skills such as 'systems thinking', pattern recognition and extension by computer, to attempt to manage higher-dimensional systems.

The first step is to understand what complex conditions are and how they work. The second is to wonder how this might apply to our daily lives and the critical decisions we need to make in the coming years. The third is to move conceptually into full Rheomode. This is the justification for including this substantial review in this dissertation.

This and the next section attempt to explain HST without the Mathematics, to provide a working, background knowledge for better judgment within an ecological approach to humans and their settlements, and to justify the presence of the various Criteria of Observation developed later under UHSE. It intends to link the more naïve Complexity notions of EPPs, with a narrative that justifies them scientifically.

Dynamic Mathematics began in the 17th Century, Poincaré's 'modern' work in 1882, and mainstream recognition came in 1950. Chladni's discovery of the limit cycle through musical experiments is regarded as the abstract equivalent of discovering the wheel.

Definitions of Complexity tend just to list the characteristics of complex systems. These include nonlinearity, fractal mathematical structures, Surprise or Catastrophe proneness, hierarchical structure, subject-dependence, exquisite sensitivity to initial conditions (system history), decentralised controls, energetic openness, constant interface with context, special sensitivity to information, conditional probability, variable containment of the whole in the part, wholistic internal connectedness, interpenetration of multiple space and time scales, unpredictable exponential magnification of minor signals by positive feedback ('butterfly effect'), and unpredictable spatial and temporal responses to stimulus.

The concept of a 'complex, dynamic, non-linear, self-organising, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*', is grounded in Thermodynamics and the special ability of

systems with living components to be open to both energy and materials, and mitigate the Second Law by sensitive response to information and the diversion of energy through organic structure (dissipation). A discipline perhaps properly labelled 'Energetics' has been thought by a number of people to provide an appropriate lingua franca for linking 'energy forms': energy, materials, information and thought. Coordinate eco-social systems have an inevitable, hierarchical structure, with 'survival vehicles' emergent from constant self-organisation and mutual triggering. An entire economic system could be devised around energy values and expenditures. The section on energy and thermodynamics links mainly with Criterion Ecocycles in UHSE below.

Far From (Thermodynamic) Equilibrium systems are inherently creative and self-organising, and constantly adapt to their environments by the triggering of perceptor mechanisms. The concept of autopoiesis comes from neurobiologists studying molecular evolution (Maturana *et al*). Mutual triggering between systems (co-evolution) or between system and environment is called 'structural coupling'. This process integrates system evolution, conservation and maintenance. They say natural wisdom consists in the Complementary aspects of 'the engineering look' (linear causal - knowledge) and the 'poetic look' (analogic, systems thinking - comprehension). Tuning and communication are the hallmark of such systems.

Systems thinkers in business schools distinguish between 'detail complexity' and dynamic complexity. They refer to long-term consequences of the expedient, short-term focussed actions that create 'Social Traps'. 'Complicated' and 'complex' are not scientifically synonymous.

The key distinction for a complex systems scientist lies between Deterministic Chaos and Stochastic Chaos. Deterministic Chaos, already mentioned under Ordering Principles (Prigogine), lies in the medium number mathematical area between order and Stochastic Chaos, where many fascinating Complex Dynamic Systems characteristics seem to operate. These include the creation of life, the ultimate source of creativity, the core of evolution: a sort of 'Theory Of Everything' - not neatly wrapped in one single formula as a physicist would wish, but an intangible, unpredictable process, whose only promise is that the character of every moment is unique. *[Actually former physicists are remarkably common amongst EPPs: Capra, Bohm, Lovelock, Zohar, Davies ...]* Complex Dynamic Far From Equilibrium Dissipative Systems are understood as clusters of variously-related elements moving together in 'state space', that can be thought of as an 'Attractor landscape' of potentially infinite dimensionality.

Different types of Mathematics have been worked out for different numbers of dimensions, but is not worked out at all well above four. The mathematics for fixed points, straight lines and oscillators are well known, and it has been usual to apply statistical methods to the study of large number systems, such as gases. In particular, power laws have been found to describe the fractal structure of Edge of Chaos entities, which are self-similar across a range of scales, and ubiquitous in Nature. *[Scientists have undoubtedly had great fun investigating these patterns, and both 'scientific' art and popular designs in commerce have familiarised us all with their appearance].*

Simple Point Attractors and Limit Cycle Attractors are relatively predictable. The Strange Attractors of Deterministic Chaos are unpredictable. The mathematical description of these special types of ordering is attempted through Complex System Dynamics, Chaos Theory, Fractal Theory, Catastrophe Theory, Synergetics, which have overlapping areas of interest.

Unlike equilibrium mechanistic systems which respond most to energy, far from equilibrium systems are uniquely information-sensitive, and in a constant state of adaptation to internal and external signals. Most perturbations are incorporated into the system, with or without an upheaval, as Complex Dynamic Systems have a lot of resilience which is structure-related (**Link: Hierarchy Theory**).

Each system working in this way, will stabilise itself as best it can, pulled this way and that by constraining field entities, creating an interference field: influences of attraction and repulsion, recursive positive and negative feedback processes. It is as if they were magnetised (and in many ways actually, as at quantum, atomic, molecular, tissue (cells) and planetary scales).

Self-Organised Criticality concerns the way SOS are poised in critical instability zones near Catastrophe Points, where multiple potential paths could be taken. They retain their adaptive function and creativity by staying near such points; small perturbations happen more frequently than more distant ones which may trigger a switching from one Attractor to another.

Molecular biologists and ecologists have found that in the medium number range, large numbers of variables can be organised into smaller modules subsumed to a small number of 'keystone' or 'ordering parameters' (or system inputs experimentally), that 'enslave' the system, making it a lot easier to study if this structure can be identified. Such a structure confers stability and resilience to such systems as biological tissues, organisms, food webs, economies and ecosystems depending on the structural pattern, but in general it has relatively discrete, hierarchically arranged subsystems (frequency hierarchy).

Synergetics specialises in phase transitions. It calls this entrainment of systems by ordering parameters the 'Slaving Principle', which amounts to 'leadership' through change by the least stable (or most flexible) entity in the system. This is interesting enough where the control parameters are stable. When they, too are changing, we have a deterministically chaotic situation. While unstable entrain during change periods, Attractors confer stability for quiescent periods, presiding over functional spaces that may or not be sustainable long-term.

The whole is a vast nested set of systems within systems, the boundaries of which can be defined in many ways, so that the definition is always subjective and exact prediction is impossible. The higher the resolution of an investigation, the more complex the behaviour of the system. We have expended much past effort trying to exactly model such systems with equations, with poor results. New mathematical approaches like Fuzzy Logic start by not even attempting to do this. Pattern is a key concept, for human education, design and computerisation, and could be exploited more. Hence the potential importance of Fuzzy Logic, q-Analysis and new generation combinations of analog computing with Nanotechnology.

Holling has produced a helpful model colloquially known as an 'Infinity Loop'. SOS at all known scales and across disciplines, tend to go through repeated, variable rate cycles where different types of attraction prevail, and which have different characteristics in terms of scalar constraint patterns, structure, function, frequency, evolution, energy dissipation, and different types of capital. The four stages are Conservation, Release (Creative Destruction), Reorganisation and Exploitation. The first and last are relatively stable and predictable; the others are under deterministic chaotic régimes. This model has helped organisations pre-empt and capitalise on chaotic periods and use them to advantage in environmental management and organisational development. It also serves as a basis for the 20-Step Design Process recommended below.

The different options for a system under environmental change have been spelt out by Kay and Holling. Timmerman and Holling have emphasised the importance of Metaphor in underpinning different approaches to ecosystem management. Ecologists of this hue are keen to see change, Surprise and Catastrophe built into environmental management systems, moving on from the unsustainable control-fetishes of the past.

While complexity is evident everywhere in Nature, the Free Market and the Internet are themselves instructive examples of complex dynamic far from equilibrium systems. The EcoCommunity avant guard has been informed both from Nature itself, from first nations' relationships with Nature and each other, and from Complexity Theory directly.

This whole section argues strongly for the inclusion of landscape, urban or human settlement ecologists in local government planning offices (not locked away in Environment Departments), and on the design teams of tract developers. They should also be involved in the training of developers, builders and architects.^v The ecosystem functions of equilibrium, stability, feedbacks and evolution are basic to the UHSE Criteria of Observation, particularly Ecocycles, Landscape, Biotics, Feedbacks, Connectivity and Rheotics.

8 HIERARCHY AND SCALE

8.1 INTRODUCTION: HIERARCHY THEORY AS AN ORDERING SYSTEM

In every area of modern life, and at all scales from the individual to society, we are trying to make decisions that will affect the future ... All policy ... must try to shape tomorrow towards what is held to be a most desirable state according to the values we hold today ... And all thinking about policy directed towards tomorrow must start with a sound understanding of where we are today, otherwise how do we know where to start from in order to steer where we want to be? ... what really forms a body of coherent knowledge and insight in the human sciences, the sciences that tell us something about ourselves and the world we create? It would be our contention that most of the content of such knowledge must be structural ... precisely because structures consist of things connected together in certain ways. It is the description and interpretation of structure that forms most of our understanding and shared knowledge ... (Gould, P., Johnson, J. & Chapman, G. 1984a: S5).

Universe lies on top of universe, layer after layer, distinct and separate, like a Neapolitan ice cream cake, What's true in the chocolate layer, at the bottom doesn't hold in the vanilla at the top. And a lemon truth is different from a strawberry truth. And each one has just as much right to exist and to call itself real as every other. Aldous Huxley *'Those Barren Leaves'*.

While ecosystem hierarchies are organised functionally around frequency and space, other aspects of Ecology need to recognise the ubiquitous existence of Dominance Hierarchy, and the human component in addition needs to consider Conceptual Hierarchy. In general, scale in Physical Geography (excluding Time and Action Geographies) or Planning, is usually thought of in spatial terms; sociologists see scale in contextual or conceptual terms, but also sometimes, like anthropologists, as dominance; philosophers speak of hierarchies of meta-description; Q-analysts work with Conceptual Hierarchies of nested cover sets, and hierarchy in Politics is classically related to power.

Usually used interchangeably, there is a difference between hierarchy, scale and levels. Strictly speaking, hierarchy implies the presence of a system: something to be interpreted at different scales, and in a sense, respected as an 'organism' (a whole entity) when 'development' is intended. Scale refers to a level: to some kind of relative or ordinated measurement, usually indicating general categories of size, speed or quantity. Scales may be relative or absolute (Gibson *et al* 1998: 3-4).

Conceptual types of hierarchy, where humans organise complex information using meta-levelling, logical typing or tree structures, may interface with and are embedded as perturbing outcomes, in very complex ways in natural systems. Complementarity is evident here: the rate-dependent and the rate-independent. Humans justify their behaviour on the basis of their conceptual structures. But ecosystems, social systems, Complex Dynamic Systems in general, are indifferent to human justification: they respond to outcomes, not intentions.

Hierarchy Theory supports the edict 'think locally!' and 'globally' and at every other scale. One should perhaps add 'love your bugs!' and 'manage the molecules!' It explains why 'acting locally' and individual response ('respond personally!'), need to be key elements in approaches to human settlements which honour ecological integrity and social justice. The segments below summarise TFH Allen *et al*'s approach to Hierarchy Theory, and extend this to other hierarchical types, especially as they apply to humans and their settlements.

8.2 HIERARCHY THEORY: ECOLOGICAL AND OTHER HIERARCHIES

Whyte, Wilson & Wilson (Whyte, Wilson & Wilson 1969) report on a milestone multidisciplinary conference on hierarchy in California in 1969, one of two that year (the other led by Koestler in Austria), which was said to reflect "an idea whose time had come" (Whyte, LL 1968: 2). The introductory remarks referred to a 60-year study of various types of ordering, regarding hierarchical structuring as proven in numbers, scales, times, positions, crystal forms, symmetry, elements & groups, symbolism, sentences, languages all kinds, logical types, concepts, principles of motion, quantities, and abstractions of many other kinds. Not yet proven were prime functions of the brain: symbolism, language, correlates and so on (Whyte, LL 1968: 3-4, 6-7). Hierarchical ordering was said to be "as old as human thought", the term coming from Pseudo-Dionysius,¹ was referred to by the humanist logician Petrus Ramus (1515-1572), and used by the German psychologist philosopher William Stern in 1923 in his "stufen system" of ranked equations: 'viten ordnung' (Whyte, LL 1968: 6-8).

The Californian conference defined Hierarchy as 'a set of ordered levels' rather than requiring a more orthodox inter-level relationship of 'governing-governed'. For the first time it drew together specialists from such disciplines as Philosophy, Chemistry, Cosmology, Medicine, Mathematics, Computer Science, Systems Modelling, Informatics, History and Sociology, who together explored structural and functional hierarchical phenomena in their various fields, seeking confluence and an indication of the existence of some fundamental meta-principle.

While hesitating to narrow the domain of discourse prematurely, by attempting specific formulations, the conference concluded that broad hierarchical concepts did apply, and that certain clusters of disciplines, especially the bio-social-computer cluster, evidenced such strong analogies as to warrant intensive study. It also affirmed bold and broad use of Analogy as a

¹Circa AD 500. Confused with Dionysius the Areopagite mentioned in Acts 17: 34; a mystical theologian (Blackburn 1996).

useful initial step in epistemological exploration, especially in a multi-disciplinary setting (Whyte *et al* 1969: vii-viii, 315-6).

Ecological Hierarchy Theory proposes a multi-level, process-rated reality-organising structure, where upper levels constrain the lower by virtue of differences in activity rates. This effectively filters or inhibits information or resource flows between levels: an asymmetric relationship which provides a fundamental Organising Principle for system analysis (O'Neill *et al* 1986: 94). Each level has unique local historic, structural and functional (emergent) properties in addition to its identity as part of a whole.

... all complex systems, including ecosystems, appear to be hierarchically structured as a natural consequence of evolutionary processes operating on thermodynamically open, dissipative systems (O'Neill *et al* 1986: 101).

Central to the theory is the concept that organization results from differences in process rates.² Medium number systems, like ecosystems, operate over a wide spectrum of rates. Behaviours can be grouped into classes with similar rates, and if the classes are sufficiently distinct, then the system can be considered as hierarchical and dealt with as a small number system. The structure imposed by differences in rates is sufficient to decompose a complex system into organizational levels and into discrete components within each level (after Overton) (O'Neill *et al* 1986: 75-6).

Bunge, considering the Philosophy of Hierarchical Concepts, distinguished between 'integrative levels' or 'levels of organisation' in Biological and Social Sciences, and "an asymmetric relation of domination and command", for which he felt the term 'hierarchy' should be reserved. He saw 'hierarchy' as human-inspired and 'artificial and odious', preferably replaced by the concept of a multi-level cosmos.³ Others disagreed with this, saying it was too late to change the word usage (Bunge 1969: 17-19). Bunge proposed a Metaphysics of Levels based on five ontological hypotheses which still appear to hold general congruence with 'Hierarchy Theory' as expressed by more recent authors.⁴ His propositions run as follows:

1. Reality is a level structure such that every existent belongs to at least one level of that structure [*note: TFH Allen et al decline to claim ontological verity*].
 2. In the course of every emergence process (self-assembly or evolution) some properties, hence also some laws [*rules: after Pattee*] are gained while others are lost.
 3. The newer levels depend on the older ones both for their emergence and for their continued existence.
 4. Every level has, within bounds, some autonomy and stability [*note: TFH Allen et al emphasise the researcher's role in defining scope of observation, which may or not correspond to natural boundaries*].
 5. Every event is primarily determined in accordance with the set of specific laws [*rules*] that characterise its own level(s), and the contiguous levels.
- (Bunge 1969: 22-23).

Bunge saw the first proposition as competing with the creationist Plotinian Great Chain of Being, with Monism and unqualified Pluralism (each level is original but not separated or

² Fundamental insight of Simon (1962, 1969, 1973) and refined by Allen & Starr (1982).

³ In fact the natural world is full of examples of domination and control as any observer of wildlife or owner of more than one dog, horse or domestic fowl will attest (not to mention the owner-animal relationship).

⁴ TFH Allen *et al*, Mathews, Costanza, Lewin, Kauffman (Allen 1982; Allen & Hoekstra 1992; Allen & Starr 1982; Costanza *et al* 1993; Kauffman 1993; Lewin 1993; Mathews 1991; O'Neill *et al* 1986).

isolated), and with Physicalism/Mechanism/'vulgar Materialism' and Idealism (with polarised claims to exclusive causation). But it did support the Theory of Evolution and 'Integrated Pluralism', to which latter the last four hypotheses refer, and which acknowledges a world of both unity and diversity. He made several other relevant points. The emergence of new patterns through creative processes is not cumulative nor necessarily directional (that is 'progress' is not inevitable). While older levels support and to some extent influence the new (providing an historical record, and allowing some intra-level play), there is also reciprocal influence. But events generally obey the rules of their own level. He then went on to discuss the implications for Epistemology and Methodology (Bunge, 1969: :23-26).

Bunge's primary epistemological proposition, which contradicted Reductionism, was that the real level structure is knowable and that like Reality, scientific knowledge is a matching level structure. This contrasts in detail with the position of TFH Allen *et al*, who see the multiple scales of ecological processes as in effect forming a continuum rather than a fixed 'natural' set of steps, with the characteristics of levels also depending on nestedness (qv) and the particular Organising Principle chosen. They see the level of observation as being chosen by the observer, (albeit often to coincide with convenient concrete surfaces like cell walls, skin or ecosystem boundaries), the scale then being fixed by the structures and surfaces prescribed for that situation: essentially a functional description (Allen & Hoekstra 1992: 11, 52-3). Their theory of observation emphasises the inevitability of selection by the researcher, of a field within a multi-scaled structure, whether acknowledged or not, whenever the researcher chooses the subject, the Criteria for observation and the scale.

Bunge proposed rules for scientific research that took levels into account and rejected 'level separatism'. His approach encompassed Integrated Pluralism and 'open-minded Methodological Reductionism'. He advised a flexible position that first tried parsimoniously to explain emergent characteristics in terms of the old level and intra-level rules, but this failing, to unhesitatingly move to seeking inter-level laws and new levels. He cautioned against "the fallacy of affirming the consequent", concluding that while the Methodology of levels had proved most fruitful, it could only be inferred that the Ontology and Epistemology behind it looked plausible (Bunge 1969: 26, 23-6).

Being primarily interested in explanatory power and robust predictive ability for research and management, Allen *et al* are more concerned with a structure that embraces constraints and limitations as central to ecological investigation. Ecology is "more than complicated Physics and Chemistry", while known, predictable constraints enable predictability in the system constrained.

Like Wood & Whyte, they emphasise the importance of studying at least the level above that in question to provide context and significance, and the level below to understand mechanism (Allen & Hoekstra 1992: 15, 7). Structures that are 'robust to transformation' (persist across several Criteria) are more predictable, especially where bounded by a multi-parameter coincidence of processes, such as at a skin surface, a topographical limit or an ecotone⁵ (Allen & Hoekstra 1992: 2-9). This is also iterated by Bunge (Bunge 1969: 23-4), Mesarovic & Maccko and Rowe (Mesarovic & Macko 1969: 35-6; Rowe 1961: 150).⁶ Scale is of equal importance to qualitative type, and can be used to explore the connections within and between Criteria (Allen and Hoekstra 1992: 23).

TFH Allen *et al* actively avoid getting into arguments about reality, and use Hierarchy Theory as "a hard-nosed protocol for observing complexity without confusion". They recognise the computer modelling of complexity as the source of this emergent Paradigm, however do make the comment that for humans a complex non-hierarchical world would be unimaginable (Allen & Starr 1982: 6). Allen & Hoekstra very strongly put the point that the observer's action in selecting scales, protocols and research subjects, takes Hierarchy Theory "out of the league of ... esoteric speculations about ontological reality ... and ... firmly into Epistemology (Allen & Hoekstra 1992: 5-12) – thus restating the Quantum Complementarity Principle for macro scales.

However in discussing biological organisation and rate-dependent metastable sub-systems, O'Neill *et al* conclude:

It does not appear that we are artificially imposing this hierarchical structure for the convenience of explanation.

Instead

... we must admit this type of organisation is presented to us by our experience of the natural world ... a fundamental principle that we can use to formulate an adequate concept of ecosystems" (O'Neill *et al* 1986: 121-22).

⁵ Tension, boundary or transitional zone between adjacent communities or biomes ("*Dictionary of Ecology, Evolution & Systematics*", 1982).

⁶ Attributes this concept to Feibleman's (1954) '*Law of the Levels*' (Feibleman 1954).

⁷ Including TFH Allen.

8.3 RATE-BASED HIERARCHIES: SYSTEM STRUCTURE AFTER TFH ALLEN ET AL

8.3.1 INTRODUCTION

Hierarchy Theory:

A formal approach to the relationship between upper-level control over lower-level possibilities (Allen & Hoekstra 1992: 10).

Chronos and Tempus assemble watches with 1000 parts. Any interruption causes current assemblage to fall apart. Tempus puts the pieces together sequentially and an interruption causes all preceding work on that watch to be lost. Chronos puts together stable sub-assemblies of 10 pieces each. An interruption at piece 608, for example, disrupts only the last subassembly of eight pieces. The other 60 subassemblies are not harmed. The point of the parable is that Chronos used a two-layered hierarchical procedure so that a failure caused by an environmental perturbation is localised ... All biological organizations can be conceived in terms of stable or metastable subunits bound into larger units (O'Neill *et al* 1986: 58-9 quoting Simon 1962).

TFH Allen *et al* have, through a number of works, produced an understanding of system structure which is of concern to ecological specialists, and should also be of concern to those whose human settlement activities may disrupt or modify natural system structures, and those seeking to restore them. They start with a discussion of scaling in general, as a critical and misunderstood process in research, and go on to discuss the part-whole relationships within complex ecological systems in terms of bond strength, relative frequency, context, containment and constraint (Allen & Hoekstra 1992: 29-35). These aspects are discussed below under slightly different headings, their salient attributes are summarised in tables, and the discussion resumed at a more practical level under Unified Human Settlement Ecology (UHSE) following.

8.3.2 RELATIVE FREQUENCY AND SCALE

8.3.2.1 SCALE RANGES, TIME-SPACE RELATIONS AND GENERAL PERCEPTION

O'Neill *et al* warn that not every situation is suitable for hierarchical analysis, but that "rate or frequency can be defended as a fundamental way of decomposing hierarchical systems" (O'Neill *et al* 1986: 93). This is even so for contextual hierarchy, as context changes more slowly than subject.

Norton & Ulanowicz strongly agree, and add that

... choice of system boundaries and scale are therefore an essential part of describing a system that is to be managed for a given purpose and thus the best description of a system is one that describes dynamic processes on a scale determinative of priority social goals (Norton & Ulanowicz 1992: 244).

The difficult problem is to integrate the social concepts, values and policy aspects with an objective description of the ecosystem and the constraints of the manager. This issue of 'fit' is now the focus of global scale political scientists (Folke, Pritchard, Berkes & Svedin 1998; Young 1998). (Link: **Criteria Organism, Biotics**).

It is not always the case that time and space have complete congruence, although one will affect the other. A general statement can be made that larger size, slowness, higher level of organisation and heterogeneity tend to go together, and the model will hold "if large systems respond to large perturbations" and "slow systems respond to low-frequency (low return time) perturbations" (Allen & Hoekstra 1992: 4; O'Neill *et al* 1986: 84).

At any level, the levels above will appear as context and relatively unmoving, having, as Allen & Hoekstra describe it, an 'always happens' quality, which then supports the evolution of anticipatory behaviours in the parts which participate in this whole (Allen & Hoekstra 1992: 31).

Table 53: CM: Inter-Level Principles: Relative Frequency extends this and describes biological inventory for organisms: knowledge necessary for ensuring resource supplies in Environmental Management.

Geological timescale processes such as soil, mineral deposition and fossil fuel development continue even today, out of our awareness, and certainly at a rate far lower than our usage. Humans, like other animals, perceive time at the scale they inhabit, which ranges from seconds to 7-8 decades⁸. Thus all research carries implicit scaling whether or not this is acknowledged (Allen & Starr 1982: 31).

We are potentially capable of relating to time scales other than our own by choice and consciously, but not intuitively (extending our native abilities intellectually or by the strategic use of advanced technologies). But we are now for the first time being asked to do so in making choices and organising our behaviour in the pursuit of sustainability (for instance to respect the needs of global extents, future generations and long time scales).

A number of authors use the time-space diagrams mentioned above to capture spatio-temporal scale and to indicate the lumpy clustering of ecological features across a landscape. These include O'Neill *et al* for a plankton ecosystem (O'Neill *et al* 1986: 81), Gunderson *et al* for boreal forest relative to lithosphere and atmosphere (Gunderson *et al* 1995: 23), Meyer *et al*, 1992: 267-9 for forest vegetation relative to atmosphere, biosphere and lithosphere (Gibson *et al* 1998: Figure 2.8); Gregory *et al*, 1991 Frissell *et al*, 1986 and Swanson, 1980 for valley landforms (Frissell, Liss, Warren & Hurley 1986; Gregory, Swanson, McKee & Cummins 1992: 543); Forman & Godron for climate (Forman & Godron 1986). **Link: Figure 29 (Holling's 'Lumpy Landscape').**

⁸Allen & Starr give the charming example of convergent evolution in northern Wisconsin bog flowers which although unrelated, are all pink mauve stars, and flower sequentially through the year, pollinated by one species of bee which thus has an even work load: a community "tightly-integrated to a time scale of a year and a space scale of one inch". This pattern humans can perceive with ease (Allen & Starr 1982: 31).

Physical Geography and Landscape Ecology deal with a spatial scale range of some fifteen orders of magnitude. The core phenomena of study are assigned approximately different scales for atmosphere, lithosphere and biosphere (and nōosphere⁹), which are clarified by time-space diagrams.

O'Neill *et al* mention a literature review of 41 species (birds & mammals), where larger organisms displayed lower frequency population cycling (Peterson, Page & Dodge 1984: 1350-1352)¹⁰. Trees and large animals like elephants and whales tend to operate on slower time scales than humans. Devices like time lapse photography and audio frequency conversion are required as interpreters, to discover how actively plants move about,¹¹ that whales sing or that elephants boom sonically to each other over vast distances. When American Indians claim that rocks have consciousness, they interpret this by moving into altered states that align with geological time, not a common Western ability.⁵

Animals appear to have a built-in sense of scale, use decision hierarchies (food, forageable patch, habitat, home range, region), to locate themselves at a spatial grain related to their body size. This determines their uneven distribution, and also the scale of their impact (Holling 1992: 449).

For inter-generational sustainability, a time horizon of approximately 150 years (relevant to specific variables such as forests and soil build-up rates), and a 'Landscape'¹² spatial scale, are appropriate. Norton & Ulanowicz¹³. see species loss as the best indicator for ecosystem health, but there may be a lag of 100 years or more ('extinction debt'). Adequate scientific delimitation of the ecosystem is possible, but relies on supportive social goals. A whole systems approach that integrates multiple levels and reciprocates with social values is necessary. Aggregated characteristics and bottom-line cost-benefit analysis are inadequate.

Resorting to the larger perspective represented by aggregation may appear to be an easy solution to complex approaches. But in ecosystems and social systems, we have already seen that different rules obtain at different scales; in a hierarchy of emergent structures, each level has a

⁹ Sphere of human impact.

¹⁰ Peterson, RO, Page, RE & Dodge, KM, 1984. "Wolves, Moose, and the Allometry of Population Cycles", *Science*, v.224: 1350-1352.

¹¹ See David Attenborough's "The Private Life of Plants" series, Channel 2, Australian Broadcasting Commission, 1995.

¹² **Link: UHSE Criterion Biotics.**

¹³ Bryan G Norton is qualified in Philosophy of Science, has worked in Environmental Ethics, Environmental Policy & Conservation Biology, and has a special interest in conceptual change in scientific disciplines and biodiversity (two books); has been or is associated with Maryland Institute for Philosophy & Public Policy, Resources for the Future, US EPA Science Advisory Board Economics Advisory Committee, currently Georgia Institute of Technology School of Public Policy, Atlanta GA.

Robert E Ulanowicz is qualified in Engineering, Science and has a PhD in Chemical Engineering; has a special interest in estuarine structure of trophic exchanges in ecosystems and relationship to other disciplines; is or was associated with Johns Hopkins University, Catholic University Washington and currently Chesapeake Biological Laboratory, Solomons MD (Norton & Ulanowicz 1992: 249).

locally-relevant interpretation or meaning (Complementarity Principle) and its own rules of operation. This is not the same as summing a large number of individual characteristics: the whole does imply more than the parts alone. Statistical statements do not have specific meaning for an individual component of an aggregate. On the other hand, just because a system is familiar at one scale, does not mean that other scales are irrelevant: they constrain each other in both directions. **Link: Hypercyclic Systems: Emergence.**

The concept 'ecosystem health' is a helpful Metaphor, and transcends individual and special stakeholder group interests, shifting policy commitment to the function of the larger scale system (Norton & Ulanowicz 1992: 245-8). **Link: Criterion Biotics.**

8.3.2.2 THE CHALLENGE OF REORIENTATION FROM STATIC SPACE TO DYNAMIC TIME OR SPACETIME

It is not easy for people normally oriented to 'snapshot' spatial concepts to re-orientate to time. For human social systems, behavioural geographers have used 'TSPs' (time-space prisms) and time managers use space-time or 'time and motion' studies (for instance see Carlstein, Parkes & Thrift 1978; Holly 1978).

Geographical Information Systems and other computer strategies are increasingly enabling dynamic approaches to Science (see **BP 5.8: Representation of Space & Time Using Geographical Information Systems (GIS)**). EPPs need something like David Bohm's 'rheomode' in public education long-term, to support real change.

'Spacetime thinking' is essentially a matter of aligning thought with process. This is an unremarkable yet essential ability in ecologists, but the task in the development of an Ecological Paradigm is to encourage this much more broadly: in the public, and in decision and policy makers, neoclassical and environmental economists, local government, developers and designers in particular. **Link: Spatial Hierarchy.**

8.3.2.3 FINDING THE 'RIGHT' SCALE(S)

Rather than fight human nature, ecologists are well advised to be explicit about the scales they use, so they can anticipate the consequences of decisions that were formerly made subconsciously ... *[they can]* ... advance with fewer delusions of objectivity, but more consensus. By recognising the importance of relative scaling inside concepts as well as in the scale of tangibles, ecologists can hope to match best the questions to the study site, compatible concepts, and data (Hoekstra, Allen & Flather 1991: 154).

For Hoekstra (after Allen *et al*, 1984¹⁴), scale is defined

¹⁴ (Allen, O'Neill & Hoekstra 1984).

... by the temporal and spatial characteristics of energy and matter within and among ecological systems ... scale of a study is determined by the size and extent of the observations in time and space, as well as the resolving power of the individual measurements (Hoekstra *et al* 1991: 148).

The research behind this paper demonstrates an implicit scaling (usually out of researcher awareness) in the choice of research objects, since different organisms occupy distinctive spatial and temporal scales, inherent in their sizes, their periodicity in movements, reproduction and life cycles, and their extrinsic scaling relative to their own environments and to human perception (Hoekstra *et al* 1991: 154). Untargetted investigation of a system at too fine a grain (too low a scale) can inundate researchers with data, and is unlikely to produce explanations for very large scale systems, nor will it identify the upper level system constraints (Allen & Hoekstra 1992: 24, 34).

The questions of resolution (spatial grain size, time, complexity) and extent (time, space, number of components) are of particular concern to modellers, who use Hierarchy Theory to minimise error in choice of scale. Large scale issues are not resolved through fine grain data. Different scales of perception yield differing and characteristic qualities, for example at the scale of a single tree, a fire may be a disaster or an essential element in reproduction; at forest scale a fire is a recurrent event with quite different properties such as nutrient recycling (Allen & Hoekstra 1992: 28). The small scale avoidance of fire in suburban bushland has large scale consequences for a fire-dependent vegetation.

Like Costanza *et al* (Costanza *et al* 1993: 548, 550) and Mesarovic *et al* (Mesarovic & Macko 1969: 36), Allen & Hoekstra (Allen & Hoekstra 1992: 24) see Complexity as scale-dependent and a function of the resolution at which the observer chooses to view a system, so the 'right' level for parsimony will be the highest at which the system can be contained and still provide a minimum of explanatory principles. As mentioned under Chaos Theory, Costanza (amongst others) feels that chaos itself may "merely" be "the low level of predictability that occurs as a natural consequence of high resolution" (Costanza *et al* 1993: 448, 548, 550). This can not with high Realism be overcome, however, by merely moving to a higher, aggregate scale, due to differing conditions at different scales. **Link: Chaos Theory.**

Each system carries its history internally, built in as outcomes of responses to initial conditions and to subsequent events. **Link: Biological Inventory.** One way to investigate and scale a system is to identify the perturbations it has incorporated or adapted to. Perturbations in functioning systems are usually responsive to a particular scale, and their frequency, strength and duration

will point to system size and character including constraint structure (O'Neill *et al* 1986: 85).¹⁵

O'Neill *et al* warn:

It is becoming increasingly clear that we must view the world at the spatio-temporal scale at which it responds, rather than the space and time frame at which we operate (O'Neill *et al* 1986: 100).

8.3.2.4 WORKING WITH CONTEXT

The word 'context' is helpful in thinking through scale issues (**Table 54: CM: Inter-Level Principles: Context**). We and other biota rely on this constancy of context: the 'always happens' quality of longer timescales. This is the socially-stabilising role of our legal systems, and is what is needed in the economic system. **Link: HST: Fitness.**

The need to manage FFE systems for optimum productivity by assuming the role of context-provider, to stay outside the system and bring in any missing context, are explained in **Table 55: RRCM: Management of Systems Far From Equilibrium**. Such systems are seen by Allen *et al* as naturally prone to runaway positive feedback, and kept in check by a range of 'limiting factors' for which the generic term is 'constraints' (Allen & Hoekstra 1992: 257, 276) (See below). Allen & Hoekstra's Principles are designed for natural resource managers, yet have a serious place in urban situations.

Inside every negative feedback is a positive feedback trying to escape. Mutualism is that positive feedback ... the effect of mutualism is not to produce change but to keep the system constantly pressing up against resource limitations (Allen & Hoekstra 1992: 232).

8.3.2.5 SCALING FOR SCIENTIFIC RESEARCH

Allen & Hoekstra's approach consciously takes an object of interest and looks at it from a series of perspectives at each scale, fixing the scale to look at Criteria, fixing each Criterion¹⁶ in turn and looking at the range of scales, and then fixing both, and examining relationships with the levels above and below, directly and diagonally (Allen & Hoekstra 1992: 89). **Link: Unified Ecology: Allen & Hoekstra's 'Layercake'**. Examples of naïve data collection in Science include organisation around a particular scale (say a landscape area), which because there exist within that area, an "awkward hybrid" of time scales related to system components, the interpretation of the study is affected at a deep but often unrecognised level.¹⁷

¹⁵ Planners are now required to allow for the '100 year flood' in their development control, but strangely, rarely consider anything else at that scale, for instance ecosystems.

¹⁶ **Criterion of Observation: see Unified Ecology, next section.**

¹⁷ Use of such data, or unscrupulous use of any data can serve political ends, as mentioned elsewhere. 'There is nothing there' can mean 'nothing there during two weeks in one summer'; 'It's only regrowth' can mean no old growth in 500 years' time.

Ecologists generally scale organisms anthropocentrically, that is, they judge size, speed, reproductive and life cycles relative to human characteristics and perceptual ranges. This is unproblematic if explicit. The subjects of ecological studies cluster at different and characteristic space and time scales, with movement (vagility) and size being chosen most commonly as scaling factors, and plants being in negative association with animals. Favoured subjects in Hoekstra, Allen and Flather's 1991 study (n = 339,000 references) were as follows: small plants for competition, population and disturbance; forest taxa for habitat, community, succession and ecosystem; ancient orders – not competition studies (reptiles, amphibians and pteridophytes¹⁸) for evolution; process participants invisible to humans for ecosystem studies (microorganisms, algae, grasses – not large animals, except fish, compositae¹⁹). (Hoekstra *et al* 1991: 148-52)

The attribution of competitive advantage to Mutualism may see Competition affirmed as THE Organising Principle favoured by Nature, without the awareness that the assumption of competition as an Organising Principle was made, nor that a scale change has taken place. The rescaling of a study is often necessary, and often not recognised as such (Allen & Hoekstra 1992: 285-6).

Development projects are normally more inclined to take the area in question, ignore scale completely, and divide it into expert domains which are relatively disconnected, and one or two of which (often Engineering and Finance) often dominate the others to the disadvantage of other, especially environmental and social, scales and Criteria. **Link UHSE**. Thus in asking human settlement designers to Scale a Criterion, one needs to be conscious of the type(s) of Hierarchy, and so, Organising Principle, they are using: are we dealing with a human Dominance or Conceptual Hierarchy, or an ecological one? The Information Sheet and two following tables describe the type of process required for using a Frequency Hierarchy-based approach in Science, including O'Neill's suggestions for conducting successful inter-disciplinary research:

Figure 30: CMCE: Scaling in Ecological Research

Table 56: BICM: Inter-Disciplinary Research Integration

Table 57: BICM: Scales & Global Change in Cross-Disciplinary Research.

These help develop a feel for how the system may be used in other settings, including larger human settlement projects. **Link: Boundaries** (below).

¹⁸ Ferns.

¹⁹ Daisies.

8.3.3 INTER-SCALE TRANSLATION

Celebrating the recent improvement in computer power, Costanza *et al* (ecological modelling) acknowledge the 'far from trivial' problem of 'scaling' or translation of information from the scale of collection to larger scales, which they attribute particularly to the problem of aggregation. This is due to fine-scale variability which is non-linear, and causes significant aggregation error at larger scales unless 'strong and unrealistic assumptions' are made about individual units. They quote Rastetter *et al*, 1992, who describe three basic scaling methods that try to deal with this nonlinear variability. These are:

1. Partial transformation to macro using a statistical expectations operator (requires very complex equations)
2. Partitioning into smaller, more homogeneous zones, using individual parameter-adjusted equations for each partition, and informed selection of the resolution (number of partitions)
3. Recalibration of fine grain data to coarse scale (only possible if coarse scale data are available, which is unusual) (Costanza *et al* 1993: 548-50).

While advocating a judicious mix of these, they see partitioning as having the most potential for computer modelling, and Hierarchy and Fractal Theories, with their inherent scalar structure, as being a particularly promising area for further attention. They also demonstrate a strong linear relationship between the logs of resolution and spatial autopredictability which may be generalisable to all forms of resolution (Costanza *et al* 1993: 553).

Gibson *et al* refer to the "well-known explanatory fallacies": individualistic (macro-level causes thought to also cause micro level effects); ecological (micro level causes thought to also explain macro level effects) and cross-level (inappropriate or unresearched assumption that ipse-level subsystems share the same explanation) (Gibson *et al* 1998: 7). Another fallacy commonly mentioned in hierarchical contexts is the 2-scale vicious circle of Russell and Poincaré (Blackburn 1996)²⁰. Newtonian approaches to cause and effect are clearly inappropriate for Complex Dynamic Systems. **Link: BP 5.4 (Cause).**

A commitment to applying the Complementarity Principle both subjectively (researcher bias) and objectively (local conditions), is essential whenever statistical approaches are used, and extreme care is appropriate when tempted to use aggregate information on individual entities. **Link: Conceptual & Contextual Hierarchy: Sociology** (below) for inter-scale translation in the Social Sciences

²⁰ The 'barber's paradox' or 'Russell's paradox', which related to a class of sets which are members of themselves (for instance the set of abstract sets).

8.3.4 CONTAINMENT

8.3.4.1 Holons (Whole: Part Relations)

Given that the natural world appears to be made up of systems internally related through frequency-relations, containment describes the different ways in which larger scales may enclose and constrain the smaller. The nested/non-nested distinction is presented in **Table 58: CM: Nested vs Non-nested Hierarchies**, and dealt with specifically under Nesting below.

A holon is defined as:

The representation of an entity as a two-way window through which the environment influences the parts, through which the parts communicate as a unit with the rest of the universe. Holons have characteristic rates for their behaviour, and this places particular holons at certain levels in a hierarchy of holons. What a holon shall contain is determined by the observer (Allen & Starr 1982: 270).

The concept of (w)holism was introduced by Smuts in 1926, who proposed that nature was composed of a hierarchy of nested wholes, the level of which should be studied in its own right, and the elements of which so studied, could not explain the whole entity (Zonneveld c1990: 70). A defined entity relates to a higher level whole and contains sub-selves that relate to it as a whole.

This concept also appears in Gestalt Psychology (Passons 1975: 16), and the Environmental Perception/Psychology literature on the 'Transactional'²¹ approach to social construction which sees entities/people in their physical and social contexts as a unit (Altman 1992), perhaps a 'socio', as suggested elsewhere. Similarly, Stenseth (: 136) quotes Patten *et al* (1981, 1983) and Patten & Auble (1980, 1981) who suggest a new theoretical concept the 'environ' - a coevolutionary unit which means an entity in its environment. Core concepts in Landscape Ecology are also the 'holon', the 'Land' or 'Landscape Unit', which is regarded as a far from equilibrium, self-organising, complex dynamic system. Other 'natural body', functional classificatory terms include 'organism', 'pedon'²² and 'coenon'²³ (Zonneveld c1990: 3), and 'codon'.²⁴

A basic tenet of both Gestalt psychology and Gestalt therapy is that a person cannot be considered as separate from his environmental field. This field includes physical and social objects as well as forces with which the person is in contact. Virtually all of a person's behaviour is in some way related to this person-environment complex (Passons 1975: 16).

²¹ This is a model promoted by Altman & Rogoff which regards time, continuity and change as intrinsic to psychological phenomena, and understands phenomena through a formal cause approach rather than the Aristotelian efficient (antecedent/consequent), material cause (self-characterising) or final cause (**Link: Background Paper: Paradox of Cause**). Not to be confused with the Transactional Analysis model of human communication.

²² The smallest vertical column of soils containing all the soil horizons at a given location (Lincoln *et al* 1982: 185). Term also used for organisms living in aquatic substrates. This term is less appropriate to the concept of a functional unit as discussed.

²³ A sharing relationship unit, usually referring to plant communities or co-evolved entities (Lincoln *et al* 1982: 51).

²⁴ Basic unit of genetic coding: a coding triplet of three nucleotides which specify an amino acid in DNA or messenger RNA (Lincoln *et al* 1982: 50).

Mathews suggests after Bateson, and would agree with O'Neill *et al*, that because they are open, self-realising systems are dependent on their environments for existence, and the 'organism-in-its-environment' constitutes the unit of survival, not breeding individuals, families or species (nor 'selfish genes' as Dawkins would say) (Dawkins 1982: 156-7; O'Neill *et al* 1986: 71). In turn this unity constitutes a self-realising entity within its own environment, and so on, thus forming a nested hierarchy of embedded entities that "provides a principle of individuation according to which intrinsic individuality is consistent with - indeed entails - intrinsic interconnectedness" (Mathews 1991: 106-7). The anti-reductionist goal of Hierarchy Theory was to extend the scale range over which ecosystems were studied.

Allen and Starr, discussing the issue of the relationship between wholes and parts in ecological modelling, propose that including hierarchy in ecological models may determine their outcome. For instance the success of the "Forêt" forest stand simulation model contrasts with the spectacular failure of the American International Biological Program grasslands model (Allen & Starr 1982: 175-183). The Forêt allows but does not require interaction between differently paced parts. It was not intended as a hierarchical model, but this was implicit in its structure. With Global Climate Change models, the problem of deriving accurate predictions at sufficiently fine grain (below 50 km²), with the enormous computer memory required, has inhibited the practical usefulness of GCMs.²⁵ Using a hierarchical approach, the Australian and German teams have found solutions to this problem, the Australian (CSIRO) group having developed ways to link separately calculated fine grain data to the larger scale model (CSIRO 1995).²⁶

There is a difference between fitting in with Nature in a linear way (the ESD approach), and conceptualising a particular region or entity as a working whole, the functions of which need to be protected, or which will certainly be perturbed by our activities (the ECD approach). **Link: Criteria Genius Loci: Bioregions; Organism; Ecocycles.** For this reason system boundaries are a big issue in Ecology (see below). Most entities of eco-social import are a footprint of Emergence. The term 'constitutive hierarchy' has been used for such entities (Gibson *et al* 1998: 3). **Link: Hypercyclic Systems: Thermodynamics: survival vehicles.**

²⁵ General Circulation Models.

²⁶ This field has advanced considerably since 1995 with the advent of more accessible satellite imagery and progress toward including interactive oceans into the modelling. Not followed up, being outside present scope.

8.3.4.2 Nesting

Upper levels of a system (as distinct from an aggregation), emerge from the lower, have reciprocal effect on the lower, so that the different layers form a structured system, a 'constitutive hierarchy', as in Langton's diagram of emergence. **Link: Hypercyclic Systems: Emergence.**

As seen in the table, Containment refers to the extent to which lower holons are contained by those above. The same hierarchy may be nested ('inclusive hierarchy')²⁷ and unnested ('exclusive hierarchy') simultaneously, depending on the perspective taken (for instance an army).

Most hierarchies are unnested, the upper not containing the lower, but are organised in functional ways, with the same principle applying to each level. Examples are the social arrangements of power and dominance: pecking order, eat-and-be-eaten (food chains), bureaucratic and ranked structures such as armies and the church (as ranked structures); also ecosystems (material and energy processing), environs (emergence), 'socioins' (culture, Script), and task forces (a specific task). This is the convergence point for the dominance and Conceptual Hierarchies mentioned below, which are really subsets mainly of the non-nested type. They are differentiated in this work because they are not primarily seen as rate-dependent. In practice they are often mixtures of the two.

Nested hierarchies are a special, robust case, where the Organising Principles vary from level to level, but the upper level does contain the lower, usually physically, the ordering of parts is constant, and internal communication is maximised. Examples are par excellence, organisms, together with the Spatial Hierarchy of landscape, classificatory tree structures (taxonomy), fractal (chaotic) systems (functional aspects), armies considered as organisms and the structure of organismic entities themselves (Allen & Hoekstra 1992: 31-4).

The non-nested, relative disconnection of government institutional structure ensures that information flow is minimal, control is maximal, and perturbations flow poorly through the organisation, according tremendous stability, but difficulty in inducing change. For fast action, special purpose functional units are now set up, small functional holons with high flexibility, rapid information flow and power nesting through single or no more than two, layers. These have much akin to organisms functionally speaking, including having a distinct life cycle, organised around a single purpose.

²⁷ (Gibson *et al.* 1998: 3).

8.3.4.3 Boundaries, Surfaces

(After Allen & Hoekstra 1992: 15-29)

The quality of project outcomes can be expected to vary according to whether the grain and extent of the study are properly scaled, which defines the range of scales at which the data can be accessed (Allen & Hoekstra 1992: 15-18, 65).

8.3.4.3.1 Introduction

Beyond the literal meanings, many sciences and humanities use the abstract and not necessarily bounded concepts of 'landscape' or 'surface', as in 'cultural landscape' (Cultural Geography) (Rose 1993: 86-7), 'preference surface' (Behavioural Geography) (Gould & White 1974: 143) 'stratified social landscape' (Sociology) (Collins 1987: 201), 'economic landscape' (Economics) (Losch 1945), 'perceptual landscape' (Planning) (Chadwick 1971: 10), 'soil landscape', 'vegetation landscape', 'geomorphological landscape' (Landscape Ecology) (Zonneveld c1990: 68), 'raster surface' (Geography) (Bracken 1989), (computer/GIS policy modelling), 'cultural surface' (Hierarchy Theory, implying a tangible/physical or intangible boundary to a culture, similar to a cultural bioregion concept). A 'fitness landscape' (Molecular Biology) (Kauffman 1993: 33) was mentioned under CDS.

While a landscape is not always tangibly bounded, the patterns within bounded areas and the conditions at the defined boundary are of great importance, and may have spatial, temporal and Attractor aspects. The collective mental maps produced by Population and Behavioural Geographers, using Homomorphic Mapping of ordinally scaled preferences (or any other nominated entity such as information diffusion or place perception - in effect using techniques equivalent to Fuzzy Logic), clearly identify Attractor places on basemaps (Gould & White 1974: 52-7). **Link: Criterion Genius Loci; HCS: Chaos Theory.**

In Hierarchy Theory, the definition of surfaces or boundaries is understood primarily as a functional issue: the limits of processes, and the landscape is understood as a system, as in the use of landscape unit surveys (Zonneveld c1990: 68).²⁸ Organisms are easily defined by their conjunction of many tangible processes; the definition of ecological surfaces relies on identifying discontinuities between background fluxes and the processes in question (Allen & Hoekstra 1992 28). They can often be indicated by vegetation changes. **Links: Finding the Right Scale; Figure 30: Scaling for Scientific Research (above); Criterion Organism; Tool 3.8: Boundary Types.**

²⁸ **Links: UHSE Criteria Landscape (Imitating Nature by Design); Biotics (Ecotones).**

8.3.4.3.2 Tangible Surfaces

While robust to several perceptual channels, tangible surfaces are conveniently yet still arbitrarily chosen by the observer, as research objects. Such surfaces lie at the limit of internal processes, tend to reinforce each other. They are manifested as multiple processes come together. They may be detected as a change or cessation of signal through the ordinary channels of perception (vision, hearing, touch, taste, smell etc.), or by technological extensions of these (scientific instruments). A structural boundary like the skin can thus be seen as a the coincidence of a number of discontinuities of rate processes (O'Neill *et al* 1986: 88-90). Yet a researcher interested in body energetic systems will seek to sense a boundary some distance beyond the skin surface. A process cluster that persists through time is seen as a structure. Allen & Hoekstra give the example of the roughly seven-year replacement cycle of the entire human body (Allen & Hoekstra 1992: 25) – another Rheomode language opportunity.

8.3.4.3.3 Intangible Surfaces

While for tangible systems surface phenomena are easily detected and conveniently selected for research, intangibles such as ecological systems or social constructs yield to similar definition, the researcher deciding whether the level of disconnection constitutes a functional surface. For instance the work of Smailes in rural South Australia, in the steps of his euhemerus Hägerstrand, maps and compares individual perceptions of extent of home range.²⁹

The intangible surface in an ecosystem or a physiological system can be demonstrated by the use of radioactive tracers. It contains and relatively disconnects internal processes from external, and connector processes such as cycling of energy, nutrients (carbon, sulphur, nitrogen etc.) or water may be more easily identifiable than the surface itself (Allen & Hoekstra 1992: 28) Similarly, in analysis of organisational network boundaries, Clark suggests cut-offs in exchange density as indicators for the existence of boundaries. Exchanges should then be assessed for significance to member function and survival (Clark 1982: 17).

Boundaries in natural systems are inherently 'leaky', but particularly so in human-impacted systems, which have both point sources and widely disseminated sources of pollutants and nutrients (Allen & Hoekstra 1992: 269-70). An apparently arbitrary delimitation of an element in a development project (for instance a path, a building or a garden) for the purposes of

²⁹ In press 5/2000.

functional design or assessment may actually constitute a boundary or a conduit in an artificial ecosystem, as geomorphology, terrain and aspect do in unimpacted landscapes.³⁰

The boundary between two adjoining communities or biomes is the creative zone known as an 'ecotone' (Lincoln *et al* 1982: 76). **Link: UHSE: Criteria Landscape, Biotics.** The importance of creativity to the ability of self-supporting systems to adapt to new, and especially, human perturbation, is emphasised by Norton *et al* *The Edge of Chaos* phenomenon operates behind system performance which for creativity requires a balance of ordered, coherent and constraining complexity, and incoherence: a "potential 'reservoir' of stochastic, disconnected, inefficient features that constitute the raw building blocks of effective innovation" (Norton & Ulanowicz 1992: 248).

8.3.4.4 Bond Strength & System Integrity

In hierarchical systems external bonding is relatively weak, but constitutes the internal bonding on the next level up, and also forms the interface between the whole entity and the external environment, thus characterising it, with the internal relationships being Backcloth. See: Table 58: Nested vs Non-Nested Hierarchies: left hand diagram. There is a weakening of bonding from bottom to top of the hierarchy. Allen & Hoekstra give the example of the increasing energy release on breaking this bonding as levels descend, such as a fire or explosion (chemical bonds) compared with splitting an atom. (Allen 1992: 29). A human equivalent could be the approximate hierarchy of disturbance from broken social contract bonds at acquaintanceship, workplace, friendship, family, couple, individual (internal), communication frequency levels. A political example would be the increasing remoteness and decreasing frequency of interaction between a resident and local, regional, state and national governments. **Table 59: CM: Inter-Level Principles: Bond Strength** summarises this notion and gives further examples.

³⁰ These days, such boundaries may support endangered native vegetation, such as 'remnant veg.' on roadsides, railway easements and fence lines.

8.3.5 CONSTRAINT

8.3.5.1 Introduction

Constraint operates by virtue of near-decomposability of complex systems (**Link: Kay, CDS above**), that is, frequency differences between levels create relative disconnection by controlling the lower level's ability to act or react. **Table 60: CM: Inter-Level Principles: Constraint** explains many of the following points in summary form.

It is not adequate to describe the components of a system: these must be understood, but that data is useless without a concept of how these elements are connected, how they are insulated from each other and how they function together.

8.3.5.2 Connectivity, Connectance & Connectedness

Connectedness and relative disconnection are two key concepts that underpin the ecological approach. As an example, as food becomes scarcer, animals are said to become increasingly connected to the supply (in terms of energy dissipation in procurement)(Allen & Starr 1982: 204). Gestalt Psychology notes a natural flow of contact and withdrawal (psychological connection and disconnection) in healthy relationships (Passons 1975: 14-21).

The system structure of connections, transmission media (water, wind, transport, information technology), biotic drivers (Attractors and Repellers), general system drivers (positive and negative feedbacks) and process cycles are all related to system integrity, and underpin the UHSE Criteria Connectivity, Feedbacks, Ecocycles and Rheotics in particular. There are a number of etymological distinctions around connectedness in the ecological literature (Allen & Starr 1982: 184-5):

Mean connectivity (Levins, 1974, qualitative approach) of components is defined as 'the mean number of direct interconnections between one component and the rest of the system'.

Connectance (Gardner & Ashby 1970, quantitative approach with range ± 1) is defined as 'the number of interconnections through competition, predation or parasitism as a proportion (percentage) of the maximum number of interconnections'.

Connectedness (Allen & Starr 1982) 'take[s] account of mean connectivity, percentage connectance, and the strength of the connections or interaction terms'.

This latter would allay Clark's concern that graphic representation of network linkages should reflect power over frequency (Clark 1982: 17), however this should not be seen as 'either/or' (that is, 'both/and' is the Complementary approach). Clark argues that a single encounter with the bank can, through funding access, make or break the organisation, so power is more important than frequency of encounter. Hierarchy Theory would say that the funding is the

context within which the organisation operates at all, being an upper-level constraint on the system, which forbids certain lower level behaviours, and allows others: small, fast-consumed maintenance funds may be allowable, while large, structural targets may be out of the question. Alexander would say each scale should have a discreet account and not be traded off in big projects. Q-analysis would point out the high level of 'q-connectivity' between the funding entity and every other entity in the organisation and would describe it as Backcloth. Synergetics would say that a stable financial field is a Control Parameter, but if it is the most uncertain element in the field, it will be called an Ordering parameter, and will entrain all the other variables, especially close to catastrophe points. Allen *et al* would see it as a system Constraint, the system being predictable while it operates, but become chaotic if it were uncertain.

8.3.5.3 An Optimal Connectivity Range for Stability

Allen & Hoekstra describe Prigogine's study of the emergence of higher order entities by incorporation of lower level perturbations:

The particulars of that high-level order are the consequence of the particular configuration of the system as lower levels of order went unstable ... Complex systems are formed by successive reorganizations where a series of instabilities cause the emergence of a series of higher levels. That is why complex systems require several levels of organization for their adequate description ... complex systems contain past disturbances in their lower levels. A low level is disturbed and collapses up against a new, more global constraint of the new higher level ... [and] ... becomes an integral part of the working of the new higher level (Allen & Hoekstra 1992: 79-82).³¹

This type of hierarchy of sequential emergents, is termed 'constitutive' by Gibson *et al* (Gibson *et al* 1998: 3). Change in the upper level (global scale) constraint system allows the simultaneous emergence of related change in many separate places (Allen & Starr 1982: 9, 190).³²

If the system is not to disintegrate from overconnectedness, a large perturbation must be incorporated. A period of instability leads to a creative destruction /reorganisation process

³¹ As mentioned above (Choosing the Right Scale), Allen & Hoekstra give the example of fire-adaptation in vegetation where communities come to rely on fire to deal with non-adapted competitors and so ensure community longevity. The fire-as-disturber perturbation persists at the lower, more primitive level (as evidenced by biomass destruction), at the same time as fire is incorporated as an ally at the upper level (Allen & Hoekstra 1992: 82).

³² This phenomenon has been called the 'hundredth monkey effect' after a report that one monkey on a Japanese island learned to wash potatoes in the sea, followed shortly and apparently spontaneously, by similar behaviour on other, widely separated islands. Another example was in the United Kingdom where sheep in different districts were supposed to have started rolling over farm grids soon after one sheep achieved this. Shelldrake attributes this to resonance to 'morphic fields', hierarchies of which he has proposed as an Organising Principle for the consistent patterning of the physical form of living entities at all scales from microbes to Gaia (Peat 1987: 165, 159-68; Shelldrake 1990: 135). The simultaneous appearance of the same breakthrough idea in more than one place (evolution theory, telephone, phonograph), similarly suggests the presence of a Backcloth supportive of such emergence. Neo-Jungians call it 'Synchronicity'.

(Holling 1995: 22), with the emergence of a transcendent system that responds to a new set of upper level (lower frequency, contextual) Constraints.³³

There appears to be an optimal range of connectedness in complex systems. Allen & Starr present persuasive evidence that both over- and under-connectedness (as measured in their population case by competition coefficient surrogates) induce instability in eco-community systems, which become prone to reorganisation or collapse. The middle range is remarkably resilient to perturbation, but beyond this, systems will be perturbed and may collapse, either by alienation of their elements (connectedness too low) or by overconnection. **Link: Criterion Connectivity.**

Stability in natural systems has been found to be enhanced when a new component encourages a subsystem structure, and less perturbed by additions or subtractions when already so structured. In adding new entities to a system, the connectivity of the new element will determine its effect: whether its underconnectedness draws an over-connected system back to stability³⁴ or its high connectedness pushes it towards over-connected collapse. However the addition of highly connected entities to an already overconnected system will generate low-frequency oscillations and finally aperiodic instability (stochastic chaos) (Allen 1977; Allen & Illitis 1980; Allen & Starr 1982: 190, 192-3; O'Neill *et al* 1986: 125-8).

Ecologists describe connectivity with the aid of 'interaction matrices'³⁵ in which the diagonal represents the stability of self-interaction. System additions close to this line are fast, directly connected and tend to clump in stable subsystems. Additions at increasing distance from this line represent the long loop (random assembly) processes which may interfere with system stability through slow variables (similar frequency to the system structure itself), that may come back and disturb the system long after it has settled down from a perturbation. They do this by competing with the reaction time of the total system, sometimes being out of phase with and even slower than the system itself, so that system structure becomes another variable, and over-

³³ Voluntary compliance (and government withdrawal from responsibility) in the food industry and lack of regulation of animal food substrates are now being seriously questioned in favour of a balance.

³⁴ Note the recent actions of large companies in Australia, which import well-connected, high salary CEOs in the hope of improving the company connectedness to trade and other business: one of MultiFunction Polis Australia's most expensive strategies, which (twice) had a very negative impact on public perception, and failed to produce the promised benefits (Connectedness was necessary but not sufficient).

³⁵ These take the species involved and run a self-referential matrix (same species arranged at random along the x and y axes in the same order for both).

correction may occur as the slow variable reinforces system feedbacks through error amplification (Allen & Hoekstra 1992: 116-121).³⁶

A system can appear unstable or stable according to the time devoted to its study, on whether this timescale includes the perturbation in question, or sees it as an external event unaccountably impacting the system in a random manner (such as our '100-year event').

Allen's claim that human overconnectedness led to changes in upper-level constraints and collapse of hunter-gatherer society,³⁷ has resonance with recent international events.

It would seem from the many examples given here that ecological systems adjust their connectedness as external forces stress consumer holons. Suitable levels of connectedness seem to be a principal factor for stability. Its relationship to diversity is by no means simple. Clearly a system which is overconnected in one dimension may be underconnected in others, so giving strategies for increased or decreased connectedness associated with each dimension in the hierarchy. These models might even be of help and significance in understanding the selective advantage of various human social patterns. Perhaps a limiting factor for human societies may not be their particular strengths or technological weaknesses, but rather the responses of the system to dangerous levels of connectedness." This leads to a theory of overconnected collapse to a new type of connectedness in the formation of the first cities (Allen & Starr 1988: 207-8).

Thus social re- or de-structuring (as seen under globalisation) is inherent in collapse to a larger system. In the transfer to a post-industrial society, a process of reorganisation or 'collapse' to a higher dissipation system (or dis-integration, *Creative Destruction*), is detectable, as connection to our resource base increases radically through transport efficiency and global trade, catch-up through an LDC Industrial Revolution escalates exponentially, and signals of positive feedback in all global homeostatic systems are now unmistakable (Brown *et al* 1994: 15-21; Meadows *et al* 1992: 97-103). System Constraints are changing, indicators confirm an unstable situation is present and a classical exponential pattern of lag impacts (Surprises) such as climate change, algal blooms, salinity, desertification and extinction debt, can now be discerned.

This type of issue is still rarely on the mind of a developer, planner or farmer presiding over land clearing, exotic plantings or housing development over productive land (to name a few perturbations). Whether present responses are 'just in time' or 'too little too late' remains to be seen, but this is now an upper level (global) issue, urgently requiring that we take up our responsibility as context-builders. Since the current global decision-making system appears to be big business, then the conversion of MNCs to an EPP position is probably our best fast option. Natural Capitalism may take us there. Global scale citizens movements now emerging, may help encourage that.

³⁶ As mentioned above, a feel for complex instability and overcorrection is easy to experience at first hand by downloading the Stella 5.0 complex dynamic system demonstration software from www.hps-inc.com, and working with the ecological and clinical modelling problems it presents.

The EPP position at its most extreme demands local self-sufficiency (that is, high connectivity to local area and remaining within local carrying capacity, which represents appropriate scale and intensity of connection), regional urban-rural looping of organic wastes, and sustainable, perennial agriculture, so the whole globalisation and growth process is considered inappropriate (Trainer 1991). A moderate short-term position seeks to include ecological and social justice constraints to existing World Trade rules, with structural adjustment of these World bodies, not the unfortunate LDC economies they deal with; plus massively increased energy and materials efficiency. This would cooperate with regional self-sufficiency and neighbourhood development, a 'bottom up' globalisation. Bioregionalism is a core EPP recommendation, on which to base governance, rather than States. **Links: UHSE: Scale, Criteria: Genius Loci, Ecocycles: Urban Footprint, Constraints, Indicators.**

Once demand for a particular product, such as seafood, exceeds the sustainable yield of the resource base, the traditionally stable relationship between demand and supply becomes unstable. With thresholds for sustainable yields now being crossed for so many resources, relationships that have been stable for centuries or millennia are becoming highly volatile (Brown, Denniston, French, Kane, Lenssen, Renner, Roodman, Ryan, Sachs, Starke, Weber & Young 1995: 15).

In February 1995 a flood blocked the Eyre Highway on the Nullabor Plain for three weeks. Two trucks held up on each side of the flood were both carrying carrots! (Fleay 1995: 122).

8.3.5.4 Connectedness in Globalising Social Systems

8.3.5.4.1 Now we are Globally Connected, we are Citizens of Every Scale

Each shift up-scale normally involves increased complexity of structure, with increased energy dissipation through this structure, although by the Prigogine-Waime 'minimum entropy production' Principle, a dissipative system will tend to settle into a state of least dissipation (Adams 1988: 43). Globalisation has seen the assignment of the controls of human systems to higher and higher scales, with corresponding increases in extra-somatic energy consumption, and global scale constraints (Boyden 1990: 47-55, 68-72). This has had the interesting effect of simultaneously overconnecting us at a material level while underconnecting us at an interpersonal level (thus probably keeping a sort of balance, but not one conducive to our optimal psychological health).³⁸ In a massified market system material Pseudo-Satisfiers are called on as ephemeral substitutes (such as for personal intimacy and the need for meaning: a disturbingly inadequate form of human connectedness.

³⁷ Through trading arrangements and the establishment of permanent settlements: the opening of new paths for energy dissipation, with the emergence of agriculture and urban systems assisted by sowing, new cultivars and storage bins (Allen 1977; Allen & Illitis 1980).

One may speculate on whether the post-war (WW2) fashion for relatively isolated suburban tract living with the paradoxically alienating but pseudo-connecting effects of television, Internet and telephone, performs the function of providing a physical balance to the overconnectedness inherent in modern life, keeping the overall connectedness within range.³⁹ It appears that new definitions of 'community' are emerging (belatedly in Australia) through a vastly expanding café society. For encounters of the well-off, this tends to keep the home territory private. The argument for a reinvention of community along the lines encouraged by modern information technology and transport, is problematic, as the transport is inherently unsustainable in its present form, and some 60% of Australian people are transport disadvantaged (Morgan 1992: A.6).⁴⁰ A similar situation applies to the Internet, and loneliness, poverty and alienation in our society are exponentially increasing, the vigorous success and flourishing of the top 20% notwithstanding.⁴¹

It is clear that thought and action now need to encompass all scales. **Links: Criteria Community, Connectivity.**

8.3.5.4.2 Arena vs. System Societies

Törnqvist, a disciple of Torsten Hägerstrand, proposed a classification of perspectives in Urban and Regional Geography: 'Arena' (sphere of action, a concrete concept based on space) and 'System', (an abstract, non-objective, intangible based on species) (Törnqvist 1981: 109-114). With Arena, being spatially delimited, territory, physical proximity and local relationships are key features. An Arena approach implies a relatively narrow but deep level knowledge of local surroundings with regional or territorial delimitations: a vertically-linked perspective. A System approach sorts its objects as to characteristic typologies in an aspatial manner, with minimal local anchoring. A Systems cognitive profile then, would have a horizontal pattern of sectoral knowledge across many territories, probably one principal deeply-informed sector and a working knowledge of one or two others, but poorly localised in space.

³⁸ This is evidenced *inter alia* by the approximately 50% failure rate of close relationships such as marriage, and massive consumption of mind-altering and stress-treating drugs.

³⁹ The author has been impressed on a number of occasions when extolling the virtues of Cohousing communities for modern overstressed middle class families, that the response has often been to exhibit panic at the idea of having neighbours who were so connected as to know one's business.⁵ A potential area for research.

⁴⁰ Transport disadvantage means dependence on others' goodwill or public transport (if any). Those so disadvantaged include the poor, the elderly, the ill and most children. Use of European-style PT is not a disadvantage indicator, as the services are generous and well supported.

⁴¹ For instance, using poverty as a surrogate for disconnection from healthy participation in society (Saunders 1998: 225), in South Australia there has been a 62% increase in the number of low to very low income households, and a >100% increase (18% → 40.7%) in school cards issued, between 1986 and 1996. 'Low' is defined by the SA Council of Social Service as 60% of average weekly earnings: 25% of the SA population in 1986 lived in such households, 41.9% by 1996 (43% in or near poverty). Numbers seeking emergency assistance at St Vincent de Paul Society SA rose 80% from 25,400 in 1986-7 to 49,600 in 1997 (similar reports other agencies) (The Australian Council of Social Service Inc 1998: 1-2, 6, 7). The Genuine Progress Indicator (GPI) per capita for Australia, United Kingdom, USA and some European countries has diverged from GDP per capita rises since 1950, the more sharply in recent decades (Halstead 1998: 58; Hamilton 1998: 89).

Törnqvist attributes to Hägerstrand the concept that the technological revolution with its accompanying massive improvement in connectivity through transport and communications was a transition from a vertical to a horizontal link principle in social organizational form.⁴² (Törnqvist 1981: 113-5). An intermediate form is suggested by the regular exit of working people from their domestic locality to participate in the ever-widening flows of the new systemic society, with a lessening dependence on the former. Before this transition the problem was horizontal integration, however vertical integration has taken over as a new emergent issue at the higher level with a threat to territorial dialects, cultures, knowledge, support, influence, civic participation and control. The loss of participation in local nature is a pertinent aspect of this transition.

Törnqvist proposes that the communicative capacity of society (connectivity) may have remained constant through these times, as better transport and communications have been accompanied by fragmentation of information and knowledge, increasing difficulties with decision-making processes and widening gaps between administrators and administered.

8.3.5.4.3 Connectedness and Social Capital

Sociologists⁴³ have recently begun to emphasise the importance of 'human capital' or 'social capital' in ways that seek to equate community and ecological values with other forms of capital development [Cox, 1995; Saul, 1997; Theobald, 1997].

Theobald in particular saw connectedness - the "reconnection of the alienated many" as the key to the social movement was encouraging.⁴⁴ Cox speaks of the valuing and rebuilding of social capital avoiding Communitarianism⁴⁵ as problematic, but supporting restitution of the role and mutual goodwill of civil society – reinvolvement of the public in civic activities and the rebuilding of conditions where strangers are not associated with concepts like 'stranger danger'⁴⁶ (Cox 1995: 30-31). Saul emphasises the loss of Democracy in following the route of Neo-corporatism (Saul 1997). All of these have to do with connectivity with social and neighbourhood processes and the constraints of alienation.

Another way to express this would be to say that we have all recently become far more directly connected than previously, to the global economic system. We are less cushioned from threats to our survival. Yet we are substantially disconnected from our own ability to provide for our

⁴² Supporting Allen's 'over-connected collapse to a higher level of organization' mentioned above.

⁴³ Eva Cox, *Life Matters* 1/11/95 & *Boyer Lectures* ABC Radio, 1995 series 11-12/95.

⁴⁴ Personal communication, 9/1998. Theobald died in November 1999.

⁴⁵ Particularly referring to the trend towards gated communities.

own subsistence in the artificial spaces of the city with its lengthening ecological footprint. We are more connected to each other and the world through communications and modern transport (and the consumer goods so provided). Yet we are more alienated from each other personally than ever before, due to the motor car, the new nuclear family structure, family breakdown, television's replacing conversation, the impacts of poverty and the systematic deconstruction of civil society through encouragement of materialist Individualism. More of us are connected to our own survival levels. In excluding us from meaningful influence in decision making, local, state and federal governments are disconnecting us from our civic connections (unless we rally together in large enough numbers – survival vehicles - to threaten the voting base). This situation would on psycho-ecological grounds be expected to generate anxiety, a sense of lack of control, territoriality, competitiveness, merciless attitudes towards strangers and those of lesser power, an increase in chronic degenerative, especially stress-related diseases, and an increase in consumption of mind-altering drugs and anti-depressant medications. Which we do see in practice.

8.3.5.5 Relative Disconnection (Functional Constraint)

8.3.5.5.1 Introduction

O'Neill *et al* point to hierarchical assumptions implicit in ecosystem research, the assumption of relative holonic independence being one (O'Neill *et al* 1986: 60). Training in the 'naïve' understanding of hierarchy as levels of organisation, needs to be un-learned by ecologists to make best use of the more sophisticated theory. **Link: Unified Ecology.**

Three of Barry Commoner's four famous ecological aphorisms celebrate the base condition of ecosystems as connectedness⁴⁷. But if everything is connected to everything else, why don't information or disturbances pass indiscriminately through every system, unimpeded. The key to understanding ecological systems lies in relative disconnection (O'Neill *et al* 1986: 86-7), which provides new opportunities to conceptualise the control systems, the protection systems, the constraint systems and the interpretation of system health.

Beyond the direct impact of spatial (dis)continuity, barriers, contiguity and access, the holonic hierarchical arrangement, with rate differences between levels, and the perturbation-resistant quality of asymmetry,⁴⁸ serve both to organise and to accord relative disconnection to subsystems of complex systems (O'Neill *et al* 1986: 94).

The picture that emerges is of a medium-number system whose organised complexity is amenable to decomposition because of differences in process rates.⁴⁹ Behaviours are arranged into a vertical structure because very slow and very rapid levels are isolated from each other. Within a level, holons are isolated from each other by gradients in process rates. Thus, the old imagery of the natural world as having everything connected to everything else is short sighted. It is the relative disconnection that constitutes the organization of the system (O'Neill *et al* 1986: 86). *[Emphasis added]*.

The intimacy of direct, unconstrained connectivity is a special situation, and a threat to system integrity if generalised throughout a structure. This clearly has implications for the dismantling of constraints in complex dynamic systems such as economies: free markets may open up opportunity for some to benefit, but concurrently also exposes them and the whole system to shocks from within or without. When constraints are artificially removed by Technology, signal, threat or perturbation can flow rapidly through the system, risking disintegration. A possible life-threatening loss of resilience is implied.⁵⁰

For instance, several cases have occurred recently which threaten(ed) large-scale damage to public health or agro-economic disaster: in Australia genetically engineered food (health and ecological threats), contaminated food (pain killers, baby food, salami and orange juice, fire

⁴⁷ 1). Everything is connected to everything else 2). Everything has to go somewhere 3). Nature knows best 4). There is no such thing as a free lunch (Commoner 1992: 8-14).

⁴⁸ Upper affects lower but relatively unaffected by lower level due to frequency differences. Acts as a Constraint and to confer resistance to perturbation. Linkage: Holons.

⁴⁹ (Simon 1973: 3-27).

⁵⁰ Personal intimacy requires the same careful balance of openness and constraining boundaries.

blight in apples, Newcastle disease in chickens, Mediterranean fruit fly; bird 'flu in Hong Kong; in the European Economic Community (especially United Kingdom) mad cow disease; and Belgium – dioxin in chickens and beyond, contaminated Coca Cola), plus a series of toxic chemical spills contaminating rivers following inadequate constraint (presumably relying on Probability Theory to assess risk). This demonstrates the hazards of globally and nationally overconnected, poorly constrained human food chains (even more deadly when combined inadvertently or not with toxic waste streams).

The international negotiation of Free Trade Agreements and the prescription of trade and growth as the top priority economic solutions is being conducted with minimal eco-social wisdom and without consideration of possible potentiation of impacts by others considered separately, nor of climate change (Martin & Schumann 1997: 242-3, 29-34, 148-9).

Economic Rationalism bizarrely believes (and this is not a joke) that the market knows what it is doing (Ellis 1998: 18 – First Abolish the Customer).

8.3.5.5.2 System Controls (Organising Principles)

To reiterate, the relative infrequency of the return time, the difference in rate processes, by their relative passivity renders higher levels indifferent to most lower level perturbation. This, like complex structure, is a survival mechanism. At the same time, the upper level corrects for errors emerging from the lower, and passively 'keeps it in place', but still depends for its existence and persistence on the levels below (Allen & Hoekstra 1992: 33): a reciprocal arrangement. **Link: CDS, FFE Systems.** This is the key point at which our development and technology programmes ride roughshod over ecosystems. We are not in a worse position because the Biosphere has been astonishingly resilient.

System function depends on a balance between inter-scale relativities derived from these fundamental asymmetries in system structure, and system feedbacks of different rates: negative feedback, which either relatively ignores or dampens signal, and positive feedback, which augments signal. It depends on the containment structure of the system (nested including overall system goals, or un-nested including Organising Principle), and the web-like self-organisation of system entities, their functions, connections, relative purposes and interference fields, in the context of their environment, which is the next higher level of the whole in which they participate. **Links: SOS, Feedbacks, Tables: 59, 58.**

In nested systems such as organisms, where connectedness is greatly enhanced, the balance of positive and negative feedbacks (homeostasis) is critical to physiological function. Ecophysiology

is less tangible than a single organism, but no less important to global function. Each level is subject to the ecological succession cycles described by Holling (exploitation, conservation, release and reorganisation), which are triggered by different states of connectedness and capital build-up in the multi-stable system (Holling 1995: 12-13).

The system Drivers are abiotic and biotic, the latter always striving to optimise their long-term growth and survival, and locate the resources they need, against an array of Constraints, from climate and geomorphology to competition. In addition, systems containing humans are affected by the Drivers and Stoppers of intangible (social, cosmological, relational) human interference fields. Such systems can not be healthy unless their biotic elements are all able to meet their survival, reproductive and well-being needs over time. Thus a 'sustainable' development system should be a needs-based system. Table 51: Key Variables and Speeds in Managed Ecosystems listed proven constraints at three scales for ecosystems. The extension of this concept to human settlement design is considered below. **Links: Criterion Feedbacks: Design Issues, and Confluence: Weaving the Backcloth: Constraints Analysis.**

These themes will be taken forward and used in the definition and use of the Criteria of Observation which constitute the Unified Human Settlement Ecology approach, the development of which is to be the tangible outcome of this research work.

8.3.5.5.3 Personal and Social Constraints

Human personality can be thought of as an interference landscape wherein the complex of perceptions, information processing and response patterns is the outcome of genetic inheritance, physical function and past experience. The Transactional Analysis understanding of the 'Life Script' (a personal version of Atkin's 'Backcloth'), which underlies individual behaviour, relies on a system of unique internal drives, drivers and programmed constraints ('Drivers' and 'Injunctions') substantially developed by each individual in the course of growing up and modified to a variable extent through life. The Life Script has multiple roles, not the least being psychological 'glue', and a positive/negative constraint and feedback system. A certain, culturally standardised level of constraint (in the form of the legal system) is essential for a smoothly-operating community, and the terms 'Organisational Script', 'National Script', 'Social Script' and 'Cultural Script' refer to the higher scale extensions of the concept of a personal Script.

On the other hand, psychopathology of different degrees is essentially a distortion of the personal constraint system: diagrams in Schiff *et al's* "Cathexis Reader", which deals with

psychosis, clearly demonstrate the abnormal internal connections and disconnections that such conditions entail (Schiff 1975: 28-9, 61, 77, 79-84).

At the scale of the individual (intra-human), excessive stimulus is intercepted and dealt with by manipulating psychological disconnection, by focusing on one perceptual channel at a time, by bringing different channel perceptions to foreground consciousness moment by moment, and also by automating operations which are not required by the person's primary process.

This system is partly modulated according to Stimulus Hunger, one of the three Basic Psychological Needs (**Links: BP 5.2 Transactional Analysis; Criterion Organism**), and is also modified according to an individual's ability range and past-modified experience in stimulus management. Overconnection to environment with overstimulus results in defensive responses which include blocking of perception, channel switching, emotional discharges and withdrawal (Goodbread 1987: 213-8, 188-9; Schiff 1975: 10-19). Underconnection is experienced as 'Stroke Hunger', or 'Stimulus Hunger', which results in (usually external) procurement behaviour. This varies with preferred individual strategies (for example requesting or demanding attention, 'hanging around' other people, addictive/consumptive behaviours⁵⁰ or positive or negative performance-related behaviours⁵¹ designed to gain approval or rejection (Berne 1964: 13)⁵². Knowledge of these dynamics is applied in the practices of Ericksonian hypnotherapy, Gestalt therapy, Transactional Analysis, Neuro-Linguistic Programming (NLP) and Process Oriented Psychotherapy (POP).⁵ **Link: BP 5.3: q-Analysis.**

⁵⁰ For example materialism, addiction to 'Pseudo-Satisfiers' such as shopping, social drug consumption, including caffeine, over-eating.

⁵¹ For example 'Workaholism', Perfectionism, obsequiousness. Workaholism may also balance overconnectedness by legitimising withdrawal.

⁵² While not pleasant, rejection and criticism are a highly stimulating experiences.

8.3.5.6 Seeking a Theory of Connectedness in Complex Dynamic Systems

Allen & Starr (Allen & Starr 1982: 194) and Chadwick (Chadwick 1971: 11-13), both propose Information Theory as an appropriate source of concepts for the scientific investigation of communication within natural systems. 'Signal' is proposed by TFH Allen *et al* to pass between ipse-level holons, not directly, but via a higher level junction holon through a threshold mechanism (a low-frequency filter), with responses in effect coming from the larger whole.

Adams is working on a higher logical level, but sees Information Theory as inadequate in its usual form in that it does not usually concern itself with energy. As seen under Energy & Thermodynamics (and see quotation at chapter head), his conceptual extension includes communications, behaviours and ideas as energy forms, in addition to matter itself, along with the usual considerations of kinetic and potential energy (Adams 1988: 78-84).

Sociologists have recently begun to emphasise the importance of 'human capital' or 'social capital' in ways that seek to equate community values with other forms of capital development,⁵³ and 'Natural Capitalism' has been mentioned (all versions of Capitalism appear to be based on Systems Theory, the main questions being what is or is not included as ordering parameters and whether or not the system ideal is equilibrium or far from it).

O'Neill *et al* and Kay detail the connectedness of open complex systems in terms of energy paths. Higher levels of organisation dissipate more energy by virtue of the addition of new connected components or the opening of new pathways. The assumption (related to Lakoff & Johnson common metaphor) that 'higher is better' is inaccurate. Higher means more complex, lower frequency of return time, longer persistence, more resource use, more side effects and more throughput of energy: a complex matter. A lingua franca could address the full range of ecological, physical and social transformations, and Adams' 'energy forms' appear to suit this role, and could encompass the Cathexis form of Transactional Analysis.

Another candidate for this role is q-Analysis, which was developed to describe connectivity in complex hierarchical systems in traffic management, but phone interviews with leading q-Analysts indicates that this would be a difficult collaboration in practice in this country.⁵ **Link: BP**

5.3: q-Analysis.

Think functionally, act strategically
Configure globally, challenge locally
(IFC 1992: Document B IFCD51A).

⁵³ Eva Cox, *Life Matters* 1/11/95 & *Boyer Lectures* ABC Radio, 1995 series 11-12/95.

8.4 SPATIAL HIERARCHY

Spatial hierarchy is of course the focus of interest of the Geographical Sciences including Physical Geography, Geomorphology, Landscape Ecology, GIS and Spatial Modelling. It is inherently nested, as the larger scales (smaller scale to geographers) contain the smaller. Spatial relationships are contiguity-based⁵⁴ and of course, readily observed, whether directly or indirectly by means of scale-limited technological extensions such as microscopes, cameras, telescopes and satellites. Most Spatial Hierarchy beyond human scale is detected through imagery which relies on electromagnetic radiation at some wavelength range. Subjects may be static, or increasingly, dynamic and relative (**Link: BP 5.8: GIS**).

Cartographers dealing with Spatial Hierarchies are accustomed to simply crossing between orders of magnitude in the range 10²cm (approximate human individual scale) to 10¹⁰cm (approximate equatorial circumference of Earth) range⁵⁵ (Haggett 1975: 14-15), and often use logarithmic graph paper for direct representations. The distance decay effect ($1/d^2$ where d = distance) holds for many spatially-mappable fields.

There is a pattern of major shifts of common focus for the discipline as a whole, usually described as 'macro', 'meso' or 'micro' (Meyer *et al* 1992: 269). Relatively simple mathematics translates from one map scale to another, and the use of ratios avoids the awkwardness of metric-imperial relativities. The fractal index complexity measure is a simple logarithmic ratio (**Link: Criterion Landscape**).

A number of authors, especially in Landscape and Population Ecology, Epidemiology, Geographical Information Systems modelling and Population Geography, have taken an interest in the patterning of features related to landscape, and found them to be tightly scale-dependent (Allen & Hoekstra 1992:61;Gibson *et al* 1998:11;Milne 1991: 81;O'Neill *et al* 1986: 84). Patterns can emerge at one scale and completely disappear at another. This phenomenon again supports caution in carrying assumptions from one scale to another, and respect for diversity.

Hierarchical spatial data structures (for instance the quadtree) have been a major Geographical Information Systems breakthrough, also related to fractal concepts: scale is viewed as a variable with process relationships across scales.

⁵⁴ "The First Law of Geography is that everything is related to everything else, but near things are more related than distant things" (quoting Tobler, 1970 Goodchild 1992: 155).

⁵⁵ As above, Meyer *et al* now claim 15 orders of magnitude (Meyer, Gregory, Turner II & McDowell 1992: 267).

Physical Geography has usually concentrated on micro (site) scale for research, but the existence of different controls operating across a range of space and time scales is recognised, if not successfully integrated.

In land-use mapping, space-for-time substitution has been found not to work for Geomorphology, nor has direct inter-scale translation, due to scale-dependent differences in the Organising Principles. Geomorphology and BioGeography tend to occupy the larger and smaller ends of a temporal continuum, but both see 'landscape scale' as the main research focus (Meyer *et al* 1992: 270). This is compatible with the bioregional perspective now emerging as a central ecological concept for 'sustainable' Planning, although where a region sets its boundary does vary with function (**Link: Criterion Genius Loci**).

Both disciplines understand the importance of integrating the micro, especially in the present context of human impacts and climate change. This has been attempted by a continuous improvement approach with a combination of model-building and empirical studies building up from below and validated against stratigraphic data. Subsequent work would test such modelling for different sites. Historical data (initial conditions sensitivity) is critical to theory testing at all scales. **Link: BP 5.8: GIS**.

8.5 DOMINANCE HIERARCHIES

Dominance and subordination characterise all animal societies with the possible exception of certain schooling fish (Ardrey 1967: 244).

The power structure of a community or family changes more slowly than the individuals of whom it is constituted. Voting itself has a shorter duration than the régime elected; dominating relations last longer than the individual behaviours invoked. Thus Dominance Hierarchies could be regarded as a subset of Frequency Hierarchy.

Adams⁵⁶ above, claimed the development of hierarchical structures to be inevitable above a certain sized population (Humans). Sagan⁵⁷ *et al* highlight the linguistic embeddedness of the dominance metaphor ('top dog', 'under dog').⁵⁸ The functions of Dominance Hierarchies include political stability, military preparedness and preferential gene transfer, but these advantages require the recognition of individuals, a working knowledge of rank, strategic thinking, flexibility and an ability to work the system. Deploing "racism, sexism and a toxic mix of xenophobias", they see the easy human recognition of individuals (by clothing, language and other signifiers) as key grounds for hope:

"This town ain't big enough for both of us" isn't really the way Dominance Hierarchies usually work. Faced with a testy alpha male, you have another option besides fight or flight. You can submit. Almost everybody does. Subordinate males ingratiate themselves to those at the top of the hierarchy through incessant bowing and scraping ... Being alpha is one strategy for males to continue their lines. Being beta or gamma with an inclination to kleptogamy is also a strategy. There are others (Sagan & Druyan 1992: 207).

An unambiguous, well-defined Dominance Hierarchy minimises violence. There's plenty of threat, intimidation and ritual submission, but not much bodily harm. Violence does occur when the rank order is uncertain or is in a state of flux (Sagan & Druyan 1992: 207).

This unpopular Hierarchy is the ground for perhaps the most fundamental difference between EPP and mainstream Cosmologies. We have big problems around dominance, three of the biggest being 'what is going on and wrong with our social structure?', 'what are we really like?' and 'can we be make it to transcendence?' **Link: Criterion Community.**

The 'right' claimed to dominate is based on cultural belief systems:

There is an almost universal hierarchy of scorn, according to which literate peoples with advanced metallurgy (for instance white colonists in Africa) look down on herders (such as Tutsi, Hottentots), who look down on farmers (such as Hutu), who look down on nomads or hunter-gatherers (such as Pygmies, Bushmen). Finally, our ethical codes regard humans and animals differently. Hence modern perpetrators of genocide routinely compare their victims to animals in order to justify the killings (Diamond 1991: 269).

⁵⁶ An anthropologist by training.

⁵⁷ Sagan, Ardrey, Diamond, Bohm, Capra and similar scientists have taken the role of public intellectuals who have at different times written for the popular press, reflecting current scientific constructions of reality back to their enthusiastic readerships. It is unusual for reader-proponents of the ecological paradigm not to have read widely from their sections of the bookshop.⁵

⁵⁸ This distinction was the basis for much of Fritz Perls' Gestalt Therapy group work, and has been refined to great effect through Transactional Analysis.⁹

With the advance of the Human Genome Project, there has been a tendency to revert to the determinist 'Nature' side of the 'Nature/Nurture' argument, potentially relieving us responsibility for our behaviour: that is of concern.

Interest was high in the 1960s and 1970s as to the best animal model from which to deduce insight about the possibility of biological determinism inherent in human behaviour such as territoriality, xenophobia, power related to gender (for instance see Ardrey 1967;1970;Bleibtreu 1968); link-seeking has continued (for instance see Broome 1982;Diamond 1991;Haraway 1989;Lopreato 1984;Sagan & Druyan 1992). Haraway gives a succinct review of literature addressing these matters (Haraway 1989: 124-9).

Many ancient voices speak within us. We are capable of muting some, once they no longer serve our best interests, and amplifying others as our need for them increases. There is cause for hope (Sagan & Druyan 1992: 217).

Earlier Ardrey, whose anthropological work was subsequently written off by Haraway as "fit for the silver screen for which he also wrote" and inappropriately supportive of the "messages of aggression, territoriality, biological determinism, male hunting as the motor of humanization, and male dominance as the structure of human cooperation" (Haraway 1989: 127), had nevertheless concluded:

Yet the broadest and most indisputable conclusion must be that society ... has been nature's cradle. Social order – with its rules and regulations, its alphas and omegas, its territories and its hierarchies, its competitions and xenophobias – has been the evolutionary way. And if I am correct, then it is the individual as we know him that has been the human invention ... Man [*sic*] indeed was born yesterday. Social order is contained in our animal past and is ingrained in the patterns of our animal sub-brains. The individual is the creature of the human future, and we still do not know quite what to do about him ... When we speak to him in the language of the neo-cortex, it is the language he understands (Ardrey 1970:357-8). [*Emphasis added*]

Ardrey then goes on to describe 'the mob' as an emergent, ordered yet monstrous and 'reptilian' human phenomenon, speaking no human language, and constituting a direct threat to the individual and post-neocortical self-awareness (:359). He sees monolithic states without 'religion' (values structure) as

... in gigantic imitation of the hominid hunting band ... directed to ... survival of the mediocre ...and needing police to enforce conformity, a solution in evolutionary terms for which we do not have time (Ardrey 1970: 360).

Diamond too, is concerned with the human tendency to genocide, an extreme collective dominance behaviour common in animals and humans, so much more formidable with the assistance of modern technology, and in active potential in us all. This same Technology can also, however, help break down the 'us vs them' distinction that maintains xenophobic dominance drives (Diamond 1991: 250, 275): the secret is to appreciate the other as an individual.

The poor image of hierarchy in the minds of many EPPs has to do with Dominance Hierarchy, the Competitive Paradigm and their implications for the less apt or fortunate. This is particularly marked in Marxist Sociology and Eco-Feminism (Birkeland 1991: 549), but is also of enormous concern to intentional communities who struggle with these issues daily and deliberately.^{5,59}

Without wishing to become further embroiled in the philosophical argument between dominant and eco-paradigm groups on the one hand, and between elements of the latter among themselves, quotes from Birkeland iterate some of the key issues. Birkeland locates in all modern schools of thought, what she calls the 'androcentric premise', the "legacy of the history of male dominance". Its essence is an assumption of "a masculine model of Man and its associated values", similar to Ardrey's vision of the individual above. Its implications include a failure to challenge power relations and structures, including this omission by gender-blind radical theories. This premise has five key aspects:

1. Masculine/feminine polarisation with elevation of 'male' traits and values;
2. An instrumentalist association of women, earth and Nature in Patriarchy's favour;
3. A false ascription of male autonomy from both community and Nature;
4. An egoistic universalisation of male goals, experience and values, based on these freedoms; and
5. The alignment of power over others with masculinity (Birkeland 1991: 548-9).

Birkeland is unwilling to entertain the possibility of a biological deterministic explanation for human aggressiveness:

What, then, are the implications of the androcentric premise? ... This Patriarchal construction of reality is implicated in the behaviours and attitudes which environmentalists cite as underlying causes of the modern crisis: competitive individualism, human chauvinism, instrumentalism, hierarchy, parochialism and the addiction to power ... Perhaps more important ... [it] prevents our questioning the necessity of power relations per se ... Ostensibly gender-neutral theories protect the power structure by concealing the ideological basis of exploitative relationships. Militarism, colonialism, racism, classism, sexism, capitalism and other pathological 'isms' of modernity obtain legitimacy from the assumption that power relations and hierarchy are an inevitable part of human society due to Man's 'inherent nature' (Birkeland 1991: 549).

This Ideology then justifies physical coercion and hierarchical structures to control this free-wheeling male-style aggression, while the female driven cooperative systems are devalued.

... if humans will always compete for a greater share of resources, then the 'rational' response to the environmental crisis would seem to be dog-eat-dog survivalism. This creates a self-fulfilling prophesy in which nature and community simply cannot survive (Birkeland 1991: 549).

This battleground is well-trampled in the literature. I would just comment that a new Ecological Paradigm has been doggedly emerging since at least the 1960s, and while understanding the terrible potential humans have for aggression, it seeks to harness their more transcendent qualities. It does have concern for inventing alternative institutional structures. Heterogeneous

⁵⁹ For instance Fuzzies Farm in the Adelaide Hills seeks to model, and has a fully-developed Philosophy and governance, based on a concept of hierarchical structures being a stepping stone on the way to the circular structures required by a re-communalised future.⁵ It is interesting that 'Generation X', (born 1965-78), who tend to live alone longer and breed

groups have been found not to work consensually above a certain size (say 100 from Cohousing - 30 households - and intentional community evidence, probably lower⁵), which at Findhorn was related to the need to conduct business in the faster outer world.⁵ The 'servant leadership' model has been prominent in the new social movements such as 'Reworking Tomorrow' (after Robert Theobald).⁵ Above all, the Ecological Paradigm is a spiritual movement in that term's broadest sense. **Links: Criteria: Community; Organism.**

It remains to be seen whether Australia's Republican Debate will ultimately deliver a refurbished Hierarchy or perhaps transcend this arrangement to a presently unimaginable cooperative power structure involving a modern (perhaps electronic) form of Participatory Democracy; could we go on to demonstrate Henderson's 'heterarchy' and Houston's 'possible human' (Henderson 1991: 68; Houston 1982: 182-200)?

The need for a new World Order can now be scientifically demonstrated. We see the principle of interconnectedness emerging out of reductionist science itself as a basis, and the concomitant ecological reality that redistribution is also a basic principle of Nature. Since all ecosystems periodically redistribute energy, material and structures through bio-chemical and geophysical processes and cycles, all human species' social systems must also conform to principles of redistribution of these same resources that they use and transform ... we see six ... post-Cartesian ... principles emerging in Westernized science ... implying human behavioural adaptation ... Interconnectedness, Redistribution, Change, Complementarity, Heterarchy and Indeterminacy (Henderson 1991: 68).

These Principles are expanded in **Table 61: ESCM: Social Implications of Six Emerging (Post-Cartesian) Principles.**

As hologrammatic being, every part of you is a nexus of all possible occasions that ever were and ever are. You are therefore the whole and the part. You are who you are, a substantial being woven upon the grid of space and time in the explicate order. Therefore you are both identity (who you are in your developmental life process) and holonomy (of the order of the whole). The structures of your being quite literally reflect the ongoing structures of the universe. (Houston 1982: 194).

We finally arrive at our own time, when the human race can no longer afford the invidious comparisons and psychological imperialism that some "successful" cultures and nations impose on others. In this time of planetary culture we need to bring forth and orchestrate all the Rhythms of Human Awakening that have ever been in humanity's search for what it can be (Houston 1982: xvii).

later, have a tendency to eat communally, in outsourced settings (to the point where their housing requires no kitchen, but rather a super-bar snacking arrangement at home (MPS Architects Sydney, market research 1999).

8.6 CONCEPTUAL AND CONTEXTUAL HIERARCHY

8.6.1 META-STEPS

The layers of these types of hierarchy are typically visualised with the slower, larger variables, often intuitively, 'up' (referring to the metaphoric constructions of up is good, down is bad; paradoxically, fast is good, slow is bad (?hence the modern impatience with values); big is good, small is bad⁶⁰ after Lakoff & Johnson, 1980). Contextual and Dominance Hierarchies are not usually seen as time-related, but could be described that way since the social context of an action changes more slowly than individual actors.

Conceptual Hierarchies usually change logical types from layer to layer, and the Organising Principles behind the changes may involve switching from tangible below to intangible (for instance land below, then people and their behaviours, then society and finally, Cosmology).

Link: Criterion Community: Dealing with Community Criterion in non-EPP Settings.

Meta-research takes many scientific studies and conflates their information, but the result is not applicable at individual level.⁶¹ This statistical strategy is a conceptual system or approach, but says nothing about the structure of the system by which the individual comes to have the characteristics measured.

In his initial paper on the theory, Atkin, 1974 quotes Piaget: "every form is content for 'higher' forms and every content is form of what it contains" (Atkin 1974: 57;Piaget 1971). This type of hierarchical thinking describes a nested system based on cover sets, which is the basis for q-Analysis. The sets are organised according to the 'Principle of Usefulness' and careful attention is given to the connections structure between set elements (Gould et al/ 1984b 57-9).

Atkin referred to Foley's work on the process of translating stepwise from an abstract, normative cultural structure through the bridge of a functional, organizational structure, to a spatially located physical one. He saw the physical environment (at human scale) as a relatively static Backcloth which changed slowly, and on a much slower timescale than the shorter timescaled human activities of the 'traffic' (the subject of concern). This was thus a SpaceTime Hierarchy, at any level of which a community would have a dynamic part (N), and a relatively static part (N+1).

It is a matter of spatial convention that the Backcloth is seen as below the traffic. This is the reverse of the orientation used for rate-based hierarchies, and may cause the same type of

⁶⁰ Note the relationship to Schumacher's famous title "*Small is Beautiful*" (Schumacher 1975) which challenges this Metaphor.

confusion as the terms 'large' and 'small' scale, which are also reversed by the two camps, for instance with regard to the scale of mapped subjects.

Embedded meta-level concepts are integral to the Humanistic Psychotherapies of the human potential movement which emerged from approximately the 1960s and remain important today.

8.6.2 BATESON AND HIERARCHY

Research for this dissertation has turned up reference to the work of Bateson in at least six disciplines. It would perhaps be seen as odd that an anthropologist (who was better known publically as Margaret Mead's husband), should have had so much inter-disciplinary influence, but perhaps Bateson would be better understood as an old-school natural philosopher and thinker. To quote his student Engel, in recommending Bateson's solution to the cultural crisis of the 1960s-1970s:

... thinking things through and taking as little as possible on faith", has a prerequisite: " ... to learn to think, you must have a teacher who can think. The low level of what passes for thinking among the American academic community can perhaps be appreciated by contrast with a man like Gregory Bateson (Engel in Bateson 1972b: x).

In "*Mind and Nature*" Bateson explicitly centres the book's Epistemology on Bertrand Russell's Theory of Logical Types or the "hierarchic structure of thought" through which he seeks to explore an "Ecology of Thought" and establish a "sacred unity of the biosphere" with less epistemological error than the sacred unities of Religion. The different levels of Conceptual Hierarchies constitute different Logical Types, and transformation processes related to this are a (probably essential) characteristic of mental ordering (Bateson 1988: 20, 43), which thus would mirror other natural structures. While this type of Hierarchy is essentially meta-physical, the underlying structure is still conceivable in frequency terms - the higher levels are contextual, or less transient than the lower, as Conceptual Hierarchy above.

NLP practitioners understand that as parts of the personal system of communication, different representation systems have equivalent validity, which contrasts with Bateson's interpretation of Russell for communication and Psychotherapy. This latter takes an approach similar to Bohr's Complementarity Principle (compare Table 17: Bohr's Complementarism), ascribing two inevitable parts to every communication – the content aspect and the relationship aspect – a binary approach.⁶² But Logical Typing, which seeks to avoid paradox by keeping logical levels separate, ascribes the meaning component of a message, including all non-verbal (analogic) messages,⁶³ to

⁶¹ To the consternation of cancer patients.

⁶² This is equivalent to the Transactional Analysis concept of 'social level' and 'psychological level' in Game Theory.

⁶³ Such as body posture, movement, tonality, tempo (Bandler & Grinder 1975: 36).

a higher level, while conflating all verbal messages to a lower level (low = less true or less valid (Lakoff & Johnson 1980)).

This immediately sets up a competitive or conflicting scenario, where one level can define another as deceitful or misleading. Therapy based on this sort of premise (and Bandler and Grinder comment that most forms of psychological intervention are anchored to this model) has been found in NLP practice to conflate information such as inter-channel incongruencies, which need to be separated out in therapy. It is more useful to put on the one level as 'paramessages', all sensory channels and their content, including the reflexive, linguistic representational system, which can represent each modality in unique ways, serve as a tool of inter-modal translation, and also make comment about itself from a meta-position (Bandler & Grinder 1975: 8, 33-37).⁶⁴ This is an esoteric issue, but of similar type to that in Ecology, where Allen & Hoekstra in their Unified Ecology consider each Criterion at every scale, while orthodox Ecology describes them as a hierarchy of ecosystem above community above population and so on. **Link: Unified Ecology.**

John Grinder and Richard Bandler⁶⁵ have done something similar to what my colleagues and I attempted fifteen years ago ... to create the beginnings of an appropriate theoretical base for the describing of human interaction ... there were a few beginnings from which to work: the 'logical types' of Russell and Whitehead, the 'Games Theory' of Von Neumann, the notions of comparable form (called 'homology' by biologists), the concepts of 'levels' in Linguistics, Von Domarus' analysis of schizophrenic syllogisms, the notion of discontinuity in Genetics and the related notion of binary information. Pattern and redundancy were beginning to be defined. And, above all, there was the idea of homeostasis and self-correction in Cybernetics ... Out of these pieces came a hierarchic classification of orders of message and (therefore) of orders of learning ... to classify the ways in which people and animals code their messages (digital, analogic, iconic, kinesic, verbal ...) ... Perhaps our greatest handicap was the difficulty which the professionals seemed to experience when they tried to understand what we were doing ... Grinder and Bandler have confronted the problems ... they have succeeded in making Linguistics into a base for theory and simultaneously into a tool for therapy ... (Bateson 1975: ix-x) [*Italics added*].

NLP takes the meta level A as that which from above, comments about B, includes B in its scope or contains B at a lower level as a system part. The system is n-ary for each level, rather than binary, (Bateson's scheme is a special case of the NLP one), and even though in the end they relate different combinations of sensory channel to functional patterning of left and right brain,⁶⁶ they regard any act of communication as having as many components as there are input channels or ways of knowing (Bandler & Grinder 1975: 35, 38). The sensory modalities most often worked with in NLP are the Visual, Auditory and Kinaesthetic, with Olfactory and Gustatory having secondary significance. Input ('lead systems'), output and representation systems ('Rep. Systems') are identified, all of which transmit paramessages. Highly valued channels may be different across these arenas. Paramessages can not be meta to each other, as they form a set of simultaneous messages from one source; each channel is limited to one

⁶⁴ The functional unit then becomes the paramessage in its metamodel context. A 'miss-ion' perhaps? (After 'environ', 'socio', 'holon').

⁶⁵ Originators of Neuro-Linguistic Programming (NLP).

⁶⁶(Edwards 1999).

message at a time, and only messages present in the same rep. or output system can be meta to each other (Bandler & Grinder 1975: 41). Conflicting paramessages are regarded as indicators for personal resources for growth and change, and the diversity arising from multiple channels is highly valued (Bandler & Grinder 1975: 38).

BP 5.9: The NLP Meta-Model provides further information about NLP.

8.7 OTHER HIERARCHIES

These include:

The Linnaean binomial classification system: a nested, Conceptual Hierarchy based on relatedness. It is similar to decision trees and computer algorithms.

The Decision Hierarchy and Opportunity Hierarchy mentioned by Holling, are used by animals to make assessments at different scales about food, nesting and home range, and lead eventually to presence and activities on a particular area of ground or water at a particular scale. (Holling 1992: 474-8). This is a complex matter, based on perception: "the objects encountered by animals are either edible, frightful, lovable, ignorable or novel" (Holling 1992: 474). Final decisions depend on the matching of several Hierarchies, and for survival, needs must be met through bad times at least, through environmental flux across appropriate space and time scales. The limits of self-adjustment are changing yourself (for example hibernation) or the environment (for example finding or building shelter or migration). Climatic transformation through a hierarchy of landscape characteristics, together with the Decision Hierarchy, at different scales provides 'habitat templates': a spacetime Hierarchy of Opportunity (Holling 1992: 478).

8.8 A CONFERENCE ON SCALE IN SOCIOLOGY

8.8.1 INTRODUCTION

This section explores an instructive collection of works from an international conference on the macro-micro link, sponsored by the German and American Sociological Association in Giessen, West Germany in 1984. It was evident that despite an implicit agreement as to the hierarchical arrangement of scales in Sociology, and frequent reference to 'emergent properties' at macro scale that differed from the micro, there was considerable variation amongst prominent sociological authors as to the definitions mentioned of the different scales. There was also a tendency to locate scales in a way that corresponds to different ecological Criteria (UHSE: Organism, Population, Community, in different micro-macro combinations).⁶⁷ **Table 62: BIRRCM: Scale Definitions of Prominent Sociologists** gives examples of these definitions and suggests the usefulness of a model which makes these distinctions (after Alexander, Giesen, Munch & Smelser 1987: 356-7).

The existence of a situation where there is definitional consistency at neither contextual nor subjective level, can only serve to promote mystification and make comparisons exceedingly difficult or impossible. Urry describes Sociology as 'a relatively unusual discourse' with 'a multiplicity of perspectives with no common concept of society which unifies them', '-not easily demarcated from commonsense concepts ...' 'difficult to establish ... progress' and of 'parasitic nature' (innovations sometimes originating elsewhere) (Urry 1989: 295). The above table indicates the potential benefit to intra-disciplinary communication of sorting sociological approaches according to the Community Criterion, to be described below.

At our scale, all the levels of the 'Cascade' from Ecorelations and Cosmology through institutions, policies, laws and rules, education and complex and simple contracts, obligations and other relationships down to the personal, are parts of the context of the humans-in-their-environment holon, even if as researchers we choose to focus on smaller holons for non-ecological or mechanism-elucidating reasons. The sociological meeting mentioned above also attempted to define the parameters of the movement from micro to macro and from macro to micro,⁶⁸ which were seen as different.

⁶⁷ These will be explained in the following Section.

⁶⁸ A difficult task in view of the dissonance as to defining both.

8.8.2 MICRO TO MACRO

Collins, while seeing micro and macro as essentially self-sufficient, supported documenting the connection, the 'mutual penetration' of theory. He saw the macro as 'aggregations of microencounters', which had primacy in shaping microencounters and could be known exactly in terms of numbers, time and space, the ultimate and only macrovariables into which all other metaphorical concepts should be translated. He promoted the micro as the locus of dynamics, the activities negotiating interpersonal power and energy budgets, the structural glue and the source of the elements which in aggregate constitute the macro.

The scales are connected by interaction ritual (IR) chains, with present conversations being dependent on group membership and social roles constructed around a core principle of control of property. He saw micro-macro as a time-space continuum, with diversity and numbers of individual encounters over time being a key explanatory principle behind emergent characteristics such as are expressed by the 'Principle of Social Density' (Durkheim). This latter expects high exposure⁶⁹ individuals to have more abstract, relativistic and long-term oriented ideation, and low exposure individuals to be more localistic, particularistic, concrete and short-term focused, with a magical thinking attitude towards external forces (Collins 1987: 195-7, 201-5). The translation consists essentially in the interpretation of emergent drivers in the cloud of historic conversations and relationships which form the context of the present interaction.

Schegloff proclaims three translators in the context of his interest in speech exchange systems: stability in social organisation (repair behaviour⁷⁰ in conversation) across a range of societies; variation of behaviours (turn-taking in conversation) with respect to a macro-relevant variable (gender relations); and invocation of the term 'context' which will always be macro to the behaviour in question. Indeed the final suggestion is that the mode of interactional organisation itself be considered context (Schegloff 1987: 209-21). The first two approaches to translation are essentially biscalar, qualitative and comparative rather than explanatory or mathematical in nature, while the third invokes a hierarchical continuum which includes sub-societal meso level organisations.

Münch and Smelser contend that the individual challenge is to derive macrophenomena from situational analysis. In summarising themes, they list the micro-macro translation modalities as aggregation, combination, externalisation, reproduction and conformity (Munch & Smelser 1987:

⁶⁹ In other words, a frequency-of-human-contact hierarchy.

⁷⁰ 'Repair', which has its own special rules, refers to efforts made by self or other in conversational interchange which seek to deal with 'trouble', which means events such as speech difficulties, incorrect words, misunderstanding and so on which may interfere with communication (Schegloff 1987: 210).

380, 276-380). They point to the difference between aggregation, the neoclassical economic mainstay, and combination:

Aggregation: $M2 = \sum M1/t$ ($2+2=4$), which assumes the whole to be simply the sum of its parts, and

Combination: $M2 = \sum M1/t + v1 + v2 + \dots + vn$ where $M2$ and $M1$ are macro and micro respectively and v represents explanatory variables.

Combination recognises the limitations of assuming all individuals to have equal characteristics, and seeks more adequate explanations by including social rates where applicable, combined with variables similar to the categories of the 'Community Cascade' (historical, institutional, organisational, leadership, collective process, **Link: UHSE**), which supply meaning or context at macro level.

This is a fuzzy situation, where multivariate weighting statistics are available for those variables able to be represented as rates (Munch & Smelser 1987: 378). In fact statistical methods are themselves aggregation strategies which speak of population scale conditions, and can relate to individual cases only through a probabilistic filter, a concept of great concern to cancer patients, who cling hopefully (or hopelessly) to statistical information irrelevant at individual scale.

Externalisation (and its converse macro-micro Internalisation), represent the projection/introjection strategies originating in the Freudian and neo-Freudian (TA) traditions. The micro-macro version sees a representative link between cultural Myths, traditions and institutions as institutional protection against threats and conflicts originating in the early childhood of individuals. Rappoport's anthropological essays on Ecology, Meaning and Religion demonstrate parallel institutional roles in Pacific Island and New Guinea cultures, which ensure ecological and thus physical survival (Rappoport 1979a;1979b). These explanatory models assume, predict or discover relations between the levels, and the translation tool consists in relating the functional outcome of respecting the upper level intangibles to the survival advantage at individual or social level.

Reproduction includes the micro approach of Schegloff and a group of theoreticians who see the interaction of informal ritual as the building blocks of a socially constructed reality, the organisation of which constitutes an emergent and constraining intangible macro. An offshoot of the 'social construction of reality' school, is the 'Conformity School', which sees individuals as conforming to or being deviant from a macro set of transcendent or independent norms and institutions, which entrains an institutional response of 'social control' in the deviant case. Translation to micro means tracing the norms to an assessment in terms of social order or

deviance rates of personal or interpersonal levels of conformity. The 'key question' mystifying these sociologists, as to the dynamics of this socialisation process (Munch & Smelser 1987: 380), could be elucidated through the study of Transactional Analysis, a multi-scalar model for Social Psychiatry, one of whose nested Time Hierarchies includes the Cultural-Social-Family-Parental-Intrapersonal axis: the 'Parent Ego State'⁷¹ or 'exteropsyche'.

The lack of a unifying model that links micro, meso and macro scales, is often deplored by writers. Cadwallader initiated a spirited debate in 1988 by claiming justification for Theoretical Pluralism in the form of an integration of Marxist, institutional and behavioural approaches to urban geographical problems, which would then cover all scales with some overlap (and unravel doubts at behavioural level as to the validity of aggregation and disaggregation) (Cadwallader 1988: 237, 247, 246). This dissertation proposes the consideration of Transactional Analysis for such a role, demonstrating its relevance by using examples from this Theory wherever appropriate. **Link: Background Paper: Transactional Analysis.**

8.8.3 MACRO TO MICRO

Munch and Smelser see two peculiar dilemmas for the macroscopist: the demonstration of relevance to micro level action and macro theory support from group and individual actions. They describe two chief relationships between the levels which enable movement between them: internalisation and limit setting (:380-385). Internalisation implies the penetration through the socialisation process of individuals by cultural mores, language etc. the introject being located in the superego⁷². This operates like a cultural frame of reference or 'prerequisites for interaction' governing the process of social intercourse, which is constantly monitored and attended to generally pre-consciously. This concept draws together Freud, Durkheim, Parson's synthesis of these and Kurzweil's description of that (Kurzweil 1987: 237-254; Munch & Smelser 1987: 380-1).

Limit setting refers to an external frame of reference limiting (constraining) to individuals and groups which consists in such dynamic entities as laws, markets, control of property or other resources, and authority systems. This concept was extended to four theoretical macro syntheses: capitalism, conflict, normative order and cultural symbolism, all of which were seen as triggering micro processes, counteraction, recursive aggregate responses or realisation of ideas.

⁷¹ **Link: BP 5.2: Transactional Analysis.**

⁷² 'Cultural Parent' in Transactional Analysis.

8.8.4 SUMMARY: SOCIAL SCIENCES

There was apparently consensus that both micro and macro are essential to both theoretical and empirical explanation of social processes, that they are neither independent nor unilaterally fundamental, and that transitions between the two and emergent processes should be on the future research agenda (Munch & Smelser 1987: 385).

In summary, it can be said that inter-scale translation tools in Sociology generally take a linguistic, conceptual, rate-independent form, while attempts to present 'scientific' explanations will use a rate-dependent, mechanistic, mathematical form, especially statistics, and other translation formulae, usually mediated by computer. A Complementary approach will of course be required for a full description. **Link: Criterion Community: Clues to the Convivial Society: Useful Models.**

8.9 SYNTHESIS: A THEORY OF SCALE: ECOLOGICAL AND OTHER HIERARCHIES

Hierarchical organisation as a unifying concept was first formally addressed in 1969. It was cautiously recognised as a cross-disciplinary meta-theory, and at the very least, a useful analogy.

An Epistemology of Integrated Pluralism (multi-Criteria, multi-level) is seen to be the appropriate approach for researching complexity, studying the level above for context and that below for mechanism.

Distinction needs to be made between intellectual concepts like 'levels of organisation' and the 'integrative levels' of a rate-dependent hierarchical process. Rate or Time Hierarchy has more of the character of a symphony (music has similar aspects of pulsation, synchronicity, frequency, change, cycles, fractal relationships, evolution, accidentals) than a decision tree or a 'Great Chain of Being', which may be rate-based, but are better described as conceptual.

TFH Allen *et al* (amongst others) argue for process rate as a fundamental way to deconstruct Complex Dynamic Systems. The model applies when a system can be organised into a continuum from large, slow entities to small, fast ones. A group of subsystems that operate in the same frequency range and respond to their environment as a systemic entity, are known as a 'holon'. The terms 'environ' (organism in its environment) and 'socion' (a society in its environment or its bioregion) have been suggested as fundamental units for consideration through an ecological approach.

Containment refers to holonic structure and relationships: a 'nested system ('Inclusive Hierarchy') contains its subsystems (as in an organism or a tree) and have different Organising Principles at each level; non-nested systems ('Exclusive Hierarchy') do not contain their parts as such but have a consistent Organising Principle across the levels. Nested systems specialise in communication or free flow, often having a tree structure (trees, lungs, blood vessels, Spatial Hierarchies). Unnested systems have built-in Constraints to signal flow, and are inherently resilient (ecosystems, classification, political & social systems).

The observer selects the grain (resolution) and extent (scope) of a system study, defining the boundary of the system, and thus the scale of observation, whether aware of this fact or not. Nature does offer tangible 'natural' boundaries, where many process edges coincide (such as at a skin surface), and these are often selected for research convenience. Intangible boundaries (such as ecosystem) may be defined indirectly. A study will be inadequate, and statements of

sustainability false, if the system's extent is not contained by the temporal and physical scope or scale of the research.

The term 'Constitutive Hierarchy' refers to a process of evolution of complex hierarchy with emergence of new functions and meanings different from those of the objects and processes from which they arose. This process results in a complex set of systems embedded within systems, with levels constraining and driving each other through rate-dependent and rate-independent processes, the outcome being determined through such structural entities as connectivity, relative disconnection, fields of influence, system drivers and constraints. Such systems must be approached wholistically.

At least four types of Hierarchy may be distinguished: Temporal (process or rate-dependent; usually spatio-temporal - nested/inclusive/organismic [*organisms, homeostatic systems*] or non-nested/exclusive [*food webs, communities*]), Spatial (nested, physical), Conceptual and Dominance (power-based). Conceptual hierarchies have several forms including: Russell's Logical Types (Bateson's Ecology of Mind: non-nested), NLP Meta-models (Metararchy: each layer seeks to explain the one below), Contextual (Sociology: non-nested, intangible context/values above tangibles/actions), Classificatory (Linnaean binomial classification system, decision trees). Decision Hierarchies (animals) which combine with hierarchical landscape structure, modifying environmental fluxes, and individual needs, to indicate Hierarchies of Opportunity or 'habitat templets', which eventuate in discontinuous distribution of animals across the landscape at characteristic space and time scales: a 'lumpy distribution'⁷³ (location decisions similar for humans but include Economics).

Conceptual and Dominance Hierarchies are also often rate-based in that the higher levels are usually slower to change than the lower. Dominance Hierarchies may be thought of as representing frequency and intensity of interaction where the Organising Principle is relationship, and the relationship may be arranged around dominance or reciprocity: the stuff of the Community structure. If Nature (genetics) determines human futures, Human Nature does not look too promising. EPPs' goal is transcendence, to design a society that brings out the best in humans, revising approaches to relationship, lifestyle and institutional structure and function.

Allen & Hoekstra present system structure (considered as rate-based hierarchies) as having five main characteristics: scale & relative frequency, boundaries & surfaces, containment, bond strength & system integrity, and system connectedness.

⁷³ Link: CDS; Figure 29: Holling's Lumpy Landscape.

A key concept in Ecology is Connectivity. But while everything is connected to everything else, the diversity, stability, resilience and asymmetric processes of Nature are a direct consequence of relative disconnection, optimal connectivity range and relative function.

There appears to be an optimal range of connectedness for any system, and the levels can be manipulated by adding new elements; their connectivity is additive to that of the system. Humans probably make intuitive social adjustments to keep connectedness within an optimal range. This may relate to the present trends towards Individualism, Territoriality and Racialism.

Translation from one scale to another is problematic, and chaos may be considered a high-resolution phenomenon. Rate-based Hierarchies suffer from nonlinear variability with scale.

The Spatial Hierarchies represented by maps, use simple two-dimensional Mathematics to move from one scale to another. The situation in Sociology is more complex, as analysis of the proceedings from an international conference on the subject shows. The 'micro-meso-macro' conceptual/contextual hierarchies of Sociology are confused by differences in definition. A range of inter-level translation concepts, which differ according to direction, involve qualitative, bi- or tri-scalar continua of contexts. Micro-macro includes: nested mutual penetration (simple aggregation); combination (aggregation plus explanatory variables as in Complementarity); externalisation (Freudian-type reciprocal projection to upper level); and reproduction (a constraining, intangible macro emerging from informal, patterned behaviours - constitutive).

Macro-micro includes: internalisation (introjection, converse of externalisation, result of socialisation process), and limit setting (representing the combined institutional constraints of external authority systems). Use of UHSE Criteria and Complexity concepts in Sociology could help clarify the micro-Meso-Macro confusion, as well as linking it across to Ecology for human settlements.

Consideration of different Hierarchy types and the types of information relevant to these, provides a method of approach to human settlements that reflects an ecological way of thinking.

9 UNIFIED ECOLOGY & ITS EXTENSION TO HUMAN SETTLEMENTS

In shaping the places where we live, we shape the patterns of our own behaviour. Over the past century or so, we have built into the landscape behaviour patterns that derive from attitudes about the nature of the earth and the human relationship with it that go back at least to the Renaissance. For our culture to survive, for the human environment to become sustainable, we will have to change some of those patterns, which means changing not only our behaviour but our environment. It is not just a matter of fine tuning, not even a matter of overhaul. What is needed is redesign ... by *[which]* ... I mean conceiving and shaping complex systems ... nothing to do with fashion statements and trendy labels ... Environmental design is where the earth and its processes join with human culture and behaviour to create form (Lyle 1994: ix).

9.1 INTRODUCTION

To this point there has been a process of describing a philosophical Backcloth, and then of presenting an epistemological framework from which to proceed. Where the Theory described above tended to lead to questions and conclusions at a systemic scale, the following is more concerned with Methodology, Technology and application. It describes the Allen & Hoekstra Unified Ecology Criteria and their essences, and combines these with other Criteria relevant to human settlements. It includes a short comparative discussion of selected matrix models which have been used for the description of human settlements, and argues for the value of extending the Allen & Hoekstra Layercake model to this context.

Criteria of Observation are essentially arbitrary, each providing a theme for conducting an investigation into a site-system in a particular way. The extra Criteria selected to complement those of Allen & Hoekstra are not necessarily the correct nor the only Criteria that may be selected for a purpose. They are suggested on the basis of issues normally of concern to human settlement designers and developers and their educators. The device of an Unspecified Criterion is included for flexibility, and is explained below.

If this approach is applied, multi-scale, ecological and social aspects will automatically be taken care of, at least conceptually. If the Ecosphere and nōosphere are not internalised in human projects, they may assert themselves as Social Traps in the longer term.

For any Criterion it can be expected that there will be a set of relevant tangibles, usually measurable, and a set of intangibles, usually not measurable, or measured by surrogates. At different scales the local rules structure the scale-dependent manifestation of natural and artificial constraints (cultural, societal, normative, interpretive). The Complementarity of the tangible and the intangible is constantly iterated by human ecologists (for instance see Boyden 1984: 20).

An extremely common error in engineering approaches to human settlements is to assume that only measurable things are relevant or important. To Align with Nature as required by the Ecological Paradigm, scale selection needs to be specified in research, design and management, and both internal and external Complementarity included with full democracy. When a scientific or technical discipline elects to approach its subject from a particular Criterial perspective and a limited scope, disciplines are alienated from each other unless they can come to an understanding of where their work fits into a wholistic framework. This is theoretically obvious, yet not always appreciated in practice, and a cause of disputes and wasted academic time. Integration is becoming increasingly urgent with advancing globalisation and today's incipient crises. A clear common framework is also needed for enlightened policy and institutional reasons, and to orientate the increasingly common phenomenon of multi-skilling.

This theory development will do nothing to persuade the unwilling to work in this way. It does provide a superficially simple framework for those who, willing but overwhelmed, need pegs on which to hang more complex concepts and strategies, and is useful at different levels of complexity and different scales of development. In human settlements, where constraining ecological context is always significantly interfered with, it invites an environmental management approach, which understands that incremental decisions are not irrelevant. It is unapologetically Humanist in that term's Renaissance sense:

... concerned to emphasise human welfare and dignity ... optimistic about the powers of unaided human understanding ... a rediscovery of the unity of human beings and nature, and a renewed celebration of the pleasures of life ... consistent with religious belief ... (Blackburn 1996).

It indicates the need to develop realistic, non-negotiable (kind but firm), over-arching, ecological and environmental policies, which emerge from the deliberations of a well-informed and systems-conscious community. It does not follow a research path very far, but indicates useful potential directions.

As mentioned above, in the words of the late Peter Gould: "To allow, to forbid, but not to require" (Gould 1986).

A Number of Tables labelled 'CE' appear from this point on. **Tool 3.1: Use of Matrices** explains the Theory behind their use.

9.2 APPROACHING A STRUCTURAL FRAMEWORK

9.2.1 SCALE: GENERAL REVIEW

Watch an elephant walk a few steps before deciding that a leg always touches the ground.¹ Geographic observations should be either lengthy enough to capture the normal range of variations in a phenomenon, or carefully adjusted to compensate for such variations. Unfortunately, knowledge of this variation requires prior observation, another of the inevitable circularities that help make observation such a challenging task (Gersmehl & Brown 1992: 88).

It was established under Subatomic and Hierarchy Theories that different rules and conditions apply at different scales. Cross-scale relationships were discussed under Hierarchy Theory, and the concepts of Emergence, and the creative work of Self-Organising Systems, were described under CDS/SOS. The importance of 'scoping' for scale, or 'scaling', has been mentioned in the contexts of ecological research and of development projects. The 'think globally! act locally! respond personally!' aphorism has been linked to the understanding of connectedness in ecological hierarchies. The deliberate restriction of space or time scales (such as single observation in one season only) by development proponents, in order to mislead the public about sustainability in EIS, is common. Yet Environmentalists often win battles for larger scale systems by focussing on 'tear-jerker' ecosystem components such as endangered cuddly animals. But in the long term, the public is still misled if the habitat and landscape issues are not explained.

Few are now unaware of the shift to global scale of the world's major economic activities. The United Nations-driven push for 'partnership' in solving the world's problems,² government partnerships with private enterprise and the business concept of networking, (allowing smaller businesses to cluster into much larger organisms for collaborative effort at larger scale, especially for accessing global markets), not only bring new types of collaborative resources to bear, but increase the scale from which the objective and its impacts should be studied. Scalar thinking is suddenly important as these processes are accelerated by massive technological expansion and local impacts are more visible, more powerful and faster emerging.

Physical laws being rate/timescale dependent, to understand a new situation in ecological terms, one needs to relate to the 'Rheomode', by projective means to the scale in question if this differs from human scale. For instance to appreciate the implications of existing at their physical size (spatial scale) and frequency of cycling (time scale), we can best understand microorganisms at their own scale. Compared with humans, temperature, humidity, light and surface tension are

¹ Refers to elephant joke mentioned elsewhere.

² Partners nominated for the Habitat II Conference, Istanbul 1997: UN, Local Governments, Politicians, Trade Unions, International Foundations, Academics, Scientists, Business & Industry, Non-Government Organisations (NGOs & CBOs: representing 'civil society').⁵

most significant, in a submacroscopic realm where the surface:volume ratio is very high and meniscal relativities to mass enable a small Organism to walk on water, or find its surface an impenetrable barrier. The Rheotics of microbes are impressive, which is reflected in their very fast evolutionary behaviour. The impacts of microbial activity at scales above and below their own are so relevant in themselves that not only does the fate of individual biota, including humans,³ rest on their welfare, but the very ability of Earth to support life depends on it.⁴

The subcellular and Quantum scales are also crucial. We have a genetic revolution at hand, and Chemistry lies at the heart of ecocycles, industrial process, pollution, air and water quality, toxicity, building materials, waste and sewage management, nutrition, health and degenerative disease, to name a few.

Now in human settlement development, no less than in food production and mineral extraction or toxic site remediation, we are suddenly coming to terms with the implications of discounting the Microbial and molecular scales, although indicative information has been available since the concepts of ecosystems and antibiotics were first introduced. We now know that animal cell mitochondria and plant cell plasmids developed originally from bacteria. The Microbiology, Genetics and Biotechnology industries appear to be about to revolutionise Science and Environmentalism all over again (Garrett 1994: 36-7; Margulis & Sagan 1987; Walter 1979: 13-21), with consequent danger of new types of pollution (molecular, biological).

One outcome of these changes for Planning, is the microbial and molecular scale decontamination of toxic sites, of which the world has plenty: a major economic opportunity through intellectual property development. This was recognised by the MFP in its initial decision to locate at Port Adelaide, and to work on TCM⁵. Environmentalists became extremely anxious about that atomic/molecular scale, fearing the consequences of interfering with contaminated acid peat soils.⁵ This conflict went unresolved through change of site.

Another likely Planning issue will involve genetically engineered plants. For instance, I visited a nursery in California that was growing genetically engineered Pawlonia trees (Chinese origin, originally engineered in Melbourne), that had the capacity to grow to 30 feet in two years, produce hardwood suitable for building and furniture, and to fix nitrogen, as does a legume. The genetic potentiation clearly has implications for much larger scale impacts. What do we as a

³ For instance bowel flora, new viral agents.

⁴ For instance cyanobacteria in the initial formation of Earth's atmosphere; rhizospheric (root zone) function in tree nutrition; micro-organismic roles in soil formation; planktonic (oceanic plankton) role in climate change, modulating CO₂ levels and oxygen restoration (Lovelock, 1988: 265-9; Margulis, 1987).

⁵ Total Catchment Management.

community want to do about this? How can we reason through our responses without broad public education?

Another area is housing materials. For instance Australia still uses formaldehyde glues in press boards, a toxic, carcinogenic material with implications for OH&S and indoor air pollution.⁵⁶

Link: Criterion Ecocycles; Figure 45: MDF. These are banned in some places, and water-based glues applied under pressure are used instead.⁵ Then there are the new super-insulating foam 'sandwiches' developed for advanced energy housing, some of which are made with CFCs or CO₂. Or indeed the most common pollution by far ($\pm 80\%$): molecular pollution, with very large scale effects indeed, in both space and time. Again, what of the hormone impacts, not just from pesticides and PCBs, but from females on Hormone Replacement Therapy and the Pill?

If Planning decisions are genuinely one-off and of apparently small impact, then they may well be accommodated ecologically at that scale individually, but if they take the form of a policy (or lack of policy or legislative enforcement) that guides practice for dozens, hundreds or thousands of individual buildings or plantings, then the scale of impact increases to take in an area of cumulative impact which will have much larger spatial and temporal characteristics that differ from those at smaller scale. I have mentioned elsewhere, Theobald's good advice, to behave as if appropriate policy were in place, until such time as it is. This is the EPP's challenge.

Systemic connectivity, relative disconnectivity and bifurcation in natural systems imply that even one small decision may wield considerable ecological tyranny, especially where habitats, land clearing, exotic imports, emissions, toxics and waste disposal are concerned. Context, initial conditions or local situation make all the difference. For instance the siting of a petrol station which subsequently leaks into an aquifer; or reduction of available habitat area to less than minimum territory size for a given animal, creating vulnerability to fire, disease or exotic competition; or an EPA framework that allows the siting of a smelter near human habitation and does not demand zero emissions.

Humans are fortunate in being able to appreciate a wide range of spatial and temporal scales. While our perceptual abilities are predicated on a sensory system designed to detect specific frequency ranges only, our mental system can project well beyond the personal in time and space, and every sensation perceived is interpreted in the context of our past experience and present abilities. We also have the benefit of technologies that greatly extend the scales of our perceptual limits. To confine our attention to one scale only (such as 4-year political cycles, one

⁵⁶ Reading the warnings on the packaging of MDF is instructive!⁵ **Link: Criterion Organism.**

field of genetically-engineered monoculture or the immediacy of self-gratification), is not only anti-ecological, but fundamentally anti-human in that it restricts our comprehension to a very limited version of the possible, the actual and the optimal. The shorter the return time, the more similar is the situation to that of an addiction, where long-range thinking becomes out of the question due to the urgency of wants and needs in the present. This creates the Social Traps and delayed impacts mentioned under Surprise above. We should not need to be told that we should take care of the needs of future generations. Do we actually care about the welfare of our grandchildren and beyond?

It is scalar myopia to claim that a notion like 'Sustainable Development' can be entertained locally in the present world. Supply lines are very long, and settlements have very extensive Ecological Footprints.⁷ **Link: Criteria Ecocycles, Indicators.** With globalised control, resource and waste management systems, only at global scale can any biospherically meaningful interpretation of sustainability or top-down intervention be contemplated (French 1993: 5-9, 61). Cities, where most humans now live, or will within fifty years, are far from real sustainability (Troy 1996: 81). In a context of global Market Fundamentalism, the details of the local are incidental to the trans-national corporations who skim off resources and arrange the world for their own convenience (United Nations 1996: 13).

The ecological movement believes⁸ that in view of the inherent inter-connectivity of all systems and scales, a re-focusing of Planning and development control to the bioregional (bio-community) level is the optimal way to meet the enduring needs of both the biosphere and the community of humans in the long run (Citizen Planners of Ventura County: 19). This differs little from the United Nations view (derived from acknowledgment of the work of Rees and Wackernagel⁹ at UBC⁹), that while driven by upper level economic forces, the scale of implementation must be at the scale of the city region (United Nations 1996: 15-21). The 'Social City Region'⁹ is also advocated as the appropriate scale of focus for sustainable urban Planning (Breheny & Rookwood 1994: 155-6). Jane Jacobs was an earlier modern advocate of multifocal, innovative, import-replacing cities supported by rural hinterlands in "*Cities and the Wealth of*

⁷ As I complete the editing, the WWF has released a Report on biodiversity based on an Ecological Footprint study at global scale. At present consumption levels, we are 30% > available resources, 35% over global sustainable consumption with active depletion, another two planets' equivalent are required even now; between 1970 and 1999 there has been a 33% deterioration of the *Living Planet Index* (which measures animal populations in forest, fresh water and marine ecosystems, indices for all three dropping steadily), with 53% increase in per capita consumption (1%pa, present world population 5.7 billion). PNN 212/10/00. (Loh 2000 and Summary Report: 2-3).

⁸ University of British Columbia, Centre for Human Settlements (Wackernagel & Rees 1996).

⁹ Term after Ebenezer Howard: "the whole inter-dependent regional complex ... what must be developed, in pursuit of future sustainability, is a whole set of distinctive policies attuned to the varying conditions and environmental potential of the different parts of the region but complementary and mutually reinforcing" (Breheny & Rookwood 1994: 156).

Nations" (Jacobs 1984: 47). **Link: Criteria Genius Loci (Bioregionalism), Indicators (Urban Footprint).**

What has become problematic now, is that with extensive globalisation, scalar boundaries have been dissolved and confused,¹⁰ as have the important ecological constraints that these reflected. It is arguable that nothing short of an old-fashioned cataclysm (or a new-fashioned financial collapse) could restore appropriate local constraint (implying regional governance and community effort), as this would imply relative disconnection from the global system, and Isolationism is not regarded with favour by the multi-national forces that now control most of our life conditions and our decision makers. EPPs are divided on whether to push for isolation or try to beat the market at its own game: they talk of decentralised local systems, but are forced to participate pragmatically in the wider economy. While there has tended to be a resurgence of Localism in resistance to the global forcefield, it has tended to have an uneducated, NIMBY, fortress character: gated community, complaints about new technologies or new types of development, especially if a small, coherent community is initiating the change. Whatever it is, there is more often a community movement to stop something than to start something collectively. EPPs often find themselves fighting local governments or communities over the implementation of advances towards sustainability.⁵ Hence the effort they put into public education, demonstration projects and hands-on workshops.¹¹

As I travelled around the world looking for evidence of 'ecological' practice in 1993, I casually asked everyone 'How's your weather been over the last 10 years?' and 'What's your employment scene like?' The universal response to the first was that extreme climatic events appeared to be increasing in frequency and severity. For the latter, in most countries people complained that jobs were going off-shore, their industries were increasingly falling into foreign hands, a new scarcity was affecting everyone, most of the new jobs weren't 'real' jobs you could build a career around, and the government decisions being made were often not in their or their ecosystems' best interests. They felt frightened underneath, but many were investing huge efforts and devoting their lives to doing something about it.⁵ In the USA and Canada I met a number of individuals who ran private, non-profit institutes for this purpose. As Theobald, quoting Willis

¹⁰ For instance in seeking to define a multi-scale Planning structure for teaching biodiversity at local government level recently, I found international (IUCN, WWF), National (Environment Australia, Australian Local Government Association), State (Department of Environment – DEHAA), regional (Urban Forest Biodiversity Program), catchment (Onkaparinga, Torrens & Patawolonga, and Mt Lofty Ranges), City (Adelaide) and local government (City of Onkaparinga) all separately working on different biodiversity strategies and plans, with an erratic web of interactions between different combinations of agencies.⁵

¹¹ For instance Urban Ecology Australia, EcoCity Builders (CA), Context Institute and Urban Ecology (USA), NGOs very active in these areas.

Harman, was fond of saying: "... change happens when a lot of people do one thing a little bit differently" (Theobald 1997b: 71).

Remembering my experience in Rio in 1992, where the main thing I learned from UNCED was that we had to do the suffrage journey all over again, but at global scale, I returned from the Northern Hemisphere in 1993 with a mixture of hope and despair: there were some frightening things happening, yet, there was a substantial global network of people who cared and were committed to act. According to Complexity Theory, in unstable times, a butterfly's wing can indeed create a sea change: at this stage, whether a large rise or a small, should be of great interest to humanity in general. So many butterflies...

9.2.2 SCALE AND SPECIALISATION

Increasing disciplinary and interdisciplinary fragmentation have occurred over recent decades, that has militated against the Wholism required for approaching a complex, multi-scaled, multi-faceted planet, indicating the importance of Integrative Generalism. Different Epistemologies will produce different Criteria (see UHSE below), each with its relevant range of Scales. **Table 63: CE: Vocations x Scale** shows the subject matter of different vocations within the human health (thus medico-legal) community at different Scales. The Criteria chosen for this exercise are law-seeking Science, local regulation or constraint systems and technical application. They express Pattee's version of Complementary Laws and Rules. Vocations or disciplines may emerge around any locus in the investigation-application-implementation cascade. The need for skilled generalist integrators who can act as bridge builders across such ranges of specialisation, is emerging as a new discipline¹². **Link: UHSE: Scale & Scoping: Project Scoping.**

9.2.3 DIFFERENTIATING ENVIRONMENTS & ECOSYSTEMS

The essential difference between the Self-Organising Systems model and the Cybernetic models developed and applied to Planning, Geography and similar 'soft' Sciences in the 1960s is that SOS are open systems, and have reciprocal relations with their environments. We have moved beyond simple, single-scale Cybernetics. Cybernetic systems are closed and mechanistic. Thus we could never say, as Chadwick did in *A Systems View of Planning* in 1971:

The environment of a system [*is*] the set of all systems other than the one in which we are interested. We are never interested in the elements of the environment, otherwise we should have to include them in our defined system (Chadwick 1971: 43). [*Emphasis added*]

¹² The University of Oregon has dedicated a whole faculty to training such multi-disciplinary individuals;⁹ University Departments of Geography and Environmental Studies are discovering new roles for their inherently cross-disciplinary agendas.

Including the environment, as we must for a holon, socion or environ, commits us to having an approach to systems with very large numbers of variables, and within which we automatically take account of other layers of environment. Indeed the most extreme understanding of the Ecosphere is that there is no such thing as an environment (a context for a given entity) in so far as there is universal interconnection. This is our difficulty as visual beings: we tend to see environments behind things as separate because they appear to be physically separate and autonomous, and we would be overwhelmed if we did not separate and classify our world. Ecology has taught us about holonic arrangements within larger systems and the key role of the constraints, control parameters and relative disconnection. Again, this is a fuzzy situation needing fuzzy approaches, not control approaches.

9.2.4 OTHER MULTI-PARAMETER MODELS

Approaches to the necessary handling of such complex datasets in human settlements have tended to follow a pattern, often involving matrices.

The architect and town planner, Doxiadis, the inventor of the term 'Ekistics', defined fifteen 'Ekistic Units' (for instance see Ekistics v58 n350: 270). These are essentially spatial and urban, and suggest an appropriate range for use in UHSE: individual human ('anthropos'), room, house, house group, small neighbourhood, neighbourhood, small polis, polis, small metropolis, metropolis, small megalopolis, megalopolis, small eperopolis, ecumenopolis. To these he added time, income, desirability and feasibility (X-axis), and combined them in a three-dimensional matrix with the 'ekistic elements': nature, anthropos, society, shells (buildings), networks, human settlements, these last being counterposed to give a matrix within a matrix (Y-axis): **Figure 31: BI: Ekistics Grid.**

Doxiadis was very concerned with structure, form and growth of cities,¹³ and predicted an ecumenopolis - a continuous, conurbating process whereby "the evils of yesterday ... are being multiplied today in a very dangerous manner", leading ultimately to a static, continuous system, a Universal City or ecumenopolis, by the end of next century (Doxiadis 1968: 210, 217-8). This would occupy all the habitable regions of the earth, and be shaped by geomorphology, resource availability and climate, as defined for Biomes.

Doxiadis' Ekistic approach is based on a health/pathology (diagnosis/treatment) model (Organism Metaphor), and would theoretically be drawn similarly to the Allen et al Layercake in reverse,

¹³ Doxiadis refers to Von Thünen and Christaller for his functional analysis of cities (Doxiadis 1968: 210). Other early proponents of these theories emphasise their hierarchical approach to the explanation of urban processes, which sits comfortably with both Hierarchy Theory, and Complexity Theory in its *Attractor landscape* perspective – known as 'urban

with the larger scales up and their six Criteria replaced with those of the ekistic elements. His scalar levels provide an array of 'natural' divisions which fall easily into most human settlement requirements. It remains for the user to select which are the most appropriate for the project in question, and this must be Criterion by Criterion. But this limitation could discount the wider connectivities. The matrix is not used as a design tool, more as a tool of orientation, (every issue of the Journal Ekistics indicates the location of the articles on such a matrix) and does not explicitly address the multiple scales involved in the criteria other than human habitat/shells in the original (Doxiadis 1968). Professor Udo Simonis of the Wissenschaftszentrum Berlin für Sozialforschung (WZB) Science Centre Berlin used Ekistics as an intellectual framework for Sustainable Development theory, later moving to Industrial Ecology (Durney 1997; Simonis 1990).⁵

Yeang takes a 'horizontal layer' approach which represents by a series of concentric semicircles, the elements of the physical base, then the biotic elements which, all in interaction, form a set of levels of a locality (geology & climate, hydrology, soils, vegetation, animal life, human communities) (Yeang 1995: 92-3) – similar to the McHarg approach, and referring to the classical 'levels of organisation' notion. White's Contextual Analysis as used by Architecture and Landscape Architecture students, emphasises the spatial, but does not emphasise the connectivity between layers (White 1983: 14). See **Figure 32: BI: Contextual Models**.

Some approaches to Environment Impact Assessment may be compatible with or supplement this approach through the detailed lists provided with checklists and matrices, which are at mechanism scale relative to that under discussion here. For instance the widely used and taught Leopold Matrix or the Battelle Environmental Evaluation System both have this matrix structure, although they are uniscalar and take no account of distant or global impacts (Glasson, Therivel & Chadwick 1994).

9.2.5 DEFINING 'ECOLOGY' AND 'ECOSYSTEM'

Ernst Haeckel introduced the term 'Ecology' to the field of Biology in 1869, defining it as "all the relationships between an animal and its organic environment" (Vink 1981a: 16).¹⁴

Tansley used the term 'biome' in 1935, which was close to the present use of 'ecosystem': the total complex of interacting organisms and habitat. The 1946 description was:

multiplier effect' in urban economic disciplines (Garrison 1959: 220; Ullman 1959: 203-9). Christaller's *Central Place Theory* was still very much in evidence in 1995 (Hall 1995: 21-9).

¹⁴ Bramwell's historical review finds 1866 or 1873 as the most accurate potential date(s) of first use. All seem to agree that Haeckel, not Thoreau, and not Sophocles, initiated its use (Bramwell 1989: 253).

All parts of... an ecosystem ... organic and inorganic, biome and habitat ... may be regarded as interacting factors which, in a mature ecosystem, are in approximate equilibrium: it is through their interactions that the whole system is maintained (Tansley 1946: 207).

Vink sees the ecosystem concept as the essential bridge between Biology and Physical Geography (with a biological emphasis). Landscape Ecology is then the bridge between Physical Geography and Biology on the one hand, and between Physical and Social Geographies on the other - all these bridges being crucial to research and its application in Land Use Planning (Vink 1981a: 16).

Fosberg added the notions of matter and energy to the mix, emphasising that the description may include its spatial relations, physical features, habitats, ecological niches, organisms, energy & matter resources, inputs, losses, entropic trends and circulation patterns (Fosberg 1963). **Links: Hypercyclic Systems Theory: Figures: 8: System Types, 9: Ecological System, Energy & Nutrient Flows; Criterion Ecocycles.**

More recently, Ellen added information:

An ecosystem - or ecological system ... a relatively stable set of organic relationships, in which energy, materials and information are in continuous circulation, and in which all processes are seen in terms of their system-wide repercussions. Specific changes, which may theoretically be anywhere in the system, trigger adjustment and re-adaptation among the other elements. The relationships between elements reflect the mutual adaptation of local populations of organisms in their non-living environment. Systemic changes take place slowly through conjoint evolution that is biological, chemical and physical. The entire joint evolution is open-ended, constant, self-augmenting and versatile. It builds on itself, increasing the capacity of a site to support life. In doing this it stabilizes the site and the biota. (Ellen 1982: 74)

Allen & Hoekstra are somewhat more generic:

Any large or small entity that blends with the biota and with the physical abiotic environment, whose system boundaries include the physical environment and which is formed in aggregate by cycles and pathways of energy and matter. Functioning subunits are not plants, animals, soil and atmosphere, but mixtures of these (Allen & Hoekstra 1992: 44-5). [*Allen et al do devote space to information elsewhere*].

Rowe¹⁵ differentiates between definitions of Ecology - as Epistemology or as world-view. As a scientific viewpoint, he makes the following summary observations. The study of physical objects and organisms starts with the familiar questions "what, how, where and when"¹⁶. These are taken care of by different branches of Natural Science, and all possible questions are said by Rowe to be covered by these criteria or their combination (Rowe 1997: 147-151). While Rowe sees Levels of Organisation as a hierarchical context, he differs from Allen & Hoekstra, in that scale itself is not addressed in his selection of basic Criteria.

Rowe thus sees wholistic Ecology as a more recent but academically unpopular scientific point of view, concerned with the function of hierarchically organised systems of organic and inorganic entities. It is unpopular because it is fuzzy, taking account of Empirical Science, but also valuing

¹⁵ Emeritus professor of Ecology, University of Saskatchewan.

¹⁶ Based on his own paper of 1961 "The Level-of-Integration Concept and Ecology".

the Complementary, divergent and unpredictable emergent entities like communities, biosphere and ecosystems, which self-organise. Rowe takes a nested hierarchical view of ecosystems, but uses an orthodox hierarchy of levels-of-organisation, which then makes a multi-scale approach very difficult. For each organism studied, his Hierarchy is: individual organism (Autecology), species & groups (Population Ecology), all organisms sharing a milieu (Community Ecology), community plus environment (Ecosystem Ecology).

Rowe takes Odum's definitions of Ecology ("the study of the structure and function of nature"¹⁷) and ecosystem ("the largest functional units of ecology") as an early-appreciated and important understanding. It challenges what he sees as the orthodox utilitarian, anthropocentric, organism-centred Science of energy flows, nutrient cycling, successional stages and productivity, which has attracted so much research funding from the military and governments. **Table 64: BI: Rowe's Criteria** shows the derivation of Rowe's series of seven 'W' questions¹⁸ or 'points-of-view' (his version of Criteria), which are applied to his research object¹⁹. **Link: Criterion Population.**

The external functional point of view is Ecology, the Epistemology. The wholistic approach to Ecology is the ontological underpinning of the whole system. Thus Rowe demands that we speak of Ecocentrism, not Biocentrism. Organisms and ecosystems, he says, are the most real/least abstract, and populations and communities do not yield to analysis as "metabolizing autopoietic beings", so Ecology should be about proper contextualising of organisms and other objects within the Ecosphere:

Ecosystems so conceived can be esteemed and studied from the seven scientific view-points tabled. Ecological communities of creatures, including humans, are "brought to life" only by including with them the sustaining Earth-matrix of air, landform, soil and water, i.e. by conceiving them as organic parts of the wholistic realities that are ecosystems. Thus human communities ... are incomplete when conceived as existing apart from the ecosystems which sustain them ... They are not free-standing, and socio-logy unleavened by eco-logy can never solve their vital problems. Only the human community integrated as part of Earth's ecosystems can constitute an effective unit of autopoiesis with self-regulating behaviour. (Rowe 1997: 149).

Allen & Hoekstra refer to a difference in definition of ecosystem between theirs and that of O'Neill *et al* (which also included Allen). In this latter approach, an unorthodox division was made into two types: the process-functional and the population-community, which represent subcultures within Ecology (O'Neill *et al* 1986: 8-10). The Allen & Hoekstra definition of ecosystem is narrowed to the process-functional approach, similar to Rowe's utilitarian

¹⁷ (Odum 1963: 3, 7).

¹⁸ This what-where-why-how-who type array is common across several disciplines in the construction of explanatory frameworks or design checklists. Allen & Hoekstra perform a similar stratagem through their "CATWOE" analysis, not to define their Criteria, but as a following exercise.

¹⁹ A trial of these Criteria for UHSE use was entertained (as being simpler) by this author, but found to be wanting in clarity for the purpose, and covered anyway by the UHSE Criteria under Population.

definition, of which the critical components are processes, paths, fluxes between organisms and their environments, and not the organisms themselves; however organisms are democratically accorded their own Criterion (Allen & Hoekstra 1992: 90-1). Thus, while de-emphasising organisms like Rowe, they enter the same area of terminological confusion between the functional systemic aspects of matter-energy transformation and the ecospheric whole, with the intent to clarify.

Allen & Hoekstra refer to the task of ecological integration, and use the Hierarchy Theory described above as their scientific approach to the wholistic concept.

In this dissertation, (UHSE below), the term 'ecocycle' (Berg 1996: 79-80; Rolén 1996), is proposed to cover energy-matter Systematics, while 'ecosystem' and 'Ecosphere' will be used to indicate the complex dynamic hierarchical system as a whole.

9.3 COMBINING CRITERIA AND SCALE: UNIFIED ECOLOGY

9.3.1 CRITERIA AFTER ALLEN & HOEKSTRA

'Unified Ecology' is based on an understanding of the existing subdisciplines of Ecology, which recognises their characteristic Epistemologies and the functions they seek to explain, and locates these on a structural model representing the time hierarchical nature of complex natural systems. The conventional ecological 8-level 'levels of organisation' hierarchy is not scale-dependent, and runs from levels 1-8 as follows: Cell - Organism - Population - Community - Ecosystem - Landscape - Biome - Biosphere (Allen & Hoekstra 1992: 7).

While acknowledging the usefulness of this for general understanding, Allen & Hoekstra point out that in a conventional ecological hierarchy, explanatory mechanisms do not match this ordering strategy. They propose instead a functional approach which ecologists follow in practice. This acknowledges that each of the types of ecological system, which they call 'criteria for/of observation' or 'criteria', (here denoted 'Criteria' to indicate reference to Allen *et al*'s definition), implies a decision as to the relationships important in an ecological observation. They are practical, conceptual Organising Principles, and they are arranged in Hierarchies of Time, Space, Concept or combinations of these. These are: Organism, Population, Community, Ecosystem, Landscape, Biome/Biosphere (Allen & Hoekstra 1992: 53). These Criteria are defined with some care, clarifying but not always conforming exactly to the usual ecological definitions, which are often under dispute (as seen below relating to 'ecosystem').

The first task of the researcher is the selection of the appropriate Space and Time scales for the situation. Scale consciousness is a necessary attribute for any human settlement professionals whose work claims to be 'ecological'. While it may seem natural to think of an ecosystem as large and an organism relatively small, or an organism as clearly differentiable from a population, Allen *et al* demonstrate examples where these distinctions are not at all clear. For instance an ecosystem may be present at the scale of a tree root or a pond weed such as water hyacinth, and some types of suckering in trees makes it hard to define an individual. Each Criterion may theoretically be available at every scale (Allen and Hoekstra 1992: 2-12). As mentioned above, Unified Ecology differs in this from the orthodox Levels Of Organisation, and is expressed as the 'Layercake' diagram described below.

Criteria are the basis upon which one makes the decision as to what relationships are important in an ecological observation. The principle criteria ... [used here] ... are: organism, population, community, landscape, ecosystem, biome and biosphere. However we will not use them as ordered levels per se. Our comprehensive organization puts them in a scale-ordered framework independent of the type of

ecological entity under consideration ... that explains what ecologists find in practice ... rather than a grand ordering scheme (Allen & Hoekstra 1992: 8).

Criteria act like lenses, drawing prescribed perceptions into the foreground, differentiating a 'Traffic' from a background or context ('Backcloth') of elements and processes, and are chosen to maximum functional advantage (to the objectives of the observer). As mentioned above, some boundary differentiations are conveniently 'natural' such as the skin of an organism, or the limits of a watershed; or 'artificial' but nonetheless real, like the wall of a building or an orthocadastral boundary.

Just as vocational alienation was related above through scale and severed Complementarity, Allen *et al* see different Sciences as occupying different ranges on their Scale/Criteria structure (**Table 65: CE: Criteria of Observation by Disciplines: Theoretical & Applied**). The ecological disciplinary approaches represented (Allen & Hoekstra 1992: 257-9), have equivalents in human-related discourses, which also differentiate into theoretical and applied disciplines.

Allen & Hoekstra demonstrate the complexity of ecological interactions through the example of the movement of mineral nutrients through different space and time scales, shifting frequently between Criteria as they go (Allen & Hoekstra 1992: 288). It is usual for a substance to move in and out of an ecological system at least four times per bio-cycle (Allen & Hoekstra 1992: 94-125, 287-90). Cycling matter behaves much as does money, which moves in and out of economic loci, or ions which are picked up, used and discarded (and thus shared) by many intracellular processes²⁰. It becomes a resource which may do time as part of an Organism, be released back as waste or by decomposition, be taken up by plants which build it into Landscape, Biota and Community²¹. Or, ecosystems being inherently 'leaky', it may be transported by the Elements (see below) to participate in much larger scale cycles such as rock formation and global weather patterns.

9.3.2 THE ALLEN & HOEKSTRA 'LAYERCAKE'

The extended 'Layercake' model is used here as a bridge from Ecological Science to the everyday reality of Designing and Planning. Allen *et al*'s Layercake²² system is generic. The core purpose of developing Unified Ecology was to encourage communication and thus connectedness across the ecological subdisciplines, whose practitioners, like the design professions, tend to righteous

²⁰ Orthomolecular medicine is based on an understanding of such biochemical processes and their co-factors: 'mass action' principles are used to ensure that an important reaction has access to the vitamin and mineral co-factors and catalysts it needs.

²¹ A similar journey was the basis for a charming visualisation & imagery exercise introducing a workshop led by Dr Karl Scherer many years ago as a demonstration of the human interconnectivity with Nature.⁵ We are literally stardust, but possibly also part-dinosaur. By whom or what has the air we breathe been shared?

claims from different Criteria or Scales, not recognising that both may simultaneously be right. Primary researchers in particular, often ignore the work of applied scientists, and this has to do with the different scoping of their work (Allen & Hoekstra 1992: 283-4). **Figure 33: CMES: Layercake Model after Allen & Hoekstra** is explained as follows. The Criteria are arranged in a conical hierarchy with the narrow end up to denote the smaller frequency of a small number of large systems (such as geological time scale) relative to the higher frequency of smaller entities (for example bacteria, or smaller still, atoms and molecules). It is drawn in a manner that indicates the extensive internal connectivity of the Criteria (as a complex dynamic, far from equilibrium system). Any elements of the Layercake can be examined more closely by reductionist methodologies or combinations to define their particular relationships. New disciplines may suggest themselves. For Ecology, Allen *et al* express particular interest in the diagonal relationships between levels (Allen & Hoekstra 1992:53). These are also relevant for human settlements, for which reason I have suggested the use of the Self-Referential Matrix (qv).

Arbitrarily placed disks represent arbitrarily defined scales (the smaller the higher and slower), and the initials represent the Allen and Hoekstra Criteria. The truncated cones representing these latter take up less than the whole volume of the figure, there being space for selection of different Criteria. Connectivity is represented by lines joining all possible combinations of connection, but inter-scale connections are omitted for clarity. **Table 66: BICM: Unified Ecology Criteria: Comparative Definitions & Descriptions** presents a substantial summary of my understanding of UE Criteria, as presented by Allen & Hoekstra. The last row 'Human Settlements' is the launchpad for the outreach of UE to UHSE. **Table 67: CMES: Advantages of Layercake** argues for the use of a UHSE model for 'Sustainable Development' and training.

9.3.3 DIFFERENCES BETWEEN RESEARCH, MANAGEMENT AND DESIGN

Thus, Allen & Hoekstra encourage the development of new Theory (to which their Layercake work is contributory), which takes account of many Criteria and many scales. Basic Research uses one Criterion but floats the scale; Restoration Ecology works within one Criterion at one prescribed scale; Resource Management works at one prescribed scale but uses many Criteria (Allen & Hoekstra 1992: 283).

Design is not merely resource management. It should now take into account multiple scales and multiple Criteria, including the intangible: a wholistic goal. The extension of this approach to

²² The term was attributed to McHarg by Yeang.
332

human settlements gives the opportunity to tap into the wealth of knowledge from (*inter alia*) Ecology and Landscape Ecology, including all that collated by TFH Allen *et al*, to advance the ecological understanding of human settlement processes. **Link: Confluence: Structure: Use of the UHSE Framework.**

9.4 UHSE INCPIT

The following sections first break down human settlement issues into Criteria, then set about putting them back together again through a design process illustrated by a Case Study and a number of Process Tools. **Link: Confluence.**

All supporting materials that may be of practical value to potential users of the UHSE model are grouped in Appendix 3. There are three versions of the UHSE Matrix framework. 3.4 is the thematic defining set, 3.9 is the core framework set, and 3.13 is the extended set with full list of subdivisions. 3.6 Community Cascade is part of the UHSE framework, but may have independent usefulness.

Other tools include **3.16 Questions for Designers**, constructed for students in Environmental Design (University of Canberra, 1998). To act on the answers would involve knowledge of the latest technical strategies, ideally the subject of standard training courses. Many of these strategies are mentioned later in the collated lists of sustainability strategies (**Links: Content for the Framework; Database 4.2**).

The sections following tease out the Criterial concepts. The rest of the dissertation concerns the description and use of this approach.

To guide data collection and classify the mass of data in a form readily comparable between projects and comprehensible by designers and their clients, a comprehensive structure for reporting is required, especially a large projects. There needs to be a sympathetic Backcloth of Complementarity: of formal data collection, but with the creative faculties involved in sensing out the site, its functions and users, with time allowing design elements to emerge naturally. The OCW¹ Project describes such a process. **Link: Confluence: OCW Project.** While time for emergence was available, modern conditions often make this unrealistic. However the planners have a well-known 'rule of thumb': 'you spend about twice as much time fighting in the courts as you appear to save by fast-tracking'⁵. So we must optimise.

It is preferable that the Organising Principles behind the different Criteria be fully understood. Nevertheless, in the City West project, it was found that interested students could, with few instructions, a one-hour lecture and a framework given, use a superficial version of the UHSE system, presented as a Summary Matrix (simplified for non-ecologists) to ensure that the appropriate data were collected, and to organise the data document. This was a far cry from the deeper understanding and potential flexibility of application which could have been achieved by a series of lectures on Unified Human Settlement Ecology, which was not an option.

Many of our townscapes are biologically sterile when they could be rich and diverse ... Why should so-called landscape schemes end up as green deserts with lollipop trees ... even formal town parks offer opportunities for a rich variety of habitats (Goode 1990: 3-4).

²³ Opposing City West.

UNIFIED HUMAN SETTLEMENT ECOLOGY

10 UNIFIED HUMAN SETTLEMENT ECOLOGY

10.1 INTRODUCTION: UHSE DEFINITIONS, EXTENSIONS AND ADDITIONS

This section defines the Criteria selected by me for a human settlements application. They could also be used in rural and Sustainable Agriculture contexts, and from very large scale to a single house. Allen & Hoekstra's six Criteria (Landscape, Ecosystem, Community, Organism, Population and Biome/Biosphere) have been retained, except for the renaming of 'Ecosystem' as 'Ecocycles', and 'Biome/Biosphere' as 'Biotics'. A further six have been added: Genius Loci, Elements, Connectivity, Feedbacks (Catalysts, Constraints), Rheotics (Time, Change, Unfolding) and Indicators. An Unspecified Criterion is also present to remind designers that there may be a special issue to watch: a project theme, concept or core objective, the aims of the project itself, or the needs of a special group or landscape area. The definitions are presented as a group to give an overview. Following that, the Criteria are presented separately. Scale is used initially to Envision and Scope the project.

The order in which they are presented is arbitrary. In this case it is arranged in a more or less natural order of confrontation through a large site design process, but Complex Dynamic Systems and design processes characteristically cycle repeatedly through their elements and their scales, and this is no exception.

The extra Criteria were based on an appraisal of approaches to Site Analysis in common use in training in Architecture and Landscape Architecture, Ecological Design (for instance Allen & Hoekstra 1992; Degenhardt 1979; Hough 1984; Krasner 1980; Kunstler 1993; Laurie 1979; Manning 1979; McHarg 1992; Miess 1979; Spirn 1984; Van der Ryn & Cohen 1996; White 1983; Yanitsky 1984; Yeang 1995), Impact Assessment, Planning and in a number of other disciplines relevant to the Criteria chosen. They have been developed through a series of versions and reviewed after testing with OCW (final year) students, and again after presenting a simplified version for first year students in a textbook (in press).

A paradox evident in JVNIC was that EcoCities and EcoCommunities must be owned and interpreted through local eco-social conditions by the community involved. The OECD needed something concrete to judge, but in providing this, entrants were forced to violate ecological principles. Thus, the following section contains principles, thought frames and examples, but can never prescribe 'world's best practice': that is another delusion that should join 'sustainability' as a questioned goal. **Link: Conclusion.**

10.2 DEFINITIONS OF UHSE CRITERIA

Tool 3.4: UHSE Criteria: Essences & Themes provides an introductory framework for the following section on definitions of UHSE Criteria.

10.2.1 SCALE

Project Scoping. See above and below. **Links: Hierarchy & Scale; Unified Ecology: Approaching a Structural Framework; UHSE: Scale & Scoping; Confluence: Structure.**

10.2.2 CRITERION UNSPECIFIED

The Unspecified or Empty Criterion is a practical device whose purpose is to cater for issues which are either not specified by the ecological perspective, or upon which temporary emphasis is required, for example the project objectives themselves. Some may feel the model relatively under-weights economic and gender issues, or a particular project may have an Aboriginal cultural focus, so one or more Unspecified Criteria may be set up to ensure that these are given due prominence. This is also the proper location for the statement and management of the project Vision. Any number of extra Criteria may become Specified.

10.2.3 CRITERION: COMMUNITY

This Criterion concerns relationship, or the mutual accommodation that integrates the biota in a given area so as to produce a "cohesive and multi-faceted whole" that modifies tendencies to raw competition:

Competition is set in a variable environmental context which does not allow population competition to come to a simple resolution (Allen & Hoekstra 1992: 44).

Natural resource managers refer to ecological Communities as 'associations'. In human settlements we are concerned with preserving these, and managing the troublesome accommodations within EcoCommunities, that include humans and our cosmological baggage, along with other biota.

Plants and animals are usually considered separately in Science, because they are so differently scaled (Allen & Hoekstra 1992: 239-40). But such issues as domestication, gardening and food production involve humans and plants in very important Community linkages.

The Backcloth for human Community combines its intangible and tangible structures, that emerge from individual and collective human Structure Hunger,¹ and which, as social glue and shared vision, have individual and collective survival value. Formal aspects order society on behalf of the dominant collective.

A 'Community Cascade' has been referred to above (**Link: Hierarchy Theory: Concepts of Scale in the Social Sciences**). This provides a simplified structure to approach Community for design settings, which indicates the main relationship issues to be attended to. These are: Cosmology/Culture; Institutions; Legislation/laws/rules/regulations/policies (including Strategic Plans all scales); Complex Contracts/ Project Contracts; Simple Contracts/ Ownership & obligations (such as rates); Communities of Interest; Education; Personal relationships.

The EPP understanding of Community emphasises the web-nature or glue aspects, also constantly struggling to define, revolutionise and manage the local rules or 'Social Contract' and often challenging the rules (laws, regulations) emanating from higher scales. Most recently the deliberate building of Community with the former 'enemy' is noticeable, for instance partnerships between Greenpeace and the Sydney Olympics bidders, or the ACF with BHP and others, for Green objectives.²

In the mutual accommodation between humans and other biota, the entire Cascade of human concerns means nought except in its outcomes and their impacts on our partners in evolution, Allen & Hoekstra's 'evolons'. **Link: HST: SOS: Autopoiesis.**

10.2.4 CRITERION: LANDSCAPE

Allen & Hoekstra define Landscape as:

Spatial structure over a range of scales (Allen & Hoekstra :47).

Note the different attitude to scale between this and Forman's (more ecologically orthodox) definition following, and Green's anthropo-inclusive version below (although Forman's text deals with human impacts and patterns in detail elsewhere). Note also that these authors are using the orthodox 'Hierarchy of Levels' approach mentioned above, and refer to consistent landscape character, differing from Allen & Hoekstra:

A heterogeneous land area composed of a cluster of interacting ecosystems which is repeated in similar form throughout its kilometers-wide extent. Geomorphic processes, colonization of organisms, and disturbance mold the structure of landscapes (Forman & Godron 1986: 31). *[Emphasis added]*

¹Transactional Analysis.

² ACF = Australian Conservation Foundation; BHP = Broken Hill Proprietary (steel, *inter alia*).

... a particular configuration of topography, land-use, vegetation and settlement pattern (Green 1985: 205). [Emphasis added]

Thus a physical entity related to land form and land use, as distinct from scenery: (For scenery consider Genius Loci). Vink's "*Introduction to Landscape Ecology*" explains the relationship between humans and Nature across the Landscape:

Man [*sic*] is a component of many different ecosystems, but unlike other components, he has the most serious potential impact on these ecosystems ... He is able to completely destroy ecosystems ... But is also able to build new ecosystems which are called cultural ecosystems or land utilization types. In these ... man is the controlling agent and his goal is to obtain materials for food, clothes, luxuries or energy or space for recreation ... the land use is a reflection of man's needs ... Landscape ecology and land use are therefore inseparable ... In this world ... it is unrealistic to undertake ecological analysis without also considering human impacts and human management ...

... Fundamental landscape ecology describes and investigates ... the phenomena, processes and relationships and systems in the landscape with regard to human beings and other organisms. The applications of this are, for example, to land evaluation, impact studies, landscape design, and to land use planning. The land resources of an area are those components of the landscape which have a particular importance for human life and living standards ... vegetation resources, water resources, soil resources etc. (Vink 1981b: 6).

On the other hand:

Landscape Planning is concerned with allocation of resources at macro scale. It links human attitudes and goals with realistic analysis of landscape features (Cook & Van Lier 1994b:3).

'Landscape Ecological Planning', using Landscape Ecology as a direct basis for Planning, is now emerging strongly, especially in Europe (The Netherlands, Germany, Scandinavia, UK) and the USA (Cook & Van Lier 1994a: 3;1994b;van Langevelde 1994: 27).

In common parlance and ecological writing, 'landscape' and 'ecosystem' are often used interchangeably. This dissertation follows the Allen & Hoekstra definition. The archetypical tool for Landscape is the map or its cousin the plan.

A human settlement is itself a Landscape, the built environment a constructed Landscape, and site relationships become patterns to be mapped. The first contact of an urban designer with a site is usually through a map, and site maps including location of site features, functional aspects and site constraints, are key tools for planners and designers.

From a hierarchical point of view, a nested style of containment (the larger scale contains the smaller), implies direct internal connectivity. So one of the key issues for the Landscape Criterion is the patterns of structural arrangement that allow or inhibit flow, access, communication or moving from one place to another. In human settlements this flow character is such an important functional, social justice and efficiency issue, as well as being crucial to Biotics and resource use including transport efficiency, that I have assigned it a unique Criterion (Connectivity).

Landscape is structured as a tangible, nested Spatial Hierarchy, or an intangible condition, the term 'landscape' being used across a number of disciplines to indicate a concrete or abstract surface whose features are unevenly distributed. **Link: Hierarchy Theory: Boundaries, Surfaces.**

10.2.5 CRITERION: ELEMENTS

Most projects assume or have a need to know in advance, a set of data on environment as a physical entity. These may be recorded on a map or a series of overlays, and are indispensable information for all forms of human settlement design, Planning and building.

This Criterion deals with issues which while not uniquely of human concern, are closely related to human activities. It concerns the interface between natural geological (structural) and climatic entities as physical processes, and includes the elements earth (soil structure, soil testing, geomorphology, earthquakes and the human modifications of earth removal, dam building, engineering works and land 'sculpturing'), water (as water: hydrology, drainage, lakes, rivers, sea, as bodies, stormwater management, waste water management), fire (the sun, fires, fire regimes, energy, heat) and air (composition, quality, temperature, wind); climate (including microclimate, weather and climate change: El Niño, La Niña, *Accelerated Greenhouse Effect [AGE]* and ozone hole issues). While many of these processes are slow and large scale, they are also relevant at smaller scales and shorter time frames, such as natural hazards, local storms, design for microclimate, house fires, domestic heating and water supply, potting soil.

10.2.6 CRITERION: GENIUS LOCI

The Criterion 'Genius Loci', the 'spirit of place', has been added to take account of the concept of 'place', which is no longer a prominent feature of leading-edge conferences on Urban Development, but which remains a core element in the ownership and stewardship of particular locales. One could go to higher scales, perhaps to the 'connection to country' which Australians could teach about, or to higher scale again, to the evolution of identification with a national and cultural consciousness, or beyond that, attachment to planet Earth as a global citizen (enabled by fast international travel and assisted metaphorically by satellite pictures of the Earth from space), or even to the cosmos (a pre-occupation of 'New Agers' seeking 'cosmic consciousness'). The word 'genius' comes from the Latin *gignere* to beget. The quotations following express the essence of the Genius Loci concept:

Genius: Presiding deity, associations etc. of a place (Concise Oxford Dictionary).

The guardian spirit of a place, institution etc ... Distinctive character or spirit, as of a nation, period, language etc. ... Derived from the Latin: tutelary spirit, any spiritual being, orig. a male generative or creative spirit (The Macquarie Dictionary).

Spirit dwelling in a particular spot; characteristic atmosphere of a place ... The qualities of a place which refer to meaning and sensory experience (The Penguin English Dictionary).

... the visual impression of a tract of country ... a much more subjective concept than landscape ... can vary with viewpoint, weather, time of day, lighting, romantic or historical associations, and even mood (Green 1985: 105).

The senses - all together - give a picture of a reality which is not adequately described by any one sense, a reality which we call spirit, the spirit of a person, event or place. More than just the appearance or comfort, it is the spirit which affects us deeply (Day 1990: 19).

A composite of sensory experiences reinforced by historical associations (Day 1990: 107).

Every place has a spirit unless it has been destroyed by hard, unresponsive actions (Day 1990: 107).

The Spirit of Place is a true intangible, often thought of in urban or built environment settings. This Criterion is also concerned with the psychological attachment of people to place, and particularly to places in Nature. **Link: Criterion Organism: Basic Human Needs.** The concept of 'bioregionalism' beloved of urban ecologists, links the orthodox concept of Place to that of ecological and social address, through the definition of a bioregion, which encompasses biotic shift, watershed, land form, elevation, (especially indigenous) cultural patterns and spirit places (specially significant local places) (Walker 1995: 43). The core of Genius Loci is sensory, meaning-related, interpretive, even spiritual. 'Bioregion' is a functional scale, and the locus of the EPP's Genie. **Link: Models & Mindscapes: Metaphor.**

10.2.7 CRITERION: BIOTICS

A biome is a relatively homogeneous, spatially located, ecological entity, mainly recognised by a dominant vegetation, which is constrained by climate and soil, perturbed by the influence of animals, fires and humans, and 'animal-groomed' (Allen & Hoekstra 1992: 47-9).

The definition of Biome is traditionally limited to large scales up to biosphere, with robust boundaries if climate is constant, but Allen & Hoekstra's view is that the essence of Biome extends to areas as small as frost pockets and vegetation patches. Such a system is held together at biospheric scale by the atmosphere, and at smaller scales by interactions between biota and their environments.

Biomes range from the entire biosphere down to a subcontinent size or smaller (bioregion, biotope). These represent on the one hand a life support system (a habitat), and on the other, the life supported (biota: animals, plants, micro-organisms). These go together, and the fact of their reciprocity is amply demonstrated by the loss of species and vegetation structure through habitat loss world wide.

To differentiate Biomes (thence Biotics Criterion) from other Criteria: Ecosystem is used here as the cover set for the whole arrangement; Ecocycles involve living and non-living components and are process-oriented, with energy and materials paths and cycles; Biomes are constraint-

defined: they are constrained by physical conditions, so are physically localised, but do not include their physical contexts in the definition; animals and plants are considered all together, in terms of service roles and collective physical constraint; this constraint is strongly geomorphological and climatic at large scales, but animal-mediated (including animal service roles, but tragically, also humans, feral and other exotic competitors) at smaller scales; at whole Biosphere scale climate is the key constraint, but finally, that leads to Gaia Theory:

The need to invoke a switch in the patterns of control comes from the very unlikely scenario of the earth's atmosphere ... It would seem that life has been controlling the atmosphere at biospheric scale, and not vice versa (Allen & Hoekstra 1992: 245).

Thus we have at least three scale-related switches in major constraints for Biomes, which accords with O'Neill *et al*'s proposal of alternating physical and biological Constraints in Ecosystems (Allen & Hoekstra 1992: 244; O'Neill *et al* 1986: 199-201), and links with Holling's work on system Constraints. Climate is considered under Elements, but Climate Change as it impacts on Biota, is the concern of Biotics. Biomes focus on life forms accommodating to their physical environment. Community focuses on mutual accommodation between different species; the focus is not on environment, but each other and relationship. Criterion Biotics, or vitality, answers the question 'what lifeforms can or do live here?'

10.2.8 CRITERION: ORGANISM

An organism is a 'self' in the Mathews sense, and a nested hierarchy. While essentially arbitrary, especially in such cases as Siamese twins and vegetatively reproducing plants, organisms are usually physically discrete, with internal physiological integrity (Allen & Hoekstra 1992: 42). The Concise Oxford Dictionary defines organism as an "organized body with connected inter-dependent parts sharing common life" (Sykes 1982), 'Organs' and 'organelles' are similarly defined as functional units (at N-1 and N-2) in a hierarchical system.

Allen & Hoekstra define organisms as "robust observables with emergent properties", acknowledging their independence of the observer's research scoping (Allen & Hoekstra 1992: 164). This may justify the reification of such robust systems as the Gaian Superorganism, a functional entity of biospheric scale, or other human-devised systems under an Organism Metaphor. **Link: Theory of Scale: Holons.**

10.2.9 CRITERION: POPULATION

Populations are collections of usually genetically homogeneous individuals, in spatially discontinuous incidence. Such collections are dynamic, numbering from a few individuals to

millions, and may be delimited by many potential criteria according to the research question, and all applying to different degrees (Allen & Hoekstra, 1992: 42-3). "Populations that have more than one species are ad hoc entities conceived for a common purpose like inter-specific disease transmission ... As broad-based conceptions they rely heavily on the integrity that comes from all members being from one species" (Allen & Hoekstra 1992: 44).

Human Population studies exhibit parallel distinctions. Population is best understood in terms not just of the size of the collection, but of the details of its presence. Thus Rowe's 'W' questions become relevant: What? Who? Where? Why? How? and When? The answers indicate the manner of solution of survival needs, wants and proclivities for the species and place in question.

As the Criterion of collectives, competition, oppression and cooperation between species of sub-species groups (such as minority group issues in human communities), predator-prey relationships and collective market behaviours come under this heading notwithstanding their relationship-based dynamics. The Mathematics underlying Population is that of Complex Dynamic System, emergence, and chaotic Attractor landscapes, particularly 'Predator-Prey' cycles (Lotka-Volterra Cycles). **Links: Chaos Theory; Criteria Organism (Needs Based Design).**

10.2.10 CRITERION: ECOCYCLES

The argument for renaming this Criterion from 'Ecosystem' was presented at length above.

Allen & Hoekstra's formal definition of 'ecosystem' is as follows:

Any large or small entity blending the biota with the physical abiotic environment, whose system boundaries include the physical environment and which is formed in aggregate by cycles and pathways of energy and matter. Functioning subunits are not plants, animals, soil and atmosphere, but mixtures of these (Allen & Hoekstra, 1992: 44-5).

This refers to the cycles of transformation introduced under Energy & thermodynamics called 'ecological services', or 'biogeochemical cycles', upon which all life on Earth depends (Odum 1963: 53). While matter cycles endlessly, energy is captured from the sun and invested for a while in plant and animal body structures (creative phase), eventually breaking down to heat, largely through respiration, nutrients return to the general pool, released by the 'creative destruction' phase of the energy cycle, and the whole system is modulated by flows and rates of environmental flux (Holling 1995: 20-23; Odum 1963: 65).

This Criterion is the starting point for the application of ecocycle principles to human settlement development. It extends to industry, manufacturing, technology in general and transport of materials and goods: the technological extension of human abilities to transform energy and materials, and interprets waste management as resource management, inviting us to abandon

the concept of waste altogether. Thus we are dealing with Industrial Ecology, Ecological Footprints and Ecological Rucksacks. Waste substances are time-scaled according to how long they persist in the environment.

In a human settlement, the whole city can be considered as an ecosystem, with a footprint extending across multiple scales (Wackernagel *et al* 1993; Wackernagel & Rees 1996). **Links: Energy & Thermodynamics; Criterion Indicators.**

10.2.11 CRITERION: CONNECTIVITY

The linkage between elements, emphasising the web or network aspects of Complex Dynamic Systems. The key themes are connection, relative disconnection and access, communication, exposure and protection: spatial, temporal and intellectual.

Thus this Criterion looks at relative and absolute, direct and indirect connectivity between individual elements. The relative temporal disconnection may be related to differing natural frequencies in ecosystem hierarchies or between Organisms; to spatial barriers such as fences or geomorphic elements; or to natural or constructed aspects of human settlements relating to access, such as timetables, business hours or peak power or Traffic loads, transport linkages, transport and communications systems and timing. An optimal range of connectedness is necessary to retain system functions and integrity (**Link: Hierarchy Theory**).

Although the Complex Dynamic Systems feedback loop structure is described by this Criterion, for human settlements it is necessary to separate this from the constraint picture (positive and negative), due to the need for separate consideration of a simple infrastructure concept (pipes, roads, IT&T, access) on the one hand, and of economic drivers, a number of other catalysts, and Planning constraints on the other. These latter are dealt with under Criterion Feedbacks.

Criterion: Feedbacks places finance in its proper role as a tool, enabler or catalyst. Having an economy is an integrative strategy (Connectivity); money can be an Attractor (Population), a symbol impacting relationship (Community), but it is a poor integrator for non-human Biota, since few can eat it, and biotic budgets trade in food, genes, protection, materials and energy. If biota can earn their keep (tourism) or have an effective champion (domestication) they may indirectly be integrated. Ecological Economics and Natural Capitalism may fare somewhat better as integrative strategies than Resource Economics. **Links: Subatomic Theory; Organising Principles.**

10.2.12 CRITERION: FEEDBACKS

The positive or negative values of connections as feedbacks, vectors in models, or constraints of all types: the control system supporting the life cycle (emergence, long-term survival, development, maintenance and decline) of a system or project. The balance of positive and negative feedbacks was first assigned its own Criterion for human settlements as a category for catalysts and enablers, including finance and other currencies, was required. Allen & Hoekstra use 'Constraint' as an ecological generic, Odum uses the term 'Regulatory Factor', Synergetics and Catastrophe Theory speak of 'Control Variables or Parameters' and 'Ordering Parameters', and orthodox Ecology uses 'Limiting Factor' to describe ecological control system elements.

Links: HST: Self-Organisation; Hierarchy Theory; BP 5.3: Fuzzy Logic: FCMs, Fuzzy Control Systems.

The Criterion was initially named 'Catalysts'. Catalysts are enabling elements that trigger or otherwise assist the implementation of project plans, as in Biology, where enzymes increase the velocity of chemical reactions. They can accelerate processes in either direction. Unlike Biochemistry, Planning catalysts (such as funding or goodwill) often appear to be consumed in the process. But may maintain their value through spending, in the form of financial, structural, cultural or social Capital which may later be drawn upon as knowledge, leverage or resources for other activities. Thus Feedbacks includes the relativities of the different 'Capitals' of Capitalism (financial, natural, social, cultural, energy).

Next I tried 'Constraints', after Allen & Hoekstra. But the term 'constraint' commonly implies inhibition, even though it can indicate a drive: "I felt constrained to ...". This was felt to be too confusing. With 'Catalysts', in human settlement settings, a series of requirements exists, to get a project off the ground, not the least being funding. It was soon realised that there were a number of other issues, such as the need to sustain the development once it was manifested, and the importance for predictability and to resist runaway positive feedbacks (that is, for stability), that the negative or 'balancing' Constraints or Feedbacks needed to be included, even mapped for physical constraints and listed for the intangibles.

This Criterion takes account of Complex Dynamic Systems aspects of human settlement developments, including their chaotic and catastrophic character, and our attempts to 'nudge' the system through strategic intervention. The weblike, self-organising and homeostatic nature of complex dynamic systems exhibits a balance between direct and indirect connections of different valences,³ and between system components, which forms a homeostatic whole in bounded systems, and includes spatial and temporal connection and relative disconnection. It

describes the feedback loop structure, combining in this with all other Criteria, but particularly with Connectivity and the Attractor/Repellor aspects of Population, to form the supportive Backcloth for any Traffic under consideration.

It may be sufficient in research for Criterion Community to explore all these Constraints, but for human settlement design purposes, the Criterion Feedbacks is proposed, as there is a need for a specific focus to identify the positive and negative forces which will need to balance each other in ways that ensure as far as possible that the conditions will be present for the project to be sustainable economically, socio-functionally and ecologically: that a lively and sustained 'Traffic' will be supported to emerge and be maintained. **Link: HST/CDS: SOS; BP 5.3: q-Analysis.**

In addition to positive and negative Feedbacks, Synergetics and Catastrophe Theory tells us that we need to identify and nurture the least stable control and ordering parameters, as these can entrain the system under stress, and subvert a desired direction, just as they are the source of creativity, resilience and new positive directions. In a human settlement setting, these are often NIMBY⁴ when they could have been YIMBY⁵ with better management and more minds working on solutions. So the needs of all stakeholders must be reckoned with, preferably in concert, entrained through visionary leadership.

Hierarchy Theory and CDS Theory combine to describe the long loop (time delayed) impacts from short-term actions, causing Surprises and Catastrophes. This Criterion enquires about the easy technofix that takes a system to a larger scale Constraint system. **Link: Criterion Ecocycles: Appropriate Technology.** It also combines with Community to consider socio-political Constraints, leading inevitably back to legislation and public policy.

10.2.13 CRITERION: RHEOTICS

Criterion Rheotics (formerly⁶ 'Time/Change' or 'Dynamics'), is included to emphasise the 'rheomode',⁷ the fourth dimension: the dynamic nature of the reality we attempt to deal with action language, verb-based, movement, rhythms, cycles, emergence, resonance, e-/de-/re-/volution⁸/velopment⁹ process, being and becoming, in the application of ecological principles to a human settlement context. It is derived from *rheos* (Greek) a stream. This dynamic Criterion is

³ Valence refers to the number of ways two elements are connected – q-Analysis (Casti 1994: 171-211).

⁴ Not In My Back Yard!

⁵ Yes! In My Back Yard!!!

⁶ As used in conference papers and the OCW project.

⁷ (After Bohm 1980). **Link: Subatomic Theory: Organising Principles.**

⁸ Volution comes from the Latin, meaning 'rolled up' (Macquarie Dictionary). E-, in-, re-, de- volution are common words that intuitively indicate a Metaphor similar to Bohm's *Explicate Order*.

⁹ A neologism coined by a drole scientist in an essay for Internet distribution.

used as a conceptual check to ensure that history and original conditions have been included, and that timing and resonance, staging and allowance for change are thought through specifically.

Rheotics involves all scales from cosmic to subatomic, in this context, most commonly from geological time (local Geology, Geomorphology, Pedology/Edaphology), Dreaming (circular time), white & Aboriginal history, future generations perspective for sustainability, electoral cycles, project duration and staging, seasons, weekly or diurnal variations (such as variable site use), day and night. Note that the Aboriginal concept of The Dreaming is non-linear and on-going, not merely a creative period in the distant past, a problem for the Western community that sees time as an arrow (Broome 1982: 15). **Links: HST: SOS: Time and Change; Criterion Rheotics: Tables 102, 115, 116.**

10.2.14 CRITERION: INDICATORS

This Criterion invites a longer-term and more specifically functional, performance-oriented attitude to design and development. It expresses accountability, learning, idealism, Resilience in a changing environment and sustainable objectives. It addresses a commitment to continuous improvement in the direction of 'Sustainability'. Indicators should thus defined as explicit sustainability metrics nominated for a project in each Criterion, for use in later auditing, self-assessment, learning, management and inter-project comparison. Indicators assume a position on the definition of Sustainability, which ought at least claim a commitment to 'triple bottom line' integration, balance and eco-social healing. Criterion Indicators is a reminder to do this.

An array of different Indicators exists, designed for different purposes. The field of Indicator development is relatively new, but it is crucial to become familiar with Indicators for the purpose of achieving environmental and social feedback, turning formerly linear systems into cyclic ones.

Link: Models & Mindscapes: Dynamic & Compound Metaphors: Table 13: Strategies for a Learning Approach.

10.3 SCALE & SCOPING

10.3.1 PROJECT SCOPING

One of the most important initial tasks in any project is to scope it and develop a brief: how far will we go? Using an ecological model will greatly extend the scope in terms of Space, Time and Concept. The challenge is to ensure that this ecological scoping is creatively and innovatively managed, lest the reordering of priorities be threatened by an escalation of costs. **Tool 3.5: Hierarchies Implicated by Different Criteria** serves as a reminder of the different hierarchical dynamics likely to be simultaneously present in the Backcloth of any project, especially large scale ones. **Links: CDS Theory; Hierarchy Theory.**

Each Criterion can be interpreted as relating to at least one Hierarchy, and all the identified types of Hierarchy are covered for human settlements by considering the suggested UHSE Criteria, as long as they are considered at all their respective levels of relevance, which, practically speaking, is best done intuitively. Hierarchical structure is not necessarily the most pressing issue for each Criterion, but does persist in the Backcloth. **Link: Confluence: Tools: UHSE Summary Tables.** All Criteria can be interpreted as having emergent properties, that is, they could be seen as Constitutive Hierarchies. The whole Ecosystem with all its attributes is the principal Constitutive Hierarchy, of which all these others are only facets. Each situation must be scoped in accordance with the relevance to that specific project. The important thing is that any aspect be considered beyond its apparent scale, going as far as necessary to achieve a sustainable outcome.

A diagram similar to White's, illustrated above (White 1983: 14) for 'Contextual Analysis', looks at the extended Allen & Hoekstra Layercake end-on, and can be used for UHSE Criteria as a practical, simplified model to visualise a range of scales for the main Fields-of-Influence for each Criterion for that site: a Scalar Analysis **Links: Confluence: Tool 3.10: Scale Analysis.**

10.3.2 ACCESSING DEMONSTRATION MATERIAL

There is an accumulating body of experience in this, but it still takes effort to seek out clues to relative dollar costs. To date, most advances have been quite heavily subsidised in the spirit of research. Reports in this dissertation barely scratch this surface, as EPPs believe there to be a crisis of prioritisation.⁵ The work of the Rocky Mountain Institute, including Amory and Hunter Lovins, Ernst Von Weizäcker and Paul Hawken, is helpful in locating specific implemented cases with substantial savings: not the 'normal cost +10-200%' widely believed by the building industry

to be necessary (Hawken *et al* 1999; Rocky Mountain Institute 1998; Von Weizsäcker *et al* 1997). This attitude is a scale-based problem. Lovins is fond of saying in interviews and presentations, that radical energy efficiency saves more and does more with less than tinkering around the orthodox edges.⁵ As mentioned elsewhere, MFP Australia had a database on implemented sustainability strategies. At Habitat II, a CD was released by UNCHS¹⁰ and the Together Foundation: *"The Best Practices Database"*, which was to be followed into new versions.¹¹ In Australia, one of the best sources is Urban Ecology Australia.⁵ The equivalent in the USA is Urban Ecology Inc., located in Berkeley, California.¹² None of these sources, to my knowledge, detail comparatively costing (\$, energy, CO₂) across all relevant scales: a clear research opportunity.

10.3.3 PUBLIC POLICY: A SCALE BEYOND MOST DESIGNERS' CONTROL

Few projects are large enough to have impact on public policy per se. JVNIC and MFP-Australia could have had, had they survived at least two decades.⁴ EPPs strive to influence larger scales by example, and use much private time in activist pursuits as well, ever hopeful that the politico-economic levers will change.⁵

Lyle, in his chapter *"Economics, Policy, and Transition"* argues for two necessary conditions for progress towards a sustainable style of development: regenerative systems must cost less or no more than the alternative, and must have a supportive public policy and economic Backcloth. He emphasises the difference in mental models when arguing for Regenerative Design with economic fundamentalists. There are at least five ways to do cost accounting, and only the first is usually counted, sometimes the second. With increasing space and time scales, they are increasingly difficult to value directly, and yet are clearly having large scale impacts, and the will must be found to cost them in. They are:

First cost (land, materials, labour – of main concern to developers, and unlikely in 'spec. built' housing);
Life cycle costs (long-term costs, operation, maintenance, management – often inversely related to first costs – should be of concern to buyers, IFF¹³ educated about the issues);

Total measurable cost (all actual externalities – infrastructure costs, subsidies, tax incentives; especially in agriculture, energy, water);

Macro-marketplace costs (multiplier effects: job creation, capital concentration);

Eco-social costs (includes first four plus diffuse but deadly items: pollution of air or water, loss of biodiversity – difficult, indirectly audited) (Lyle 1994: 307-10).

¹⁰ United Nations Centre for Human Settlements, Nairobi, Kenya.

¹¹ *The Together Foundation*, Office of the President, 55 East Street, New York, New York 10021; (+212 628-1939; Fax +212) 628-4265; <http://www.together.org/>.

¹² Email address: urbanecology@igc.apc.org/.

¹³ If and only if.

10.4 CRITERION 0: UNSPECIFIED

The main use of this Criterion is in matrix situations.

This may appear redundant, but recent practical experience in complex and large scale design demonstrates the need for reminders about mundane issues, through the heat of the deadline or for the safe delegation of project design elements to less informed individuals. At later stages of the design process, the Unspecified Criterion can be used to check the design concept itself against all the other Criteria.

If issues specific to a particular project do not appear in the standard format, then there is no problem with simply adding further Criteria and considering them at the scoped scale ranges. The purpose of the unspecified Criterion is to invite the user to consider whether such extension(s) could be required, and to follow that through as appropriate.

10.4.1 CRITERIAL ESSENCE

Integrity check. Thematic/Project Vision specification & tracking. **Link: Confluence: Weaving the Backcloth: Tools.**

10.5 CRITERION: COMMUNITY

The biosphere is in an unsustainable state, brought about by human behaviour ... The six areas considered here are over-population; technology; self-interest and greed; in-group/out-group behaviour; aggression, warfare and crime; and the pursuit of power. Unless we take remedial action these behaviours ... will provoke a catastrophe ... in the past they served us well. Recognising the pressures generated by our evolutionary biology may enable us to modify our behaviours so as to escape disaster. Only thus can we justify our species label, sapiens (Barnes 1991: 31).

Conservation is getting nowhere because it is incompatible with our Abrahamic concept of land. We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way ... That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics. That land yields a cultural harvest is a fact long known, but latterly often forgotten (Leopold 1966: xix).

10.5.1 CRITERIAL ESSENCE

Community is a complex Non-nested Hierarchy with conceptual, constitutive and dominance aspects. With virtual Community now a reality, one can no longer claim Community to be essentially place-bound. Dominance Hierarchy will be expressed overall along the continuum of cooperation \Leftrightarrow competition. The collective aspects of this are properly the realm of Population (ecological behaviours of competition and cooperation between (sub)populations in the who's where, how and why category), but the (human) belief systems, the tangle of linkages and the nature of relationship is of the essence in Community.

There are formal and informal tangible aspects, and Complementary intangible aspects are often confused, skewed, hidden or dichotomised: the larger and more complex the Community, the more possibilities. Values and wisdom have, since the industrial revolution, changed in tone and emphasis, but have, especially since Market Libertarianism strengthened, been seriously discounted in favour of 'facts', but not across the whole of society, and these camps are lately in serious collision.

The archetypal community is the forest. The tangle of processes holding the community together can be studied in aggregate as competition, interference, accommodation, mutualism, (predation) and many others, which form a restless, complex, dynamic scene. These processes often modify the physical environment, but (unlike ecosystems),¹⁴ are explicitly not part of it. Clean predator-prey, competition and mutualism type relationships are available to Population studies, but Communities are "fully integrated", only allowing statistical studies in aggregate (contracted from Allen & Hoekstra 1992: 44-5).

That is, for ecologists, as for communitarian humans, Community refers mostly to the 'glue' or intangible cohesive matrix connecting a group of species. However in any human Community of size, governance and policy issues inevitably emerge, and intellectual, educational and spiritual aspects strongly drive outcomes. Link: Thermodynamics: Energy & Social Systems.

Human social relationship is bathed in cultural percepts and Cosmology. These are Ideology-driven and Metaphor-mediated, interpreted by the individual through an amalgam of genetic

inheritance and personal experience. These are manifested collectively through derivative political arrangements, institutions, laws and regulations, promoted by education and the array of formal and informal social contracts, that reflect the normatives for mutual accommodation. Normatives (functionally patterned 'introjects'¹⁵ from external sources, both learned from parent figures and inherited as instinctive behaviours), are not confined to humans, but are supposedly under more conscious control, and supposedly more flexible with us. Introjects (in individuals):

... consist of complex, integrated ways of behaving or being, adopted wholesale by the developing organism from significant others without assimilation or integration with the self. They correspond quite closely to Berne's (1961) 'parent' or 'extero psychic' ego states. They can be detected by the repeated concurrence of a certain voice quality, type of verbal content, and gesture-posture style, and by the similarity with which others respond to this unified complex of behaviour ... They are the chief actors in the endless self-nagging and inner argument between the 'ideal' and the 'real' self in which so many people fritter away their lives ... They also clutter up interpersonal relations ... are one of the main transmitters of pathology across the generations. An individual who has successfully minimized his [sic] use of introjects in other areas of his life may still activate them, when he functions as a parent with his children (Fagan & Shepherd 1972: 129-30).

This theory lies at the heart of a number of modern Psychotherapies.⁵

The following sections deal with Community as Glue, then as informal and formal structures, and conclude with a simplified approach for use in design situations, using the 'Community Cascade'. This is a heading set drawn from a much more complex Backcloth.

It is not the job of a design project to spell out the detail of such structures, but it is necessary to relate to them, and to recognise that developments are capable of impacting many levels, but particularly those at their own functional scales and below. Impacts at higher scale are usually triggered by entrainment at times of instability or collective power. Emergent phenomena are common. It is not the role of the UHSE model to prescribe community standards, except to point out that if they are not in line with individual and social needs of all groups impacted, Social Trap phenomena will emerge in due course.

10.5.2 THE COMMUNITY 'CASCADE'

Social constraint systems have mutually reinforcing Dominance and Conceptual Hierarchy characteristics: social constraints are generally accepted – or not – in a climate of coercion and conditioning (Conditional Stroking¹⁶) within a shared Ideology. Link: Criterion Organism: Human Psyco-Social Needs: Steiner's Stroke Economy. The layers can be viewed as flowing down from a Cosmology as follows, but probably arose by emergence from below, as described by Adams (Energy & Thermodynamics) for survival vehicles and regulatory sector.

¹⁴ By Allen & Hoekstra's definition: 'here termed Ecocycles'.

¹⁵ Term from Gestalt Therapy.

¹⁶ Term from Transactional Analysis Stroke Economy Theory. Stroke Economy can be seen as a type of psychological *Stimulus Capitalism*, very relevant to Marketing.

The 'Community Cascade' is a mnemonic framework for the social Constraint system. A minimal set of conceptual/regulatory, Constitutional Time Hierarchy levels to which an eco-designer would need to refer for working purposes would be Culture/Cosmology ⇔ Institutions (Parliamentary, Executive, Judicial and Educational Systems) ⇔ Strategic Context (all scales from international to local) ⇔ Policy & Regulation (all scales Commonwealth to Local Government) ⇔ Legal Contracts (legally binding agreements & obligations, including legal ownership & rights, accountability) ⇔ Glue Quality: (Communities of Interest (consultations, agreements partnerships, understandings, workshops, collaborations, interpersonal relations) and Learning (trial & error, shared experience, accountability, Benchmarks, recording and future evaluations, reviews & opportunities for learning).

Tool 3.6: Community 'Cascade' lists the Backcloth components (under this Criterion): a worthy example of Allen *et al's* "tangle of processes" that self-organise and "produce a cohesive and multi-faceted whole" (Allen & Hoekstra 1992: 44). Most important and elusive, a robust 'Glue', the Community cohesion born of the quality of the relationship Interference Field, is actively sought by EPPs who work lifestyle at the quotidian timescale.

A conscious effort to expand and exercise our capacities for loving and altruistic, cooperative behaviour is now crucial if we are to survive in this Age of Interdependence (Henderson 1991: 144).

10.5.3 SOFT POWER: INTANGIBLE STRUCTURES OF COMMUNITY

10.5.3.1 INTRODUCTION

A number of issues arise as EPPs grapple with their efforts to manifest alternatives to the mainstream Bias. Decisions are filtered through an ill-defined, pragmatically-negotiable, ecological framework, referred to by one group as 'The Green Box', and by another as 'The Ecological Bottom Line' (meaning 'Eco-Social').⁵ The following identifies some of these challenges as potential planning or community development issues in changing to an EcoCommunity Paradigm.

10.5.3.2 COMPETITIVE VS COOPERATIVE PARADIGM

This topic follows on from the discussion on political arrangements under Metaphor, including Table 13: Strategies for Learning: Approach to Ecological Management.

In the context of a strongly competitive system threatening deadly extremes, Conflict Resolution is fast becoming a key skill. It is difficult to maintain a prejudiced position simultaneously with a

Maturana style position of loving, but few have heard of Maturana! **Link: Criterion Community: On Love as the Biological Basis of Social Life.** Our system, so skewed towards the competitive now even in law, may be seen by some as a reflection of the ecological world, where survival of the fittest is said to reign, and Social and techno-Darwinism creep ever closer through the flasks and computers of the genetic engineers and the Market Libertarians.

We should remember what happens in birds with increasing overconnection to food resources through scarcity: small parties start flocking, then every bird fights for itself. Space-challenged rodents⁵ and chimpanzees¹⁷ kill each other. An exaggerated tendency to competition could be used as a macro indicator for scarcity, real or contrived. This is a psychological survival mechanism well known to Transactional Analysts, in families where the Stroke Economy¹⁸ operates on negative. Collaboration within a Community-of-Interest is an evolutionary truth in humans, as are both aggression and competition, and trading, cooperation and inter-marriage with outsiders. Lord Peter Kropotkin, anarchist geographer and contemporary of Darwin, Marx and Engels, was even then reporting evidence of natural cooperation under duress, rather than obligatory inter-species competition in harsh climates (Breitbart 1981).¹⁹

We have set up a world based on Competition, idealising freedom of individual choice (which has stopped meaning freedom from oppression and become a spoilt child, rights-demanding, greed-driven phenomenon that avoids responsibility for bigger pictures and wastes scarce resources), an 'enemy-oriented' or at best adversarial, winner-take-all, either/o system. Paradoxically, ecological threat, Globalisation, communications, especially television, Internet and transport, have connected us into a single Community of Interest as never before. The challenge is thus to redefine Community to a much larger scale in order to bestow family status on all biota, and to look to Maturana as we contemplate each other through global eyes.

Links: Hierarchy Theory; Criterion Organism: Needs-Based Development; Nature's Needs; Basic Human Needs.

10.5.3.3 LIVING IN COMMUNITY

10.5.3.3.1 Introduction

For everyone to have the opportunity to be involved in a group and to participate in its activities, the structure must be explicit, not implicit ...

¹⁷ (Diamond 1991: 261-4; Goodall 1999).

¹⁸ See Steiner's *Stroke Economy* below.

¹⁹ The expression 'survival of the fittest' came from an essay on a theory of population written by Herbert Spencer in 1852, based on an earlier paper by Malthus, and neither the broad political use of this expression, nor the concept of *Social Darwinism*, can be attributed to Darwin himself (Burrow 1988: 27-8).

Once a group has given up the ideology of structurelessness, it is free to develop those forms of organisation best suited to its healthy functioning (Freeman 1992: 76, 77).

EPPs speak of 'living in community', and many live that out through intentional communities (including EcoVillages and Cohousing), survival vehicles (eco-socially focused communities-of-interest) and family/individual practice. They see Community, and particularly Community 'Glue' (see below) as a major missing link to health and vitality in modern society, and viability and liveliness as goals rather than sustainability, but do address the latter specifically. Others contribute to local or other scale communities-of-interest, which are usually eco-socially focused⁵. **Links: Early Findings: Aligning with Nature; Confluence: Cohousing; Plate 15.**

There is something in the human condition that eternally yearns for a greater sense of connectedness, yearns to reach out and deeply touch others, throwing off the pain and loneliness of separation to experience unity with others. In all times and in all places people have consciously reached out to feel their connectedness with a larger whole. This is the experience of community. The word "community" is the experience of unity or oneness with all people and with all life ... Community is not a static structure, rather it is an ongoing process of unfoldment ... on all levels – physical, mental, emotional, spiritual ... the context for actualizing potentials within the individual and between the individual and others ... (McLaughlin & Davidson 1985: 10).

A number of intentional communities I visited in 1993 emulated Findhorn, North Scotland,⁵ in having a strong community service ethic (for instance Fuzzies Farm Adelaide,⁵ Alpha Farm,⁵ Lost Valley⁵ and Cerro Gordo,⁵ Oregon USA), and combined this with their economic activities.⁵ Findhorn was also notable as one of the longest-surviving communities (established 1971), members attributing the relative harmony to cooperative and spiritual underpinnings, but in particular to the practice of weekly 'attunement'. This was a compulsory, large group activity, whereby any potential dissonance must be pre-empted by dealing with it in group as soon as it came to awareness (not allowed to 'fester').⁵ My interviews there revealed major perceptual differences as to the health of community function (for instance one claiming dysfunctional crisis and competitive workoholism, another revelling in the constant change: "that's how it is: growing and changing all the time!") A fascinating potential depth study.

10.5.3.3.2 Glue

In its excellent Report for the Context Institute (Bainbridge Island, WA, USA), the Danish Gaia Trust described the full set of challenges and questions inherent in EcoVillage development (Context Institute 1991a: 10-13). Within the deeper whole system, and underpinning bio-system, built environment, economic system and governance, the concept 'glue' represents the basis of shared values in a Community. Development and maintenance of this "something that holds them together" raises questions as to common values, vision, practices, inter-personal and extra-community relations and closeness, discovery, development and evolutionary processes around the vision, and the unity/diversity balance (Context Institute 1991a: 12).

These issues are at their most intense in intentional Community, but also relevant in Community development at wider, less committed scales, especially if a group within a Community wants to implement something unusual. For instance Aldinga Arts EcoVillage had 42 objections about its presence, its ecological impact or its proposed sewage treatment system, despite most of the complainants having had no direct information about the intended site restoration, or the type of treatment system, and having not come to the many open days and information sessions offered. One individual engineer at local government level has a 'proper engineering', concrete pipe fetish, and argues for grid connection, which is delaying approval.⁵

This familiar, reactionary process emphasised the need for a larger scale glue than that of the intentional Community itself. **Link: Early Findings: 'Failed developments'**. At Bamberton, Vancouver Island, I asked the Developer's Project Leader (Chip Kauffman, now working in Australia) what they would have done differently to date. Despite hundreds of hours of Community Consultation and workshops, and extensive efforts to involve Community, more of this was nominated.

10.5.3.3 Optimal Community Size

The main difference between EcoCity/Village or Community and ESD, is community itself. If a community does not exist, it is created in advance, as by North American developers McCamant & Durrett (Cohousing: Muir Commons, Davis, CA), Ahmanson Land Company (Ahmanson Ranch CA) and DPZ (Bamberton, BC). The latter two were larger scale and more consultation initially. Future patterns remain to be seen. Resident inclusion for the longer term requires that clusters be no larger than 35 households, otherwise:

... intimacy, cooperative workability, and even the distinction between "common" and "general public" begin to grey. Management becomes institutionalised out of sheer necessity, and people feel that they really have to assert themselves to be heard in the common meetings. Participation tends to dwindle, and management decisions are delegated to a committee. For anyone who plans to build a community of more than 35 units, we strongly recommend that the development be broken into smaller clusters (McCamant *et al* 1994: 160).

The rewards are very rich, but the intention needs to be established very firmly from the start. A balance needs to be struck between burning everyone out and coming unstuck. The fire soul role is crucial. Muir Commons (Davis) took about four years from first meeting to move-in, has 26 units and eleven committees. These are: Communications, Architectural Review, Garden, Governance, Children's Issues, Landscape, Common House, Meals, Community Spirit, Finance and Coordination (one member from each of the other groups) (McCamant *et al* 1994: 214).⁵ **Links Confluence: Scoping: Stakeholder inclusion; Plate 15.**

10.5.3.3.4 Values & Spiritual Aspects of Community

As mentioned above, there is ongoing dispute as to the core qualities of humans – are we inherently bad, sinful, mindless, murderous warmongers? Are we intelligent, sensitive, caring, decent, even saintly? Without becoming embroiled in that again or calling on our primate ancestors, it would seem clear that we are capable of the full spectrum of beingness, and that the issue is not what we ‘really are’, but rather, what we can be convinced to hold as an ethical framework. How may we re-write our Cultural Script or set up our social Backcloth or Organising Principles to embrace a sustainable future? Theobald often used the Matthew Fox term ‘original blessing’ as a substitute for ‘original sin’. Fox says:

In my earlier book, *Original Blessing*, I named the religious paradigm shift of our time as one from original sin to original blessing. In terms of the history of spirituality, this paradigm shift is from the three stages of purification, illumination, and union that mysticism inherited from Proclus and Plotinus (not from Jesus or the Hebrew Bible since neither of these thinkers was either Jewish or Christian) to the four paths of delight (*via positiva*), letting go (*via negativa*), creativity (*via creativa*), compassion, i.e., celebration and justicemaking (*via transformativa*). Today “to enter the mysteries” means to enter the mysteries of the four paths of creation spirituality – mysteries of delight, darkness, birthing, compassion ... Though I am approaching this paradigm shift from a theological perspective ... this shift will affect every aspect of our culture ... The “Jesus” dimension to religion paralleled the individualism of the Enlightenment and industrial age. A “cosmic” dimension to the Jesus story parallels an emerging age in which Mother Earth yearns to see from the human race a living cosmology, an awakened creativity and a deeper commitment to compassion ... without a living cosmology our tradition cannot sustain us for the adventurous journey to which so many feel themselves called (Fox 1988: 82-3). *[Italics added]*

A number of EPPs have explored what spiritual qualities may be needed for or emerge with, the ecological approach (for instance see Cock 1991b; Fox 1988; George 1995; Lindfield 1986; Spong 1998: 149-67; Spretnak 1986; 1994).

Spretnak gathered a wide range of people to work on building a new, globally relevant Politics, then called the ‘Committees of Correspondence’. They put together a list of ten values and questions for discussion, concerned that neither ‘left; nor ‘right’ traditional political movements were addressing these adequately, and reconnecting Green Politics with Spirituality and Values as does Goodin in “*Green Political Theory*” (Goodin 1992: 86-112; Spretnak 1986: 78-82). These are listed in **Table 68: ESCM: Spiritual Dimensions of Green Politics: 10 Key Values of the US Green Movement.**

Cock’s work was part of the Fundamental Questions Program at ANU. In FQ Paper No 5, “*Values for Sustainability: the Necessity of Transcendence and Sacred Realms*”, Cock makes a powerful argument for social transformation through the alignment of society’s instinct for self-preservation, with a renewed recognition of our sacred realms: Aborigines have no monopoly on Sacred Sites (Cock 1991b: 1). We must identify our interests with those of Nature, and we can not do that effectively in the absence of Community:

Developing the full potential contribution of transcendence requires a sense of meaning that goes beyond sustainable survival. As Ehrlich has said, ‘a quasi-religious transformation leading to an

appreciation of diversity for its own sake, may be required to save other organisms and ourselves' ... The way that local social structure connects the individual to other persons and nature is the key to a bridge between the person and the planet. The development of community is vital for us to be able to draw on its informal social sanctioning power. Without it there is excessive dependency on professional and formalised mechanisms of social control, and these are relatively powerless as preventive agents and are usually applied inequitably. Sacredness of place, or community, cannot be effectively developed without a structuring that enables a shared expectation of on-going future relations between people and that place ... without it, an individual's capacity to be responsive with their [*sic*] environment is greatly diminished ... (Cock 1991b: 6).

But Cock warns:

... the social power of the community has the potential not only to facilitate, but also to impede human sensitivity toward nature. There need, therefore, to be national and global authoritative reference points for local community accountability (Cock 1991b: 8).

Links: Criterion Organism: Human Psycho-Spiritual Needs; Confluence: Content: Cosmology,

Process: Community.

10.5.3.3.5 Decision Making

The goal of the twenty-first century must be a high quality of life; this can only be achieved with a commitment to:

- 1). Social cohesion which is based on a commitment to mutual respect and acts on concerns about growing gaps between the rich and the poor and ethnic, tribal and racial division,
- 2). Ecological integrity at all scales from the local through the regional to the global,
- 3). Effective decision-making which prevents our virtually unlimited productive and destructive power, from destroying the systems on which all lives depend,
- 4). Living in a values-based culture - a basic requirement for survival (From flyer advertising visit of Robert Theobald to Adelaide, 1998, expressing his objectives).

Many EPPs have, especially since the 1960s, been engaged in thinking through, designing or 'walking the talk' of Community.²⁰ Intentional community is arranged around the glue of shared beliefs, aspirations and values. It is based on the belief in humans:

... more than social creatures, they are community animals ... Men [*sic*] live best in integrated groups of limited size. They crave community life, not simply social life (Morgan 1993: 16).

All groups with decisions to make, need to agree in advance what the rules are to be. The question of desirable social structure and what actually constitutes effective decision making remains problematic, needing constant consciousness if true Community is to be built, especially if the Community is a tight, intentional one. Effort is often made by EPPs to avoid hierarchical governance, to rely on flat or circular structures and consensual decision making, which causes misunderstanding when interfacing with hierarchical official structures (Newman 1980: 143-64).⁵

Searching for an answer to the question "... whether people in communes do or do not show, through their attitudes, values and deeds, sufficient evidence for us to conclude that communes could be a significant, even major, part of a green society - an Ecotopia [*after Callenbach*²¹] "

²⁰ The work of M. Scott Peck, a psychiatrist who advocates love as the basis for spiritual growth in Community, and who takes a Quaker approach to community building, has been much emulated by interest groups in Australia (for instance see Peck 1983;1987;1993).

²¹ (Callenbach 1978).

(Pepper 1991: 2), Pepper studied 13 United Kingdom communes in depth. He found that only half handled consensual decision-making systems well, and that they took a long time to establish effectively (for example 10 years), and required a lot of hard work (Pepper 1991: 148).

I found at Findhorn, that that the community had reached about 300 residents, and had, well before that, discovered that it was impossible to operate flexibly in the 'real world of business' using a consensual system, because rapid responses are often needed and consensus is usually very time consuming. They were obliged to reduce the numbers to a more manageable limit of 200, and to elect representatives, trusting them to make decisions according to prescribed principles, on their behalf. This was felt to be necessary because the community set great store and derived income from projects involving community service and education. Such a representative democratic system was strongly resented by some I interviewed.⁵

It seems that above a certain community size, and with mundane issues, consensual decision making becomes very prolonged, tedious and incompatible (speed) with business management interventions. It can inhibit change, and democratic decision-making systems are probably better suited to large populations, especially where some decisions are intellectually difficult.²² Even at Fuzzies Farm with a decision-making team of three, the ability of any one to veto any decision meant that decisions were often delayed or not made at all. Experience in intentional community has found that, especially where membership is defined loosely, or where one vexations, inflexible or destructive person may seek to entrain, prevent or hijack community decision making processes, a rule of 'consensus-minus-one' works well. The facilitator ensures all are heard and the issue recycles if more than one dissent (Estes 1992: 81).²³

Respect for and careful recording of any 'contra view' in 'group conscience' decisions in Alcoholics Anonymous (2/3 majority required for important decisions; different rules specified for different situations), serves this large, bottom-up organisation well, especially considering its members' considerably capacity for disagreement.

The Quaker movement, which sets great store by its system of consensual decision making, even in very large assemblies (many hundreds), is nevertheless assisted by common subscription to and honouring of the system rules. Vexatious elements determined to disagree, as found in the

²² Where issues are intellectually beyond voters, the latter tend to follow the most forceful or charismatic 'expert'; mundane, easily understood issues may then, paradoxically, be given hours of attention and fierce dispute.^y

²³ Also personal communication & Yanto Evans contributing to p.81 with similar experience: **Link: Plate 9: Places of the Soul: cobb house (Cerro Gordo Community).**

general public, would not sit well here.²⁴ They can entrain the system, yet this can work both ways:

We know how to distinguish between genuine community and pseudocommunity ... above all we have learned that, given the right conditions, it is possible for small groups of people to live together routinely with love and in the spirit of peace ... If small groups, why not larger ones? If single congregations, why not entire churches? If the civic leaders of a small city, why not all the citizens of entire towns, cities, and even states? If one nation, why not all of the nations of the world? (Peck 1987: 169).

Peck's view is that genuine community has the following characteristics:

- Inclusivity, commitment & consensus (consensus is an emergent from open group process, with no voting; inclusivity is not absolute, and the boundary must be negotiated)
- Realism
- Contemplative (very conscious living)
- A safe place to let down personal defences (high trust)
- A laboratory for personal disarmament
- A group that can fight gracefully
- A group of all leaders
- A spirit (never competitive, as 'team spirit' is understood) (Peck 1987: 59-76).

At larger scales, the optional preferential, or multi-representative electorate systems, come closer to a (fairer) fuzzy ideal. I have mentioned elsewhere the Fuzzy Logic decision making approach, which uses computers to sort out a set of fuzzy weighted preferences. It is only a matter of time until computer-assisted voting becomes commonplace.²⁵

However voting is becoming increasingly meaningless in societies where most countries have voluntary voting, the important decisions are made by MNCs or behind closed doors by experts, whose averred 'taking account of' the results of public consultation is open to question.²⁶

With the locus of control now explicitly at global scale, for the necessary global protection of biodiversity, peace and social justice, and the global need to rationalise materials, water and nutrient flows,⁵ according to HST we need the development of new, trusted, reliable and ethical institutions, and governance at that scale,²⁷ as well as better informed and less partisan arrangements at regional or local government scale, where most of the key destructive decisions are presently made ('development' approval).

²⁴ Quaker proponent (and member), personal communication.

²⁵ I was asked by MFP Australia in 1992 to investigate medium term future impacts of modern technologies. At that time, the software and the necessary security systems for electronic voting were already available.⁵ In the meantime, postal voting is now being accepted as appropriate for Local Government and the nominations for the Convention on the Republic, despite the many theoretical access points for vote rigging.

²⁶ Paul Heliyer, former Deputy Prime Minister of Canada told Australian audiences in 1999 that there were two governments, those we elect, who appear to govern, and those who actually drive the system (Public Lecture, Adelaide 1998).

²⁷ Not in the image of the United Nations, or at the least, a less skewed one. The anarchist geographer Élisée Reclus had an interesting approach to governance, including a rotating leadership, that may bear revisiting (Rounsefell 1991b).

10.5.3.4 CLUES TO THE CONVIVIAL SOCIETY: HELPFUL MODELS

10.5.3.4.1 *On Love As The Biological Basis Of Social Life*

Maturana & Varela, beloved of more esoteric EPPs, in *"The Tree of Knowledge"* propose the following. There is a recursiveness about knowing, and an apparent taboo against "knowing that we know" since the Western lifestyle is action-oriented and not generally reflective. Certainty is illusory, as "every act of knowing brings forth a world" so that "all doing is knowing and all knowing is doing", and it should never be forgotten that "everything is said by someone". Language is seen as the deepest foundation of human reflection, action and knowledge: our cognitive being as humans, and human uniqueness "lies exclusively in a social structural coupling that occurs through language ...". The "attitude of vigilance against the temptation of certainty" which is compelled by the "knowledge of knowledge", and the recognition of the constructed nature of our realities, imply an unavoidable Ethics of recognizing the legitimacy of truths other than our own. "We have only the world that we create with others whether we like them or not" and the only way out of conflict is to shift to another domain that allows coexistence. Love is defined by the act of seeing another person and "open[ing] up for him [sic] room for existence beside us": "the acceptance of the other person beside us in our daily living". Maturana *et al* see love thus defined as the biological foundation for humanness and all social process and thus of all Ethics (Maturana & Varela 1988: 24-7, 245-7).

There is no distinction between this and the Basic Position theory of Transactional Analysis, except that the TA version extends the acceptance inwards to self and outwards beyond other to society (a larger, more integrated model: a multi-scalar positive or negative 'regard' intended for practical application). The apparently simplistic and (to Australian ears) objectionably American shorthand expression 'I'm OK, You're OK' actually represents the Basic Position of psychological health, towards which therapists are urged to work with their clients and to model in their own lives.²⁸ It refers to an attitude of self- and other- esteem whereby self and other are both accorded the right to be considered important, to have needs, wants and feelings, and to deal with these assertively, and to expect these to be met within reason in a context of mutuality,

²⁸ While being annoying to the tidy and esoteric professional mind, these terms do have more formal multi-syllabic 'scientific' names. The beauty of this apparently simple but profoundly workable system for human relations training (for all levels of client from kindergarten to psychotic to large organisation to inter-nation), is that it is easily teachable, even to the subnormal, feels 'real', and is extremely effective clinically and in Human Relations.⁶⁵

respect and cooperation. What this means is that any individual, in order to know how to behave in the world, needs to have a Position about each of these realms.²⁹

Each person has wants, needs, and feelings that are inherent to his or her existence. The early experiences of the individual, including whether or not these needs are reliably met, play a deciding role in the establishment of that person's Life Position (also called Basic Position or Existential Position). The Life Position filters and influences how the individual thinks, feels, acts, and relates with others. There are four Basic or generic Life Positions:

1. I'm OK – You're OK (unconditional): health, cooperative
 2. I'm OK – You're not-OK (conditional competitive): I'm OK as long as you're not): socioipathic
 3. I'm not-OK – You're OK (OKness IFF .. very conditional): depressive, competitive
 4. I'm not-OK – You're not-OK (unconditional): despair
- (Harris 1973" 43, 37-53). **Link: Figure 34: Ernst's OK Corral** (below).

The 'quantum' attitude here would thus be 'both/ and' in psychological health, with 'either/ or' representing a competitive and non-cooperative positions (competing for scarce resources), whereby psychopathology is enabled.³⁰

10.5.3.4.2 Linkages from Intrapersonal to Community Scales (Human)

The work of psychotherapists (Transactional Analysts) usually involves the 'I' level in the first instance, then the 'I-thou' for close relationships. The wider relationships often fall under the jurisdiction of family therapists, radical psychiatrists, process oriented psychologists, transpersonal psychologists, psychiatrists, social workers, sociologists, criminologists, anthropologists and environmentalists. These can be summarised as 'I-you-they' (Berne 1972: 85-89), or 'I-you-they-them-it' (Rounsefell 1993a), which extends the theory to wider society and the environment as the penultimate relationship system.³¹

This implies a level of negotiation when needs conflict, and a period is recognised in the personal developmental history at around the age of two years, which has the outcome of a Social Contract that accepts the existence of others who also have wants, needs and feelings to be accommodated, just as for self.

²⁹ In 1992 I asked a senior lecturer from the Anthropology Department at the University of Adelaide, what were the most basic cultural needs of a society. He answered that it didn't matter what the details of the belief system were, but that there had to be one, a frame of reference, otherwise there would be no standard against which to assess social behaviours, and people could not know how to 'be' in their cultural context, nor whom to condemn.

³⁰ The first instance of this situation is often early in the formative years, where young infants or children are thrown into a position of having to take care of the parents' needs first, and can develop no trust that their own needs will be met by the caretakers. They usually conclude 'I'm not OK', and 'you'd better be OK because you're all I have', but in the worst situations, the conclusion can become 'I'm not OK but I'll pretend I am, and you're NOT, and I'll treat you accordingly. 'You' then becomes extended to wider society as the person ages and the negativity mirrors itself in external encounters, affirming the basic expectation – a recursive process.

³¹ Next levels up would presumably be cosmos and God or *The Void*, depending on point of view.

It is easy to identify adults unresolved in this contract, as under stress they will be prone either to bullying, highly competitive or tantrum behaviour at one end of the spectrum, or over-compliant, unassertive, 'doormat' behaviour and depression at the other. Historically the origins and specific details, inclusions and exceptions of this attitude may usually easily be explained from the individual's early or later experience of life, but especially under two-five years or even earlier (see also Berne 1972;Steiner 1974).³²

Failure to resolve early issues results in the recycling of behavioural patterns later, constantly seeking satisfactory closure, especially on entering new contexts, such as the development of adult independence in the early teen years, in the formation of relationships, on marriage and in new work situations. All these patterns make sense in terms of the overall Life Script.⁵³³

A two-dimensional grid of possibility exists at each level, which is expressed at the I-you scale by **Figure 34: BICM: Ernst's 'OK Corral'** and the we-they scale by **Figure 34 BICM: 'Social Corral'**.

Addressing the relationship of self to Nature, a TA grid bears close resemblance to the Douglas Group-Grid/ Cultural Bias Analysis, where 'it' refers to Nature, and 'OK' refers to nature's relative rights (**Links: HT: HST: Surprise; Dominance Hierarchy**). The TA Parent Ego State is divided functionally into a 'Nurturing Parent' , a personality subsystem (based on introjects) that models nurturing, supportive behaviour towards self or others (the drive itself will arguably have instinctive origins); and 'Controlling' or 'Critical Parent': a complementary parent-type system that attempts to judge or control (internally and externally). **Link: Confluence: Cosmology: Transpersonal Ecology.**

As seen under HST: Surprise, Douglas' goes up a scale to a person's relationship to social structures, a collective model that has a similar pattern: 'Group' measures the support relationship with the social group, while 'Grid' is the extent of constraint and control. The four resulting bias sets were illustrated above. They have been further elaborated into 3-dimensional and transcendent versions, and related to Catastrophe Theory (Topology) by other workers (Ostrander 1982: 28-9). **Links: HST: Surprise: Tables 39; Figures 22, 35: Mythology of Surprise, Douglas Cultural Bias Analysis; Criterion Organism.**

It is a system not so much for diagnostic purposes as to suggest five different directions that a symbolic system may shift as attitudinal, social, economic and environmental Constraints change.

³² Ken Mellor, then Cathexis Institute, 1977.

³³ Pam Levin, developmental psychologist & Transactional Analysis trainer, personal communication, Workshop 1978.⁵

It also explains different potential positions, fears and likely responses from different groups under duress (Douglas 1985;1992;Douglas & Wildavsky 1982). For instance, in a free market situation, with low control and low support, one would expect an increase in and approval of, people operating from an ego-oriented, individualistic and Nature-discounting position. **Figure 35: BICM: Systematisation of Social Constraints: Douglas' Group-Grid (Cultural Bias) Analysis** links the TA Basic Positions and attitude to Nature aspects into the diagram presented earlier. **Links: Criterion Organism: Human Psycho-Social Needs; BP 5.2: Transactional Analysis.**

10.5.3.4.3 Maruyama's Mindscapes

Maruyama, originator of 'The Second Cybernetics' (recognition of the deviation-amplifying function and creative essence of positive feedback in dynamic systems, 1963), recognises a number of different 'Mindscapes': ways of thinking or logical approaches. They have bearing on interpretation of reality, selection of Metaphors, ascription of Cause and interpersonal and intercultural fit. They are used in situations requiring good communication, innovation, productivity or delegation, such as within organisations or in international business. Mindscapes tend to be present in all cultures, but four types are most common, and cultural differences are often profoundly related to general espousal of particular logical styles (Maruyama 1994: 1-3, 75-87). There is considerable overlap with Cultural Bias and TA concepts.

The four common Mindscapes are summarised in **Table 69: BICM: Maruyama's Mindscapes.**

While Maruyama denies that his system could have anything to do with Chaos Theory, by the definitions used in this dissertation, his descriptions relating to G-type Mindscape are the epitome of deterministic chaotic systems. In effect, the H-type represents the hierarchical-competitive 'either-or' style (Douglas' bureaucrat) and the I-type the alienating and alienated specialist individualist (Douglas' Entrepreneur), both common in the West and so often ecologically destructive. The S-type, a circular, group-oriented, harmony seeking, social, equilibrating, 'both/and' style, is common in Japanese and Danish organisations and rural communities (much in common with Douglas' Sectarians). The G-type is mathematically similar to the S- in having a dynamic, group-oriented approach, but where S- is equilibrium-seeking (emphasising negative or stabilising feedback loops), the G- is generative, creative, and emphasises positive feedback (entrepreneurial style but group oriented, possibly Transcendent) (Maruyama 1994: 29-34, 81-2).

In conflict resolution, an H-type would focus on areas of agreement, discounting areas of disagreement, and have a simple linear view of Cause and causation. Both S- and G-types value

poly-objective vision, and would take pains to value all the different perspectives, having a *Causal Loop* view of causation that gives outcomes in situational interpretation, conflict resolution, intra-organisational relations and decision-making, quite different from the H and I types. They tend to balance each other in terms of *structure : freedom*. **Links: HST: Figure 25 (Causal Loops); BP 5.4 (Cause).**

This is the essential difference between the more orthodox forms of H-type problem-focused 'Positional Bargaining' (Nutting & White: often frankly abusive, threatening: soft and hard versions are described), and S-type approaches such as those of Fisher & Ury (solution-focused, 'Principled Bargaining' seeking win-win solutions: 'soft on people, hard on the problem'), and G-type such as Mindell's 'Deep Democracy' (collective mediation using conflict, diversity and direct dealing with power, rank, revenge and abuse), but always following the process, protecting personhood strongly and celebrating Surprise⁵ (Fisher & Ury 1981; Mindell 1995; Nutting & White 1992).³⁴

It would be possible to describe the present global struggle for ideological dominance in terms of such Mindscapes, with the 'ecological perspective', and indeed this dissertation itself, as attempting to put H- and I-type ideologies into appropriate perspective, and seek harmony, with more emphasis on the G- and S-types, the +/- Basic Position, the 'I-Thou' (Teilhard de Chardin) recommended by Maturana and Varela, Houston's 'Possible Human' and the CBA 'Transcendent'. EPPs are strongly idealistic, not because they are 'New-Age air-heads', but very often because they have experienced the warmth of true Community and awe in Nature, and yearn to share this with others.⁵

10.5.3.4.4 Partnership

As the United Nations observed at Istanbul (1996), global problems are so extensive they can only be resolved in partnership, including civil society.⁵ My experience in a team struggling to find a unified voice for thousands of NGOs and CBOs at that meeting, demonstrated how problematic it is to expect such local organisations to operate with global accord without funding or any centralised structure, while any such structure is regarded as yet another unwelcome bureaucracy, by NGOs and CBOs. These organisations, especially the small, local ones, are the eyes and ears of the Community, emerging to alert governments to gaps in the structures and processes supposed to meet needs in artificial environments where this is now an

³⁴ Principles of negotiation & references sourced from course "*Windows on Management and Leadership*", MARC (Management And Research Centre), Salisbury Campus, University of South Australia, 1997; *World Work Workshops*, Arnold & Amy Mindell 1996,⁵ Dr. Max Schuepbach & Dr. Jutte Vikkelsoe, 1998.⁵

indirect process. They are a crucial part of the feedback loop for a learning society, and their presence is an indicator in itself.

Local Government does have an international scale structure, plus local roots, and is well placed to access the wealth of local knowledge available in CBOs. It clearly has a strategic role in local interpretation of global concerns, with active partnerships and collective learning. **D&C 6.5: Istanbul Declaration of Cities & Local Authorities** spells out what the World Assembly of Cities and Local Authorities committed to at the Istanbul meeting. It went on to ask for support in that from the private sector, the international associations of cities and local authorities, the States and the international community (World Assembly of Cities and Local Authorities 1996: 6-10).³⁵

EcoVillage developers would do well to find out who are the local CBOs and NGOs, as well as local government elements (such as staff involved with 'LA21', Local Action Plans, Environment Department, 'Urban Forest Biodiversity Program', 'Cities for Climate Protection or 'Healthy Cities'), and involve them from the start. **Link: Criterion Organism: Healthy Communities, Healthy Cities.**

10.5.4 INSTITUTIONAL STRUCTURES

Complexity Theory indicates that a complex dynamic system self-organises: a balance emerges between external regulation and self-assertiveness, which in human communities is partly informal, through socio-economic activities, and partly formal, through laws, regulations and legal contracts. Conceptual and Dominance arrangements are ideally co-aligned. But EPPs perceive that to adapt to present changes, different institutional and governance models will be needed.

It is precisely man's *[sic]* lack of a fixed genetic inheritance that makes stable institutions essential as a substitute ...

On the other hand:

... the danger of clinging to outdated institutions in the face of a changing environment, suggests that institutions must evolve in response, and be allowed to become responsive to contemporary reality (Bramwell 1989: 8).

Higher scale types of relationship implied by the Community Criterion, especially in the human case, involve institutions, a focus that has emerged in recent years at the international scale of environmental concern and research. Institutions are at once structure, orientation and activity organisers, instruments of dominance and survival vehicles:

Institutions are collections of rules, decision making procedures, and programs that give rise to social practices, assign roles to participants in these practices, and guide interactions among the occupants of the relevant role (Young 1998: 1).

'Institutions' is a crosscutting theme used as a basis for the influential IDGC (Institutional Dimensions of Global Change) Conference topics and research programme for the next 10-15 years.

The core of the IDGC project is an analysis of the roles that social institutions play in global environmental change as determinants of human/environment interactions (Young 1998: 1).

Young labels institutions as drivers of diverse problems including land use, industrial transformations, pollution, resource scarcity and the Accelerated Greenhouse Effect. Thus in setting major research foci for international scale attention, the IDGC Project is looking at the causative roles played by institutions, groups of institutions and institution-generated Surprises, the functional characteristics of effective and ineffective institutions, issues related to the design of new institutions for environment protection purposes, and the prospects for funding and integration of environmental régimes into existing institutional arrangements, especially the economic (Young 1998: 2).

IHDP experience with assessment of institutional effectiveness in governing the human-environment interface indicates two major clusters of concern: 'the problem of interplay' (inter- and intra-scale linkages), and 'problem of fit' (compatibility of institutional activity with biophysical reality). Work on the 'problem of scale' (and generalisability due to different rules pertaining at different levels), indicates that most global scale systemic and cumulative problems (such as climate change), are ultimately under the jurisdiction of institutions operating at much lower scales (such as regional, national or local) (Young 1998: 2-3).³⁶

For sustainable outcomes an effective global scale institutional structure is clearly necessary, since the control systems are now at that scale. Efforts to construct very large scale governance in Europe provide an opportunity to reinvent institutional structure and overcome the usual resistance to change. But tenacious Power Politics, corruption and locally disastrous overarching regulations (such as those demanding that cucumbers be of standardised length and straightness) have been initial difficulties. However the Discomfort Principle³⁷ is driving keener interest in pollution and Greenhouse issues in Europe than on this continent.

³⁵ It may be timely soon in Australia to re-present the status of local government to the people at Referendum.

³⁶ It is encouraging that international Political Science has finally acknowledged the scale issue espoused by environmentalists for so long under the 'think global!, act local!' slogan.

³⁷ "People don't change unless they're uncomfortable, so in my therapy I escalate the discomfort, and they change amazingly fast" Ken Mellor, TA Cathexis School, 1976.

The optimal form and function of such institutions could well be discovered by the TNS 'Compass' 'backcasting' technique: a preferred, eco-socially sustaining future is defined in principle (using the Four System Conditions for Sustainability), ignoring what we perceive to be the present reality; the present situation is defined within the same framework, acknowledging the steps already taken; small, realistic but persistent steps are defined for getting there, starting from where we presently are; an indicator system is defined to quantify success; the Four System Conditions are used as a Compass to guide all decisions (**Link: Criteria Ecocycles, Indicators**).³⁸

10.5.5 SERVANT LEADERSHIP

Servant leadership is a model emerging in response to a re-evaluation of the role of power and authority in situations where there is a need for management on behalf of a collective (**Link: Early Findings: Fire souls & Bottom-Up Partnerships**). The principle is that "the only authority deserving allegiance is that which is freely and knowingly granted by the led to the leader in response to, and in proportion to, the clearly evident servant status of the leader" (Greenleaf 1993: 56). This model has been practised by Alcoholics Anonymous (a huge international organisation) since 1950 (A.A Grapevine Inc. 1987: 3), and more recently by intentional communities such as Fuzzies Farm (Adelaide Hills)⁵ or Findhorn,⁵ and networks representing EPP-type concerns such as *'Reworking Tomorrow'*, and *'Resilient Communities'*, both global-scale networks associated with the work of the late Robert Theobald.⁵ Greenleaf's 'best test' of such leadership asks the question: "do those served grow as persons; do they while being served, become healthier, wiser, freer, more likely themselves to become servants?" (A.A Grapevine Inc. 1987: 57).

As electoral process around the world has started to produce strategic voting and parliaments with minority leadership, as electronic feedback and 'government by poll' are enhanced by information technology, and as shareholders start to experience their collective power, governments, industry and business may be expected to take on more of these qualities and become more consultative.

10.5.6 EDUCATION, LITERACY AND CAPACITY-BUILDING

Education is of course, the major formal means of transmitting a society's Cosmology, and orientation to the rest of the Cascade. Systems thinking and ecological knowledge, bottom-up decision making, citizenship and proactive consumerism, are prerequisites for the emergence of

³⁸ The Natural Step, advanced training.

a just, needs-based approach to governance (at any scale). All levels of governance are inherently constraint systems, and all need to serve, to be balanced by a reasoning and fully participatory Community, the absence of which is presently allowing so much damage and discomfort. Thus the role of public education and capacity building in these matters is urgent: in MDCs, not just the LDCs.

A new, bureaucratic drive for Benchmarking and packaging Education,³⁹ and the recognition of the existence of different types of 'intelligence',⁴⁰ or 'literacies' have emerged (Vialle & Perry 1995: 12), perhaps a spin-off from the new interest in standardisation on one hand and Individualism (differentiation) on the other.

Old-fashioned academic literacy has become a political issue recently, with sustained and damaging cuts in tertiary education funding, reduced access for the poorly-off, the channelling of secondary school funding into the private system, and a punitive attitude to people without employment. Meanwhile, there is a general trend towards 'dumbing down' of standards in media both printed ('tabloidisation') and visual ('infotainment'), and we are presented a very limited, monocular view of current affairs (media concentration), mercifully counteracted by listservs and other Internet sources. In 1998 I was asked to write at high school level for a chapter in a first year university textbook, for what the editor described as the 'attention deficit generation'.⁵

Claude Steiner (a Transactional Analysis elder) was one of the earliest to use the term 'literacy' outside of the three Rs: he averred in the late 1970s that the teaching of emotional literacy in schools was overdue (Preventive Psychology). The question 'where is your ecological literacy?' shocked a social planner colleague into a PhD on that subject in 1991. Tony Blair's policy adviser, Dr Geoff Malgen, in his St James Ethical Lecture, Sydney November 1998, announced the return of values in most European countries, in reaction to the harsh amorality of Thatcherite Economic Rationalist politics. He advised a new attention to a range of different literacies: academic, social, emotional, ecological and ethical/moral.

³⁹ The standardisation of training in the name of portability is creating a nation-wide system which could easily be described as 'bureaucracy gone mad', but at the same time would be an opportunity to inject ecological consciousness into every accredited non-university course in the country by the simple addition of a sustainability category to the core requirements, in exactly the same way as Occupational Health and Safety has now been built in.⁵ See Australian National Training Authority, 07 3246 2300. Website www.anta.gov.au/.

⁴⁰ These are: linguistic, logical-mathematical, spatial, musical, bodily-kinaesthetic, intrapersonal, interpersonal. Compare with NLP's 'Sensory Modalities': visual, auditory, kinaesthetic, olfactory, gustatory, or POP's 'Channels': Proprioception (body feeling), visualisation, hearing, kinæsthesia (movement), relationships, world phenomena (*Collective unconscious*) (Mindell 1990: 23).

The preoccupation with literacy and mastery at Community scale was taken up by Theobald in his last years through an ambitious project known as 'Resilient Communities'.⁴¹

The education of women has been identified as a key factor in limiting population and moving LDCs towards sustainability (World Commission on Environment and Development 1990: 184). With pressure to privatise university education and research funding, channelling of research funding away from basic research and placement of the information so gained under 'commercial-in-confidence' constraints, (now known as 'intellectual property', where once university research outcomes were mostly public domain), access to and the character of postgraduate education is changing radically.

Education is seen as a *sine qua non* for ecologically sustaining social change, by EPPs traditionally, and particularly in association with demonstration projects and hands-on workshops: 'learnshops'. The involvement of community in the development, building and management of 'ecology parks', 'ecostations' or 'nature parks', has very successfully implemented the 'learning-by-doing' Adult Education principle in a number of countries (Arabella Park Ökostation, Freiburg im Breisgau, Germany;⁵ Arid Lands Centre for Urban Ecology, Whyalla, South Australia;⁵ EcoEducation Centre, Port Phillip Melbourne, Camley Street Ecology Park, London;⁴² and Toronto Ecology Park⁴³), in addition to offering ongoing centres for community, child and tourism (including ecotourism) education. **Link: Confluence: Models for Postindustrial Community: Plate 17: Collage: ESD (1) Der Seepark.**

There are several loops to close with Education. One is education of Human Settlement Development professionals. Another is the large, political loop that requires an aware, well-informed public to support ecologically friendly strategies:

255 Make Sure Everyone Understands the Issues

The changes required by these Patterns seem profound but in reality are only attitudinal alterations. Only when the general population is fully aware of the imperatives of sustainability will the necessary attitudinal adjustments be possible (Entry 101: JVNIC).

Another relates to continuous learning and learning by doing. Its goal is Natural Wisdom.

⁴¹ Some very exciting developments have been seeded by this in the City of Marion, SA, which are too early to report, but involve large scale community building on this model.⁵ Dr Alan Stewart, (professional communicator) personal communication.

⁴² (Johnston 1990).

⁴³ (Gordon 1990).

10.5.7 THE FORMAL REGULATORY SPHERE: POINTERS FOR PLANNING AND DEVELOPMENT

All significant design work takes place in a Statutory and Strategic Planning context. Part of the background work includes discovery of all the relevant Acts, Codes, regulations and Planning documents affecting the site, including Strategic Plans from all scales. Political issues and stakeholders can constrain progress powerfully. Public consultations for big projects, mediation, court battles and so forth are familiar events. In South Australia the Acts are confusing and contradictory, three are new⁴⁴ and negotiating them takes up most of the available resources.⁴⁵ But Incrementalism usually goes unchallenged. The argument for and against Planning could be more realistically assessed if plans were more usually actually carried through and accountability, Benchmarks and Indicators were built into the design.

Planners in my small Local Government survey in 1999-2000, said they were too busy doing Development Application approvals to worry about Strategic Plans, especially with the surge of land purchase ahead of the new Goods & Services Tax (July 2000). Residents told me that some 'terrible things' had been approved, including subdivision and clearing of unspoiled bushland for housing blocks next to a Conservation Park (active buffer zone habitat extending the Park). The planners said they could do nothing, the situation was not covered by the Native Vegetation Act, and Biodiversity Policy wasn't in the Development Plan.⁵

We live with a plethora of Strategic Plans and Visions. Small and medium businesses (SMBs/ SMEs) are encouraged by Business Schools and Governments to produce Business Plans. Privately, business folk often say that they rarely or never refer to them.⁵ Most available energy is expended producing, not implementing them.

For many councils, managing a plethora of local projects has not been balanced by systematic region-scale tracking: there is no feedback loop and learning proceeds by trial and error (literally). High staff turnover, poor internal communication and lack of proper databases also magnify error potential. Formal Plans confer stability, but risk rigidity. Lax controls confer some resilience, but also increase short-term, Surprise-free thinking.

Having the will to back up sustainable behaviours in Law is problematic in a structure that supports Market Libertarianism and the litigious possibilities of adversarial expectations. Many large, polluting organisations would actually welcome more Government intervention on behalf of sustainability, because unilateral action puts them at cost-competitive risk from unconstrained

⁴⁴ Water Resources, Local Government and Native Vegetation.

⁴⁵ Catchment Board and Local Government Officers, personal communications 1999-2000.⁵

competitors who feel no environmental responsibility.⁵ The EPA is well known as an under-funded, 'toothless tiger', at least in South Australia,⁴⁶ and triggers for Commonwealth attention do not cover the full range of possible impacts, and only those of National interest.⁴⁷⁵ The SA Native Vegetation Act has until recently been useless in urban areas and rurally where housing is concerned, and its recent improvement, raced through State Parliament under 'emergency' conditions, has a really silly definition of 'significant tree' from an ecological standpoint ($\geq 1.5\text{m}$ circumference, not related to species). But secret ringbarking is circumventing this anyway.

The SA State Government's reluctance to control private entrepreneurial behaviour and its penchant for over-riding local Planning arrangements create great damage. But Local Government, where most environmental impact occurs, could improve the situation markedly if it were to ensure that legally binding Development Plans were in line with Council Visions and Policy, and if a long-term Landscape Restoration Plan also linked to Catchment Water Management Board Plans and a legally binding Development Plan (**Link: Criterion: Landscape: Restoration Development; Figures 40, 39**).

Otherwise, planners are reluctant to act on their powers due to fear of precipitating expensive court cases in a litigious and economically spare environment, or just plain confused.⁵⁴⁸

Developers and residents regularly destroy habitat, and this is further impacted by uncoordinated activities of functionally fragmented departments.⁵ Education programmes usually seem to reach the converted but little further.

It is unfortunate that eco-destructive orthodox development is given such ready licence, while experimental, sustainable strategies tend to meet with considerable resistance. For instance the establishment of Fuzzies Farm (Adelaide Hills) was delayed by locals' and planners' fearing an influx of hippies, so building permission was denied on a technicality. Self-representation won the case, but involved months of delay including six weeks of intensive effort reading the Planning Act. This deflected energy and money from other pursuits.⁵

⁴⁶ Evidence from the SA State EPA and Conservation Council of SA recently won a judgment restricting tuna fishing licences. The State Government immediately passed a Bill to over-ride this and legitimise the ecologically damaging and illegally established tuna farms.

⁴⁷ For instance Greenhouse impact does not 'trigger' such Commonwealth attention, and an attempt (2000) by the Environment Minister to have it so, by having major CO₂ emitting projects be subject to Commonwealth veto, is being robustly resisted by Economic Fundamentalists in Cabinet who have semi-direct conflicts of interest (ie their families may benefit from fossil fuel shares, even if they relinquish them), and also rely on statistics biased towards the fossil fuel industry, and who thus fail to see the potential for jobs from new types of industry that such a veto could catalyse (Hamilton, Hundloe & Quiggin 1997; The Australia Institute 1997).

⁴⁸ The new South Australian Catchment Water Management Board Plans will have force in law. There is potential for increased Connectedness between these and Development Plans. In a recent 'Comment on Draft Plan' I suggested appointing a specific officer whose job it was to facilitate this linkage, perhaps an 'Eco-counsellor' as trained in France, Germany and Austria (investigated in Strasbourg & Freiberg im Breisgau⁵). The advent of Catchment Water Management Boards has provided an opportunity to view water management at regional scale, but the tendency is to limit responsibility to that, and to draw a line at the Board's own boundaries (for instance where a river meets the sea). Only two Australian States currently have such Boards (SA, NSW).

Sun Village (Queanbeyan NSW) was having similar problems with what they perceived as unfair treatment compared with and responding to, local developers and residents. They suffered delays and refusals of planning permission for two different properties, one urban, one rural. They had also run through 12 different architects in an attempt to find one who understood and supported their wholistic goals.⁵ This whole situation is reversed by 2000, with flow-ons from the attainment of 'credibility' with Environment Australia and success in their supporting business. This has opened local Planning doors as well.

The Crystal Waters unsustainable subdivision problem is mentioned elsewhere. A similar fate dashed the hopes of the Solar Village near Humpty Doo, Northern Territory during the 1980s.^{49,5} Bamberton ran foul of environmental protection legislation, after extensive community consultation and great expense in the planning.

Ahmanson Ranch is still fighting determined environmentalists, but being an established large developer, has few planning problems. **Link: Confluence: Content: Top-Down EcoCommunity.**

Aldinga Arts EcoVillage had some 15 years of being unable to secure land, always being outbid by developers until assisted by the South Australian Government. The Committee has just been forced to move to 'Plan B' (similar to New Haven) for their on-site sewage treatment works, as there was no other Australian example with which they could thaw local Council resistance. Council engineers want them to connect to the grid, but the resource is crucial for their Permaculture farm. Now their meetings on other infrastructure are requiring determined resistance to unacceptable levels of impervious drainage infrastructure.

The City of Adelaide Planning Department remarked to Ecopolis Ltd in better times, that their Halifax Project proposal was so far in advance of the City standards for sustainability that there were no further statutory requirements and much staff time had been saved. How nice if the new Council had understood the economic potential of implementing such demonstrations!

The Danish Government's and many Municipalities' support for Urban Ecology experiments has been discussed elsewhere. **Link: Confluence: Methodology: A New Approach to Development.**

⁴⁹ A beautiful communal building was designed by University of Queensland prior to the availability of Community Title; planning permission was refused; banks refused to lend on communally owned property; the community was forced to fragment the property into large blocks, sealing a structurally determined fate.⁵¹⁹⁹²

10.5.8 LIVING IN COMMUNITY WITH NATURE

This requires an attitudinal shift for non-EPPs, although RCD technologists are working to exploit these relationships, even before they are wholistically understood. For instance Biotechnology is developing Bioremediation of toxics such as acids, heavy metals, PCBs. Urbanites live in Community with the soil at an alarming level of ignorance. We hear the soil contains bacteria, so rush for the disinfectant. We are not aware of the ubiquitous presence of fungi, nor myriad other decomposer microorganisms, that actively move through soil to fallen leaves, dead animals and other organics. We burn weeds and leaves, losing their nutrients from ever-depleting garden soils to our eutrophied rivers, then spend a fortune on fertilisers and biocides to try to restore ecological balance - if only we understood that as our goal. We remove native trees, then pay for ineffective electrolysis treatments for salt damp 80 years later. The soil we so abuse is playing an unannounced part in essential Ecological Services: a distributed factory fixing and breaking down molecular pollutants, absorbing CO₂, recycling nutrients, and modifying ambient temperatures through albedo and the vegetation it supports.

We have believed the germ-phobic marketing message pushed by manufacturers of antibacterials and antibiotics, striving to kill every germ in house and body - to the point where our children are thought to be losing immunological resilience. And then, what is the fate of these substances in the wider environment (a worthy research project). Alternative health practitioners and their patients use 'probiotics', seeking resilience and harmony, and aware that most of our bowel content is a living flora of bacteria, fungi and yeasts, that our skin crawls with microbes. Appreciation of this and its relevance to health, and attending research, is only recently emerging in orthodox 'scientific' medicine.

At larger scales, we live in Community with our pets, our domesticated plants, our gardens, our Landscapes. Aldinga Arts EcoVillage Community has strong biotic by-laws as a Permaculture community. Local seed has already been propagated for restoration of an extensive matrix of local indigenous scrub designed into the plan. Starting with the land, Bioregional Planning and bioconsciousness are essential ingredients for living in Community with Nature. **Links: Criteria Biotics, Landscape; Figure 43 (IPM); Plates 12 (Site Plans), 16 (Permaculture).**

1.6 CRITERION: LANDSCAPE

1.6.1 CRITERIAL ESSENCE

The essence of Landscape is pattern (an emergent entity or 'Traffic'), which in turn implies many complex processes (a 'Backcloth'). In nature, Landscape is an emergent of the climatic and topological processes moulding geomorphology, and constrained by their outcomes, reciprocally affected by water, and labelled by soil-climate-vegetation associations and fluxes.

Different forces of modification pertain at different scales and have characteristic frequencies (Allen & Hoekstra 1992: 59-62). Spacetime diagrams as illustrated above are useful for general comprehension of these concepts. **Link: HST: Figure 29 (Holling's Lumpy Landscape)**. The themes for Criterion Landscape arise from Landscape Ecology and the Geographical Sciences.

1.6.2 PATTERN IN NATURE

It is said that the Buddha once gave a sermon without saying a word; he merely held up a flower to his listeners. This was the famous "flower sermon", a sermon in the language of patterns, the silent language of flowers. What does the pattern of a flower speak about? (Doczi 1985:1)⁵⁰

Allen & Hoekstra (after the work of Stevens, 1974), describe in some detail the patterns found repeatedly in Nature, and present an analysis of function (Allen & Hoekstra 1992: 66-73). They comment on the relatively small number of options for pattern regularity, because of the mix of scales from which moulding processes originate (**Table 70: CMES: Patterns in Nature**). They conclude:

Given that there are so many different types of entities in an ecological system, it is remarkable that we find self-similarity to any degree, and very unexpected that we find a unifying set of ideas that offers so many explanations from disparate scales. The same general class of causes underlie [*sic*] branching systems of mighty rivers and the trails left by ants on a tree trunk. The explosion of Mount St. Helens is matched by the tracks of livestock to water buttes in the desert grasslands of New Mexico (Allen & Hoekstra 1992: 72).

One could add the road patterns converging on human settlements.

Thus if one needs to design in a particular function such as resource conservation or access, a working knowledge of Nature's solutions to such problems would be helpful and efficient.

Links: Imitating Nature by Design: Permaculture; Criterion Connectivity.

1.6.3 PATTERNS OF NATURE IN HUMAN SETTLEMENTS

The pattern of green space in the built environment is approached from above by Geographical Information Systems initiated by satellite or aerial imagery (for instance see Goodwins & Noyce

⁵⁰ I am informed by a reviewer that this sermon was about impermanence, not pattern, but Allen & Hoekstra would say "well a structure is just a pattern that hangs around long enough to be measured", so I think we may keep the quote.

1993), or at meso-micro scale by ground-survey, ground truthing or grid mapping of what is, unfortunately often, fragmented remnant or relict vegetation. 'Green space' is used as a general term for vegetated urban areas of mainly recreational or amenity function (for instance see Zonneveld c1990). The term 'natural' used of landscapes, ecosystems and vegetation, is noted by Taylor (in the context of searching for terms appropriate to a Biocentric view of Nature, which includes humans as elements), is a cultural construct that is often inappropriately used in opposition to the word 'human'. She explains (after Mueller-Dombois & Ellenberg), the emergence of whatever plant species is dominant, as the outcome of the interface between 'natural' and 'human dominated' landscape elements (Taylor 1990: 415), (interference patterns Allen & Hoekstra 1992: 61). **Link: Criterion Biotics.**

An 'undisturbed' landscape in Nature usually has fuzzy, irregular features and a particular fractal mathematics which connects multiple scales in a self-similar manner. The similarity is functional or statistical rather than strictly structural, in that a similar level of complexity is repeated over a limited range of scales. **Link: Table 70: Networks.**

10.6.4 FRACTAL IMPACT ASSESSMENT: PATTERNS OF HUMAN ACTIVITY IN 'NATURAL' LANDSCAPES

Most human -impacted landscapes have small-scale patterns that accord with relatively high frequency activities (Allen & Hoekstra 1992: 62).

Human dominated Landscapes are immediately recognisable by the simplification from straight lines imposed by roads, monoculture crops, land subdivision (fencing), buildings and other artificial boundaries. The transition from 'natural' to human impacted landscape is discernable from a sudden change in fractal index (read off a log-log plot), which measures the relative complexities: humans simplify complex landscapes (Allen & Hoekstra 1992: 59, 58-61). Figure 18: Fractals image (a) demonstrates how this appears in the FI graph over a particular range.

Landscape Ecology indicates that sustainability will depend on the nature of cities in future: landscapes, as foreseen by Ebenezer Howard (1899), should be working landscapes, a settlement's matrix, not trivial decoration, actively processing, supporting human and local life through comprehensive ecocycling and relying on Nature rather than inappropriate technology (Franklin 1997a: 263-6; Hough 1995: 108; Lyle 1994: 286-9).

The specific patterns out of which a building or a town is made may be alive or dead. To the extent that they are alive, they let our inner forces loose, and set us free; but when they are dead they keep us locked in inner conflict (Alexander 1979: 101).

Milne has taken this concept further in recognising fractal-type (scale-related in detail but functionally continuous) regularities in the Landscape geometry of patch density, edge length

and shape, and forage biomass, which are inevitably impacted by Landscape modification. He gives a research-supported list of ecological phenomena which have been found to be affected by such geometries (modified by other factors such as climate, latitude, fire régime, pollination schedules, range size and other Organism characteristics): spread of fire, redistribution of nutrients, hydrological cycle, flow of pollutants, predation and nest parasitism (Milne 1991: 81). Thus design sensitive to Landscape geometry should be important to 'sustainable' developers. It is certainly strongly advocated by Permaculturalists [see (3)] and other EPPs: 'Always start with the land'.⁵

Due to the regularity of space and time scale effects in animal and plant behaviours, Milne has been able to develop a model that assists Landscape Design by interpreting Landscapes in ecologically meaningful ways, and making Fractal Impact Assessments. In Agriculture or Conservation, fractal dimensionality can alert designers to the scales available for occupation by appropriately scaled animals and plants, to the necessity for expensive context replacement (food energy or water) for inappropriately scaled animals, and to the possibility of using fractal patterns in Landscape Design (Milne 1991: 82-3). The definition of the scale of human occupation of Landscape has become increasingly problematic. **Link: Criteria Indicators: Urban Footprint, Biotics: Different Scales of Landscape Occupation.**

10.6.5 LANDSCAPE ECOLOGY

Landscape Ecology, being a recent hybrid between Ecology and Geography,⁵¹ with centuries-old roots, has much to say about scale and the interface between landscape patterns and human impacts, but does not usually involve itself in design:

Landscape ecology ... focuses on (a) structure, the spatial patterns of landscape elements and ecological objects (such as animals, biomass and mineral nutrients); (b) function, the flows of objects between landscape elements, and (c) change, alterations in the mosaic through time (Forman & Godron 1986: 31).

Landscape Ecology relies on much of the theory mentioned in earlier sections. It scans for patterns (shape, size, grain) of patchiness, their connectivity and quality of the matrix in which the patches are located – Landscape issues (Forman & Godron 1986: 486). The natural generation, sustainability or optimal design characteristics of patterns depend for explanation on other Criteria, such as Biotics, Elements, Community, Population and Connectedness. That is, Landscape is an emergent entity. **Table 71: CMES: General Principles of Landscape Ecology**

⁵¹ Forman & Godron note quite different histories, disciplinary contributions and emphases on different continents. For instance North America: recent inception, Ecology + several related disciplines, major focus on basic concepts; Soviet Union: inception under Biology + Geography, strong in Economics & Social Planning, emphasis on land development, productivity improvement, environmental impact recognition; Europe & Middle East: rich mix including nature conservation, Planning, Landscape Architecture, Wildlife Biology, Land Evaluation, Geography, Environmental Science, Forestry, landscape history, concept development (Forman & Godron 1986: 30).

brings out the most important issues for Landscape when development threatens, listing and explaining Forman & Godron's "General Principles".

The major emerging Landscape issue in Australia is salinity, resulting from gross interference with Ecosystem function, particularly by native vegetation clearance. Salinity is affecting not just agricultural lands, but also roads and urban buildings ('salt damp'), the latter a serious problem in Adelaide.⁵² Building a city does not remove the need of a Landscape or Ecosystem to function: they will 'not be mocked'. The CSIRO in Western Australia is researching the potential of deeper-rooted native perennial plants that may be used as alternative food crops, paying particular attention to replacing ecosystem services that have been removed through unsustainable land management practices. See **Figure 36: ES: Deep-Rooted Prairie Plants**, a graphic teaching aid that would do well in an Australian version. Permaculture already has amassed extensive experience in perennial food plant selection and 'permanent' (sustainable long-term) landscape management (for instance see Nugent & Boniface 1997). **Link: Criterion Connectivity: Integrative Strategies.**

Permaculture is common sense, but the thing that separates it from other methods of providing human needs is design. The design is based on observations we have made of patterns of natural ecosystems and how they function. In our planned ecosystems of useful plants and animals, different plants and animals in the system contribute to the integrity of the whole and all benefit from it. Monoculture with its associated destruction of the soil, its heavy demands for energy and use of chemicals becomes redundant. There are a few fundamental principles which must be taken into account. Every element in a system should serve many functions. Every function should be supported by many elements. Every action we make should achieve many results (Nugent & Boniface 1997: 11).

The recently released "Salinity Strategy" for the Murray-Darling Basin, recommends establishment of mosaics of food crops and native vegetation, with further research into special timbers and an emphasis on fruits and nuts rather than grains as food crops.⁵² An experimental orchard outside Quorn (Flinders Ranges SA) has successfully used saline water (1/6 sea water concentration) to grow olives, carob, almonds, pistachio nuts, figs, quandongs, feijoas, table and wine grapes:

The choices that we have, basically, are to take some tough decisions about the way we want the landscape to look. As a country I think we need to really come to grips with a sort of vision for the Australian landscape, and by the way this is both an urban and a rural problem, it's not just a rural problem. There's many instances now of urban infrastructure - roads, bridges, culverts and so on coming at risk to salt as well. So, it's everybody's problem. But what we need to do is figure out the way we want the landscape to look. We're clearly going to have to live with salt, which means that we're going to have to essentially allow parts of the landscape to go to salt and we're not going to do much about it. Many parts of the landscape we can tackle, but we need to find out what are the most effective sort of vegetation, forestry, farming systems and even engineering solutions to those areas - that we can slow down and stop the problem (Graham Harris, Head of *Land and Water Division*, CSIRO, Australia).⁵³

⁵² *Earthbeat*, ABC Radio National, 8/9/2000.

⁵³ Graham Harris radio interview with Michael Vincent, "PM" ABC Radio National, Monday, May 15, 2000.

10.6.6 LANDSCAPE ARCHITECTURE

Every action is significant – every place is important (Franklin 1997b: 275).

10.6.6.1 ACADEMIC TRAINING

Landscape Architecture has the opportunity to lead the development industry in a sustainable direction particularly through educational bids of trained consultants for large-scale developments. Local government and others who design tenders are also culpable or potential leaders. Once 'grass and nursery advanced lollipop trees on a drip system' have been specified, Nature takes a back seat.

Landscape Architecture has become a well-defined subdiscipline in recent times. It is appropriately Anthropocentric, yet ideally, embeds the human-influenced Landscape in ecosystemic and social reality. In practice it (or its substitutes, especially commercial Landscaping) very often fall far short of this ideal, imposing an unimaginative utilitarian Landscape where control appears to be the prevailing ethic, a particularly poor arrangement in an Australian setting, especially if chemical control and piped water are essential elements, where endemic native habitat is replaced with exotics, lawns⁵⁴ and potential weeds, and where the delusion is maintained that we live in England or Italy.

Landscape Architecture has, with few exceptions, been about garden-building historically:

In this tradition, decorative and tractable plants are arranged in a simple geometry as a comprehensible metaphysical symbol of a submissive and orderly world, created by man. Here the ornamental qualities of plants are paramount - no ecological concepts of community or association becloud the objective. Plants are analogous to domestic pets ... tolerant to man [*sic*] and dependent upon him ... man's companions, sharing his domestication. This is the walled garden, separated from nature ... the final symbol of this garden is the flower ... [*it*] symbolises domesticated nature, the wild is beyond; it is only the man who believes himself apart from nature who needs such a garden. For the pantheist nature itself best serves this role (McHarg 1992: 71-2).

As currently practised, Landscape Architecture is spatially organised, geo-graphic rather than temporal in organisation. The textbook by White is commonly used by both Architecture and Landscape Architecture is a core reference for Site Design, a subject which is often poorly covered by standard courses (White 1983).⁵⁵ **Link: Figure 32: Contextual Analysis (White).**

However, as currently taught by a leading Australian centre, Landscape Architecture does involve a multi-scalar discovery of the unique values of a site, aiming to link user, programme and context through a design and Planning process which results in a "pleasing place for human

⁵⁴ The horticultural 'instant mature trees + grass' formula beloved of landscapers and project tender writers and despised by biodiversity managers.

⁵⁵ Established by phoning three universities and enquiring what texts and courses their Architecture students would access during standard training.⁵

activity".⁵⁶ This particular course seeks to work with the user's needs through physical, social, economic and spiritual values, and to implement this through an integrated landscape design, aiming to preserve environmental processes rather than particular entities, and proclaiming that "NATURE is the very stuff of our environment ... it is INTEGRAL and INVALUABLE ... It is not merely what we design ON ... it is the essence of what we design WITH!" (Mongard c.1996).

This course offers three techniques of environmental assessment, all involving map overlays designed to come to terms with multiple criteria: McHarg's 'Landscape Approach' (values listed in **Table 72: BIES: McHarg Landscape Values x UHSE Criteria**), Fabos' 'Parametric Approach', and Koslowski's 'Threshold Approach'. McHarg uses composite map overlays with values ranked I-V,⁵⁷ Fabos' is a computerised refinement of smaller scale Landscape Approach, using GIS to quantify relative values, enabling tradeoffs, and Koslowski's 'UET' (Ultimate Environmental Threshold) works with developmental thresholds - territorial, quantitative, qualitative and temporal, looking at the first and ultimate environmental thresholds with each nominated criterion in turn.⁵⁸ - the first (minimum) and ultimate (maximum, the overall limiting factor), with any nominated criteria.

For all this Idealism, the new graduate will rapidly discover that the client 'must be pleased', and respect for Nature as our integral and invaluable context will often sink without trace in the face of community and professional ignorance, junior status of new graduate designers, Planning impotence and entrepreneurial momentum.^{59, 5} Thus policy makers, regulators, developers, community educators and the approvers of development applications, can be recognised as target points for education, and gate-keepers of sustainability. That is to say, sustainable Landscape awaits institutional assistance, Regional Planning and collective effort, and that will not happen in the absence of a reflective and well-informed public.

⁵⁶ At Queensland University of Technology (reference: notes for Landscape Architecture students); an informal telephone enquiry to University of Adelaide in early 1997 did not reveal a particular commitment to this type of Philosophy, although the exact Philosophy was not specified.

⁵⁷ For example McHarg's case study: criteria for interstate highway route selection. Values are considered as three 'zones' in each case (zones are defined to differentiate areas of different type, not necessarily ordinal, (eg slope >10%; <10%, >2.5%; <2.5%). They are specified as collected attributes for graded photographic overlays (now possible with GIS). Values were: Slope -Surface drainage - Soil drainage - Bedrock foundation - Soil foundation - Susceptibility to erosion -- Land values -Tidal inundation -Historic values -Scenic values -Recreational values -Water values.- Forest values - Wildlife values - Residential values -Institutional values (McHarg 1992: 33, 35, 37-9).

⁵⁸ The technique was first developed as an economic approach to development, which identified which areas of land would be cost-effective to develop using a small grid/cell overlay to organise a multi-Criterion overlay mapping system. It was used to good effect for environmental Planning in the Tatri National Park in Poland and subsequently on a Barrier Reef island in Australia (*inter alia*), and was found to be able to adapt to any nominated Criterion, the thresholds being derived by a modified Delphi approach if no scientific data were available (Kozlowski pers. comm. 1992 Kozlowski 1986;Kozlowski & Hill 1993).

⁵⁹ I was told by a local government Biodiversity Manager in Adelaide (08/99) that Horticulture was one of the biggest threats to biodiversity in urban settings, in that "everything has to be a project, and projects demand instant, mature trees, usually exotic and irrigated. Even if local indigenous, there won't be an understorey, so only selected large birds are favoured and herbaceous layers are lost", for all the apparent greening.

10.6.6.2 LANDSCAPE DESIGN BECOMING ECOLOGICAL DESIGN

Thompson & Steiner (Thompson & Steiner 1997: 2-5) challenge their profession to run with the public good and the ecological aesthetics promoted by McHarg. Their book *"Ecological Design and Planning"*, records a 1993 multi-disciplinary international symposium in Tempe, regarded as 'watershed event'. It provides an excellent overview of theory and practice.

Woodward (also Franklin) in that work explains how to read the ecological signature of a landscape, sensitising the designer to the geomorphic, climatic, biotic and cultural processes that shape the patterns of place, understanding the responses of vegetation to these processes, to elevation, aspect, water concentration, soil and disturbance. She goes on to explain how to balance the regional needs of Nature with the more local human needs for protection, production, aesthetics and order (Woodward, JH 1997: 202-212:274-67).

Woodward's regional objectives require one to acknowledge and design for flows: reduced water in and out, decreased heating and cooling, movement and habitat needs, and nutrients kept on site. At the same time human (cultural, physical, psychological, social, budgetary) needs must be met without introducing problem biota. Planting patterns should match and celebrate the various micro-conditions of the site. From site scale she ranges up to larger space-time scale projections (say region, 100 years), and gives pointers for project evaluation. She demonstrates the inadequacy of traditional design in regional terms, and the partially adequate response of xeriscape design compared with signature- (pattern-) based design (Woodward, JH 1997: 215-222).

A major obstruction to Ecological Design is the architecturally derived mode of representation by drawings. This is paper-oriented, two-dimensional and orthogonal. In contrast nature is multi-dimensional, living, growing, moving with forms that tend to be amorphous and amoebic. They can grow, expand, interact, and alternate. Field design would be a marvellous improvement ... We should be committed in our work to designing living landscapes in urban, rural, and wild settings ... [to] study natural systems, their components, rules, succession, and, not least, their forms. This should be the basis for an emerging Ecological Design (McHarg 1997: 327).

The basic premise of sustainable landscape design is to allow the ongoing processes that sustain life to remain intact and to continue to function along with the development ... almost every site on which landscape architects work has been abused. Sustainable design must go beyond the modest goal of minimising site destruction to one of facilitating site recovery by reestablishing the processes necessary to sustain natural systems ... not "naturalistic landscaping" or "preserving endangered species" but the preservation, restoration, and creation of self-sustaining, living environments (Franklin 1997b: 264).

10.6.7 IMITATING NATURE BY DESIGN AND LANDSCAPE PLANNING

10.6.7.1 INTRODUCTION

In human settlements pattern is evident through the superimposed features of the built form in its adaptation to and of Nature, and the underlying processes are strongly related to Community

forces, including Cosmology/Cultural Scripting and economic situation (Goodwins & Noyce 1993: 14).

A number of conservation-minded writers in particular focus on pattern as a design tool for emulation of natural processes, including Alexander, Mollison, Yeomans, Van De Ryn, Spirn, Sainsbury and McHarg (Alexander 1979; Alexander *et al* 1977; French 1991: 3-11; Mars 1996: 18-31; Mars & Mars 1998: 2-3; McHarg 1992; Mollison 1988; Mollison & Slay 1991: 16-66; Mollison & Holmgren 1978; Morrow 1993; 1997; Sainsbury 1994; Spirn 1984; Woodward, P 1997: 13-18+; Yeomans 1993). **Link: Metaphors & Mindscapes: The Emerging Synthesis of Human, Ecological, Systems and Complexity Concepts in Science and Practice.**

In presenting her 'Multi-scale Planning' concept for the protection of biodiversity in Planning, Peck goes straight back to Landscape Ecology and applies it in a Planning context (Peck 1998: 21-5).

10.6.7.2 SPIRN

Spirn was trained by McHarg, and a number of other well-known teachers in Landscape Architecture and Environmental Planning, having first awakened through Art History and the works of Frederick Law Olmsted (late 19th - early 20th Century, social reformer and USA park/parkway designer), to the aesthetic, spiritual, intellectual and social values of urban Nature (Spirn 1984: vi). Spirn's "*Granite Garden*" speaks of "nurturing the urban biome", and understanding the "necessities of life" for urban Nature and humans alike, to seek integration of these with urban functions such as energy and materials flows, transport patterns and social spaces (Spirn 1984: 5, 184-214, 215-226, 242-62, 74-87).

She deplores the "dismal survival rate of urban street trees", noting the rarity of provision of a Backcloth for survival. Experimentally based planting lists exist, but are not fully used, (some places like Dallas manage all their trees as one large, urban forest),⁶⁰ and trees are not provided with their required access to drainage, aeration, nutrients, water, freedom from compaction and the accumulation of salts. She quotes an "old nurseryman's maxim": "Plant a one dollar tree in a ten dollar hole" and see to the key triad: selection, planting and maintenance – apparently obvious but rarely practised (Spirn 1984: 191).

'Ownership' should be added to this trio: Adelaide researchers have found that not only do poorer suburbs support fewer trees (Goodwins & Noyce 1993: 14), but that if any are planted, a

very high percentage are pulled up by the roots by disgruntled youth.⁶¹ The Los Angeles EcoVillage Project cancelled its greenfields EcoVillage, and instead, drew a line around an existing, mixed social, ethnic and income area in Los Angeles, population 500, with two blocks of run-down buildings of architectural significance. The Cooperative Resources and Services Project (CRSP) then set about building community, with grants and the human resources at hand. One of their impressive strategies was to round up all the children and give them a tree each, to name and nurture.⁵ Others included regular community 'pot luck' meetings with interesting visitors, and a tiny organic, community vegetable garden.⁵ Longer term aims include street reclamation from parking lots, energy and resource saving strategies and a community-owner eco-business incubator (Anonymous 1993: 17); field visit.

10.6.7.3 CONTEXT REPLACEMENT AND INDIGENOUS PLANTING POLICY

The need for context replacement is maximal in Australia with disconnected, urban, exotic street trees and lawns. Ecologically speaking, wherever possible, plantings should be local indigenous species in three storeys (tree, shrub, grass/herb), connected to other habitats (wildlife corridors), and avoiding horticulture (mature trees on permanent drip systems). Deciduous, exotic trees or vines may still be the best choice where the needs are for Winter Sun alternating with Summer shade. Secondary effects on biodiversity automatically follow non-indigenous species selection for human settlement plantings. For instance non-local trees planted in Canberra, having supported little of the potential range of indigenous wildlife, were dying after only 15 years, their maintenance requiring water, labour, machinery and fuel for mowing the grass surrounding them, and their replacement creating added expense (1994).⁵ Further, massive *Pyracantha* spp. plantings have resulted in massive skewing of local bird populations, favouring parrots over the smaller birds. The 'City of Parrots' is much admired, but is an ecological distortion.

As seen with the definition of Community, the whole dynamic system never comes to a comfortable resolution. It is not ideal to keep trying to control the system. Rather, one needs to manage a self-sustaining system, to appreciate and support its restless creativity, while at the same time setting up broad constraints that are designed to keep it within an appropriate Sustainability Space. To re-quote Gould on data management: "to allow, to forbid, but not to require".

⁶⁰ I found the same in Thousand Oaks, California, where a substantial, two-volume resource manual was available on this subject (Wolfe Mason Associates 1990a;1990b).

⁶¹ Ref from MultiFunction Polis and Advertiser article on Green Ratings for suburbs.

The city must be seen as a part of nature and designed accordingly. The city, the suburbs and the countryside must be viewed as a single, evolving system within nature, as must every park and building within that larger whole. The social value of nature must be recognized and its power harnessed, rather than resisted. Nature in the city must be cultivated, like a garden, rather than ignored or subdued (Spirn 1984: 5).

Link: Confluence: Conceptual Brief.

10.6.7.4 PERMACULTURE (MOLLISON)

Permaculture is notable for its wholistic, EcoCommunity oriented system, and a three-dimensional approach to designing gardens for maximum productivity and parsimony in space utilisation. It tries to come to terms with the needs of Nature impacting sites minimally, and works mainly at that scale within a bioregional context.

Mollison and his supporters use strategically the low edge-to-area strategies of spirals and circles, the high edge-to-area strategies of undulation and zig-zag, with zig-zag trellising and vertical gardens to increase three dimensional space (Morrow 1993: 61). The Permaculture⁶² system takes a number of approaches to Design, which are spelt out in the Designers' Manual (Mollison 1988: 35-69, 70-105).

Philosophical and strategic characteristics of the Permaculture Approach are summarised in **Figure 37: BIES: Permaculture 'Spider'**, which was produced by a participant in the JVNIC Seminar, **Figure 38: BIES: Aldinga Arts EcoVillage Project: Material Promoting Permaculture**, an information sheet distributed in Permaculture circles, and **Table 73: BIES: Mollison's Design Approaches**, which has more detail. **Link: Confluence: Content for the Framework: Permaculture.**

The approach especially focuses on self-sufficient Rural Design, the functional relationships between a dwelling and its supporting garden systems in designing layout, enunciating a number of Principles. Urban versions of Permaculture are in progress world wide.^{5, 63}

Permaculture starts with appraisal of Landscape patterns and processes and seeks to align with and build on natural biotic behaviours, encouraging proactivity and ongoing personal observation of Nature's behaviour.

Mollison spells out the differences in outcome between Permaculture design and the present orthodoxy in terms of the difference between a stable, locally inclusive and dynamic, evolving solution to a social problem, and an unstable, profit-driven, short-term, non-responsible and

⁶² Perennial Agriculture.

⁶³ For instance Block 6 Project Berlin: an integrated sewage treatment system with recreational areas and effluent forestry in the centre of and servicing a square of high density apartments in central Berlin.⁵

exclusive arrangement that promotes individual powerlessness and social alienation (Mollison 1988: 59).

Discussing Permaculture in landscape and society, Mollison elicits three "concurrent and parallel responses to the environment":

1. CARE FOR SURVIVING NATURAL ASSEMBLIES, to leave the wilderness to heal itself.
2. REHABILITATE DEGRADED OR ERODED LAND using complex pioneer species and long-term plant assemblies (trees, shrubs, ground covers).
3. CREATE OUR OWN COMPLEX LIVING ENVIRONMENT with as many species as we can save, or have need for, from wherever on earth they come (Mollison 1988: 7).

Mollison takes a globalist position on ecosystems ("while we see our local flora and fauna as 'native', we may also logically see all life as 'native to earth'"), acknowledging the need to preserve local, diverse arrangements, but also seeing human technology as accelerating an ancient evolutionary process, and thus being democratic towards the emergence of new life forms which suit the new environment, and the establishment of recombinant ecologies for food production and land stabilisation (Mollison 1988: 7)⁶⁴. Mollison carefully weaves plants, animals, water, humans and soil into a complex assembly, and Permaculture courses give participants strategies and knowledge to approach this task. Permaculture practitioners have claimed an early niche in the East Timor rebuilding process, which may well provide rich rewards as a demonstration. Permaculture would be a worthy Competency for local government training.

10.6.7.5 MANNING

Manning's work arose around the same period as Permaculture, although he does not mention any alliance⁶⁵. His approach fits well with the principles later enunciated by Mollison and McHarg, and with the Ecological and Complexity Paradigms in general.

Echoing Laurie's cry, Manning despaired of

... the public landscape, characterized by extreme austerity of means and of affect, but arising less from artistic motives than from the demands of civic security, administrative convenience, or mere expediency" (Manning 1979: 25).

He was in agreement with Ward (1973),⁶⁶ that such "green deserts" fed the "vicious circle of social abuse of the landscape", bland, faceless and alienating. Architecture and Landscape Design ran in ("alarming") parallel: in producing the "visual poverty and psychological

⁶⁴ This is in one area where Landscape Ecologists would have a quarrel with Mollison, however as long as Mollison kept this attitude for his (perennial) utility crops (which he does), allowance would probably be made for the need to minimise impact on the environment to produce food, with acknowledgment of the benefits of organic farming methods. Permaculture steers a path between preserving local associations and extensive sharing of exotic (usually unusual, LDC) agricultural plants.

⁶⁵ In my cited texts.

⁶⁶ "Vandalism", Architectural Press.

uneasiness" of modernist interpretations at one extreme, or in having the potential to provide a sense of inclusive, deep satisfaction, with an approach which sought real social involvement and design for nature together (Manning 1979: 25).

Describing an ecological approach to Urban Design, Manning emphasised the multidisciplinary nature of Landscape Design, which requires a preliminary phase of site assessment analogous to Planning (and thus termed 'Landscape Planning'), which respects the givens of topography, water and climatic régimes, habitat diversity and the relationships that tie living forms, and ultimately, humans, to their environments. While such considerations have been intuitively followed in such locations as China, Japan or pre-industrial England, Manning follows McHarg and Fairbrother in emphasising the importance of the then recently re-discovered approach, which took scientific account of local animal and plant communities and their requirements for health and well-being. In other words he was describing the need to produce a supportive Backcloth to enable the flourishing of a 'natural' landscape. Not only this, but there must be an understanding of the way communities change and develop over time, and especially in the urban setting, where humans must be considered as community components, and the whole system managed and maintained with an acceptance of change, which is a key aspect of a managed natural environment (Manning 1979: 7-9).

Manning identified basic parameters for working with such complex, Self-Organising Systems in an urban setting. The natural community should be emulated as far as practicable, including all the biotic categories known to participate in fulfilling its essential roles. Maximum species diversity should be sought, with wild native types being preferred to domesticated or exotic species. Finally, allowance should be made for the full growth cycle, and the expectation that differential growth would eventuate in a mosaic of developmental stages. He concluded by enunciating a set of General Design Principles, which are summarised in **Table 74: CM: Design With Nature: General Principles (after Manning)**.

In his Postscript (Manning 1979: 32), Manning argues not for striving to produce pristine natural conditions in urban environs, but to recognise that human productions are natural creations also, and that the expressive and symbolic value of natural forms and materials may serve us very well in dense technologically driven settings, but only if used with artistic judgment and the highest integrity. For instance, water and rocks are deeply symbolic, but rockeries are danger signals. He gives an apt quotation from Jackson⁶⁷:

⁶⁷ Jackson, J.B., 1970 Landscapes, University of Massachusetts Press: 86-7.

... the well designed city ... [where] ... we everywhere feel at home ... cannot give us all of nature, but it gives us archways and pools of daylight, and flights of steps and views; the splash of water in fountains, echoes and music; the breath of cool damp air, the harmony of colours and the unpolluted sun; indeed it gives us so much that our excursions into the countryside cease to be headlong flights from a sterile environment, and become a conscious search for the missing ingredients: solitude in the presence of other forms of life, space and mystery (Manning 1979:33-4).

10.6.7.6 Regenerative Design

The fragmentation of local government function has resulted in corresponding fragmentation of habitat to a disastrous extent. Arguments about urban form and restoration usually start with an historical review of urban patterns, as seen in **Figure 39: ESCM: Urban Form**. Regenerative Design, promoted by John Tillman Lyle,⁶⁸ overlaps with the work of designers mentioned above, as demonstrated by **Figure 40: ESCM: Regenerative Design Strategies after Lyle**, which explains his twelve Regenerative Design Strategies and reproduces his diagram on the evolution of urban land use patterns. He differentiates the future, regenerative 'Neotechnic City' from the industrial, arbitrary, sprawling, 'Paleotechnic City', now heading rapidly towards conurbation. He corrects the misperception of Ebenezer Howard's 1899 proposal of the garden city as an austere set of buildings surrounded by open space [*a modernist fetish*]. The essence of Howard's vision, which Lyle espouses as a model for the future, was a rich matrix of working landscape: greenbelts with pastures, food and energy production, forests and recreation areas, storing and processing water and wastes, modulating air temperature, filtering pollutants and unifying and integrating a clustered and nestling urban form (Lyle 1994: 286-8). **Link: Criterion Connectivity: TOD.**

10.6.8 ECOLOGICAL RESTORATION DEVELOPMENT

An ecocity is an ecologically healthy city. No such city exists. There are bits and pieces of the ecocity scattered about in present-day cities and sprinkled through history, but the concept - and hopefully the reality - is just beginning to germinate ... ecocities are a direction, not a destination. No city stands still ... But once we have started seeking the healthiest, most vital relationship of city to nature, we will discover there is no end to it in time or variety. The journey is infinitely long, but its goal will arrive over and over in infinite forms along the way, emerging from the interplay of our own creativity and nature's regenerative abundance. We will never *solve* all our problems, but once we launch on this journey, we will at least be *solving* them from then on (Register 1987: 7, 135, 136).

A number of workers and communities are concerned to heal the damage already done to natural landscapes through regenerative activities such as tree planting, roadside remnant conservation, riparian restoration, erosion control and so forth, but these are usually uncoordinated by any official Landscape Plan. It is more difficult to deal with urban ecological restoration and larger scale issues, but a number of examples are proceeding. For instance Perth has a wildlife corridor restoration programme, which identifies and buys for reversion to bushland, key pieces of land. Adelaide has recently announced a major hills face zone wildlife

corridor investment⁶⁹. The City of Burnside in Adelaide has done a very detailed vegetation audit and has identified potential corridor connections, but has not a plan for purchasing land, despite being a relatively wealthy and progressive council.⁷⁰ The NSW Lower Hunter and Central Coast Biodiversity Strategic Plan (Port Macquarie area) involved working with seven local councils and getting them to coordinate their Development Plans and Biodiversity Strategies: a Bioregional approach that should be emulated everywhere possible.

The urban form literature mostly had a resource-management, pollution or climate change focus (for instance see Commonwealth of Australia 1995c; Energy Victoria *et al* 1996; Loder and Bayly Consulting Group and others 1993), and arguments against urban consolidation, such as those of Troy, do not come to robust terms with the destruction of habitat which has been a major impact of current car-dependent patterns (for instance see Troy 1990: 17-22; Troy 1996: 77).

Register⁷¹ in Berkeley, California, has devised a long-term Planning scheme for the remodelling of an existing city over a 50-150 year time frame, to become an EcoCity. He applies these principles theoretically to the City of Berkeley (Register 1987), and for decades has been initiating and implementing community projects which support this goal (Register 1992a).⁵ The Town & Country Planning Association in the United Kingdom has recently set up a '100-year Committee' to think through larger spacetime scales.⁷²

Register's repatterning is based on: **Figure 41: ESCM: EcoCity Rezoning Map** (after Register), which emphasises access by (walkable) proximity, and works (through policy with legislative backup) by enhancing density and diversity in existing town and neighbourhood centres, while preserving, restoring or avoiding identified natural value or hazard areas (Register c1987). Register's Map series in Figure 41B shows how this pattern moulding works over time. The approach starts by identifying localities where humans already concentrate (Attractor sites), zoning to augment this trend unless contraindicated. It identifies ecologically significant areas (creeks, waterfronts, marshes, ridglands), unsafe areas (fire, earthquake, landslide, flood zones), and links activity centres through human corridors such as transit, at the same time linking green

⁶⁸ Professor, Department of Landscape Architecture, California State Polytechnic, Pomona, USA.

⁶⁹ (Huppertz 1999).

⁷⁰ Biodiversity Management Department personal communication 1999 (and see Crompton & Kuchel 1997).

⁷¹ The term 'EcoCity' was coined by Register, whose group (1975, Berkeley, California), inaugurated the NGO *Urban Ecology (USA)*, was instrumental in setting up the first world conference on the ecological city, '*EcoCity I*' in Berkeley in 1990 (Canfield 1990). Register fell out with UE, establishing *EcoCity Builders*, an Urban Ecology consultancy and eco-project developer of long-term Planning & many community remodelling projects, including creek restoration (Figure 41B), reserve creation from roadway closure, creek marking ('Creek Critters' Project: to educate locals in location and valuing of local creek), traffic calming (reclaiming the streets for pedestrians to share), car park reclamation for community garden project, nature-sustaining landscaping, and recycling systems plus linkage with Cohousing programme run by McCamant & Durrett, architect who authored the famous Cohousing books (McCamant & Durrett 1988; McCamant *et al* 1994; McCamant *et al* 1993).

⁷² Michael Breheny, personal communication 09/99.

space through wildlife corridors and strategic land acquisition. This latter is addressed by a system of 'restoration development' that develops two properties in tandem (Figure 41B, bottom right). The more peripheral 'restoration site' loses buildings and reverts to nature, while the 'development site' in or near the centre or along inter-centre corridors, is rewarded for building at higher density and diversity (mixed use)(Register 1992c;1993).

Despite the statement "We very much need strong, positive images of what the future can be"⁷³ and the presence of the Rezoning Map on the Mayoral wall, interviews with several council professionals and Mayor Hancock herself, demonstrated enthusiastic support for these ideas yet very little action in policy or planning approval terms.⁵ Meanwhile, local contrived to prevent implementation of a plan to increase building density along a transit spine, demonstrating the necessity for public education and probably financial incentives, in pursuing ecological concepts. When substantial losses were sustained through a major fire, a unique opportunity to rethink local development strategies was lost, when residents in their trauma, were allowed to replace their burnt homes in the same hazardous style that had contributed to the blaze.⁷⁴

On a larger scale, long-range re-patterning of whole states or bioregions is proposed by Jim Bell⁷⁵ of San Diego,⁵ who in 1993 was doing large scale mapping of (Californian) geomorphology, hydrology, vegetation and edaphic character, with a view to more appropriate pattern matching for optimal function, particularly food production, possibly through processes similar to those suggested by Register. **Link: Elements: Earth.** This would include reclaiming high quality farm land from housing estates in the very long term. Some 'redlining' of urban boundaries and reclamation of farmland in the face of developmental pressure now has a number of precedents, but it requires funding for purchase, long-term notice and opportunity cost compensation.

10.6.9 URBAN LANDSCAPE: HUMAN SCALE DESIGN & URBAN FORM

At urban scale, many land use patterns are described, including: 2D flat city/3D compact (ecological) city (Register 1987:20-21); Concentric Zone/Sector/Multiple Nuclei/Urban (class zoned) (Kivell 1993: 21); preindustrial dispersed compact/ industrial sprawl, regenerative (Neotechnic: human/Nature blend with working landscape)(Lyle 1994: 286-7); pre-1860 walking/ 1860-1940 transit, 1940+ automobile/ multi-nodal (now emerging) (Commonwealth of Australia 1996a: 3-6); grid/ radial/ garden/ village/ machine/ crystal (glass skyscraper)/ trading/ mega/ closed circle (mediaeval fortress)/ temple/ crossed circle (camp, zulu), bursting out modern (Girardet

⁷³ Loni Hancock, Mayor of Berkeley, about her expectations of the First International EcoCity Conference in 1990.

⁷⁴ Register 1996, personal communication.

⁷⁵ Ecological designer and author (Bell et al 1991).

1996: 38-64); exchange space : movement space (ratio patterns) (Engwicht 1992: 42-3); sprawl city (car dependent)/ TOD (transit-oriented, multicentred, traffic calmed, urban villages)(Newman *et al* 1992: 1-18); underground city (Saari 1988a;1988b;Saari,Stauffer,Valkame & Virtanen 1988;Ylinen 1988). **Link: Models & Mindscapes: Metaphor & the City.**

Intentional EcoCommunity and Cohousing have a goal of implementing home bases for people, that are psychologically friendly to residents and supportive of eco-social Community. One of the responses to huge, modernist buildings⁷⁶ has been a counter-reaction demanding 'human scale design' (Alexander 1979;Alexander *et al* 1975) and 'Human Scale Development' (HSD) (Max Neef 1991). The Transit Oriented Development (TOD) model promoted by half the entries in the JVNIC, is centred around 'access by proximity', with a pedestrian-oriented, 5- or 10-minute city centre and open, grid pattern for accessibility (Katz 1994;Newman *et al* 1992;Register c1987;Yanitsky 1984). In this psychological aspect it shares ground with Genius Loci. **Links: Criterion Connectivity: Urban Connectivity: Transport & TOD; Criterion Population: Population at Human Settlement Scale.**

In Davis California 1993, supermarkets have been banned to preserve the economic viability and social liveliness of the downtown area strip shops. On my way there I heard two separate radio announcements calling for community assistance to resist the location of supermarkets in towns nearby.⁵ The introduction of a large supermarket complex to the contracting rural City of Whyalla has been disastrous for the city centre, where many strip shops are now in trouble and the Council may deal a death blow if it moves, as mooted, to the 'EcoCity Core Site', immediately adjacent to the supermarket.

The more living patterns there are in a thing - a room, a building, or a town - the more it comes to life as an entirety, the more it glows, the more it has this self-maintaining fire, which is the quality without a name (Alexander 1979: 123).

Most Urban Ecology projects implemented have in fact been quite low density, excluding large Scandinavian projects like Egebjerggård (Ballerup, Denmark) and Tusenskönan (Västerås, Sweden). Semi-rural areas may be selected for their cheaper land, their lack of utilities (for instance composting toilets may be banned in urban areas yet allowed in rural), or the availability of land for growing food.⁵ Some JVNIC entries looked to ancient Greek or Italian 'Hill or Bridge Towns', which were built in one connected piece for protection in the original, but provided a way to minimise energy and materials use in the postindustrial context. The winning JVNIC entry opted for low density with a full range of mixed use options, (with a 'smart taxi' service to reduce car use), on the grounds that convivial places are lost when low density is

⁷⁶ Apart from drastic responses such as those in 1960s Melbourne of jumping off them to commit suicide.⁵

replaced with high, and self-sufficiency will be an important aspect of ecological futures, thus needing space (Rounsefell 1994a: 102).⁵ Most entries recommended mixtures of density. Now that the legislation is available, EcoCommunities often opt for the pattern of Community Title with small-footprint housing nestled in a matrix of common land with a high proportion of greenspace (for instance see Plate 12: Site Plans: Aldinga Arts EcoVillage.⁵ **Link: Criterion Organism: Population at Human Settlement Scale.** If EcoCommunity values are to be implemented, then they must be in a context of matrix preservation and restoration, as Aldinga is to be. As mentioned elsewhere, the rule of thumb as advised by ecologists is maximum clearing for ecofunction 30%; optimal 50% for non-endangered areas.

Small footprints can always be extended up or underground if the site is sensitive: if it must be developed. The Bamberton Project was to be developed in forest in a sensitive but damaged area of Vancouver Island. The housing sites were tiny, and the developers had cleared an extremely small experimental house site, carefully keeping the timber for use - probably as firewood (!) - but the roads were narrow and few, with a steep central thoroughfare along severely damaged terrain, from hilltop to waterfront, to accommodate activities and pedestrians, and probably have a mechanical escalator.⁵

Eco-sensitive site and road planning is a neglected area in development design, although the Catchment Boards are bookmarking water issues, especially during construction. In early 2001, I was emailed by a New Zealand Landscape Architecture firm as follows:

Looking for built examples of true eco friendly residential development road layouts etc. and any names/contact numbers. We are involved here in one that proposes using a timber boardwalk road with all the services slung underneath with only the piles touching the ground, which has been rejected by Council because they don't want to be "the first" to do it. Would appreciate any help if you know any that exist elsewhere.

This innovative solution by the in-house ecologist was superior for that sensitive area to all others considered, outside of refusing to design. Over two hours' phone research to 'green' architects, urban and regional planners, Planning SA and Transport SA failed to find a single residential site in South Australia where ecological sensitivity had been considered and consistently applied throughout the development. Some of these people did suggest some of the unsustainable 'sustainable' projects with which I am familiar. They also seemed unable to hear my question: the combination of sensitive road and site design. They reiterated information about energy design for housing. One private consulting planner said none of his clients wanted that sort of thing. One planner at Planning SA agreed it was sad that Council Development Plans did not reflect policy. Strange you should say that, he said, 'Someone else said that too, recently. Why don't you ring the Conservation Council?' CCSA said 'Why don't you ring Urban Ecology?' Urban Ecology referred me on again ... I was able to send New Zealand a set of checklists and project profiles from the USA (Rocky Mountain Institute 1998:423-53, 465-75).

10.7 CRITERION: ELEMENTS

10.7.1 CRITERIAL ESSENCE

Every formal project of any size starts with a statement listing the physical attributes of the site: location, size, water bodies, aspect, soil, solar and wind exposure, climate and so on. Thus in the human settlement development context there had to be a Criterion that responded to these. This is a 'snapshot' type of Criterion, providing a physical description at a point of spacetime. Part of its value is to help the designer come to terms with what a place is probably like, and part lies in its value as a framework for designing locally relevant resource-sensitive strategies. In addition, many of these parameters are used as Indicators of Condition or State (**Link: Indicators, P-S-R model**). Many developments in Australia ignore the reality of our climate and physical conditions in design, and then compensate by using technologies like energy-voracious heating and cooling systems. A key point of difference between the orthodox and EPP designs is the latter's commitment to designing with, capitalising on and celebrating, local environmental conditions for eco-social benefit.

Many of the core strategies for Ecological Design represent interventions in this Criterial area on behalf of 'alignment with Nature', resource conservation and management⁷⁷ or preventive design. There are many opportunities for 'soft engineering' or 'eco-engineering' to achieve more sustainable outcomes.⁷⁸

Initial physical site assessment has major importance for EPPs. The initial elements investigated are 'vibes' or the 'feel' of the place (Genius Loci), terrain, water régime, soil characteristics, climate-related issues such as solar exposure, wind behaviour and availability of local building materials and other resources. Many of these relate to the Elements Criterion and contribute(d) to existing and past Ecocycles and Biotics.

10.7.2 EARTH

Earth is concerned with the structure and quality of the land, the soil, and processes past, present or intended, that may impact on it, such as contamination (an issue also of concern to Biotics and Ecocycles), or that may be extracted from the ground (minerals), and thus, Chemistry. It requires a physical and/or chemical description of Geomorphology, Hydrology, Seismology, and any other relevant earthy metrics. It is related to Genius Loci in its identity as 'the land', and to Landscape in its need to be mapped to locate its various features and their patterns.

As my Aboriginal guide on the second of five site visits to the huge Jerrabomberra Valley National Ideas Competition site in Canberra (2520ha)⁷⁹ said in 1994, "go to the high ground, then to the low ground; let the land speak to you".⁵ This is partly a Genius Loci approach, but Feng Shui speaks of Earth energies, measurable and reproducible for trained sensitive people. At the start of the OCW Project we had a lesson in dowsing, and all practised walking over the land, sensing out whatever 'site energies' may be there. This was fun and probably not particularly objective, but there was a surprising degree of agreement about what was detected. It was certainly a good way to start to get to know a very large site (160ha).⁵ Other Elements which contribute to Genius Loci include the presence of vegetation, rocks and water, the visual outcomes of design and the nature of air quality.

Seismic characteristics are also important but often discounted. I was the only entrant of 32 to check with the Australian Geological Survey, as to the seismological picture for Jerrabomberra Valley.⁵

Soil characteristics are usually investigated for building technology reasons (for example soil analysis for footings, septic systems, sand filters for composting toilets). Additional eco-design reasons may include siting of buildings away from the most fertile soils, seeking earth technology building materials, assessing suitability for wet composting toilet effluents, Planning for soil building and restoration, Planning for water retention on site, solar access considerations for alternative energy generation, and assessing soil suitability for food production.

There is a serious Social Trap impending as development overtakes more and more prime farm land, particularly areas close to cities where fresh vegetables are grown.^{80,81} This was brought out in 1991 when a new drive to forbid subdivision in the Adelaide Hills saw the rapid formation of a million dollar fighting fund by farmers who claimed to have bought their farms with the expectation that their subdivision would provide for their retirement. **Link: Criterion Landscape: Ecological Restoration Development (Jim Bell).**

No-dig gardening and composting have been organic and Permaculture gardening strategies for decades (for instance see Bennett 1995: 120-35; Deans 1977: 8-23). These are replicated at larger scales for Sustainable Agriculture. One of the MFP's successes was the artificial construction of

⁷⁷ See notes on MFP Australia **Link: Early Findings.**

⁷⁸ For instance see Mitsch, WJ & Jorgensen, SE, Eds, 1989. John Wiley & Sons, New York.

⁷⁹ (Foulsham & Rounsefell 1994: 63).

⁸⁰ A patient from my practice in the 1980s was a vegetable grower from what is now the Golden Grove Estate. He was deliberately forced out of business by the Local Government through huge rates rises, due to 'land improvement potential' or lost opportunity cost, which then made the land available for development.

soil using a compost mixture derived from the Torrens Island dump. Low-tillage methods are starting to be used by farmers as a soil conservation and pesticide minimising strategy. Most recently, soil has been identified as a carbon sink: massive amounts of soil-sequestered carbon are oxidised and released as CO₂ by ploughing, with major implications for Greenhouse gas strategy. **Link: Criterion Community: Living in Community with Nature.**

10.7.3 WATER

This subset first collects data such as rainfall patterns, but goes on to look at water flows and physical means of dealing with them. Water and air are of major importance because they constitute Nature's main transport systems (to these add animal and human agency).

Water occurs in bodies terrestrial and marine, aquifers, stormwater resources, piped water supplies, grey or black waste water. This subset looks at water as a physical entity. EPPs will normally look harder at water quantity and quality and stormwater management potential because they want to access the resource, collect and use rainwater if possible, build swales, absorptive surfaces, artificial aquifers and other arrangements to keep stormwater on site and recharge aquifers, to mitigate flooding elsewhere, and service indigenous plantings and food production. In rural areas many will consider mini hydro power generation, pelton wheels, keyline dams, pitting, water spreading, swale building and wetland construction (Mollison 1988: 152-81).

The 'Keyline' approach to site Planning was mentioned by several of the 50% of Jerrabomberra Valley National Ideas Competition who advocated Permaculture principles. This system, congruent with but not actually part of Permaculture, consists in a combination of Urban Forestry (see Yeomans 1993)⁸² with a 'Keyline grid'. It applies a knowledge of climate and Topology to Site Planning, using natural water flows and gravity in a way similar to determination by natural process. It was developed over three decades from 1945 following a visit to King Island (Bass Strait) by P.A. Yeomans, who discovered there a rainforest supported by a modest but daily rainfall (Yeomans 1986: 9). The objective is to use biological ecosystem processes in the restoration for reuse of 'waste' water: a homespun and independently developed approach with similar objectives and methods to a scientifically documented academic version from Penn. State USA, known as the 'Living Filter System' (Sopper 1986: 8;Yeomans 1986).

⁸¹ On 10/11/2000 the Premier of South Australia announced that new regulations would now require land to be rated on present use, not on potential use. This should make an important difference.

⁸² A modern version of Yeoman's original, classical work "*The City Forest*".

The control of water for its most beneficial use thus becomes the supreme basis of land Planning. The first objective of Planning had to be the enhancement and enrichment of the land. All land Planning interrupts the natural tree-like branching and joining pattern of the little valleys, the small creeks, the stream courses, and the rivers. Planning also interrupts the patterns of water from rain flowing over the land to these streams. It has to. But it is not the interruption as such that is wrong but the manner of it. Planning the land can lead either towards the enhancement and enrichment of the environment or to its degradation ... one pattern may rape the landscape, another will woo the landscape for its greater enrichment (Yeomans 1986: 9).

Yeomans explains that the grid pattern necessitated by human systems of land ownership is usually imposed on a landscape with scant regard to the natural geometry of the place. The Keyline grid by contrast is "imposed on the planner by the land itself and by the water associated with it". This combines the natural flow lines with new lines designed to control, collect, store and distribute runoff water for later use such as regular, brief flooding ('Keyline flood flow irrigation': high volume,⁸³ gravity-fed, gentle, economic, 5-20 minutes per day only, and 'well proven'). This has been shown to develop a rainforest-type soil ecology, regarded as second-to-none for renovating polluted water. The subsoil is regarded as a potential source of nutrient wealth, universally available if required, and accessed with specially designed tools such as the 'chisel plow' (Plenary Session 1986: 29). The method appears to suit many areas in Australia, including semi-arid and high-rainfall, and relatively flat terrain. It is designed for high level, transient penetration, never quite allowing the soil to dry out (Yeomans 1986: 8-9).

A hydrological approach to Landscape Planning has been combined with a matrix or 'framework' approach to 'environmental sustainability zones' in a Netherlands solution to the problem of severe ecological damage from inappropriate land uses and different land use needs. It seeks to maintain (or in the historically much-damaged Dutch environment, restore) a sustainable habitat matrix (which requires long-term stability), that encloses areas of much more dynamic and intensive transformation for human exploitation. Wetter and drier areas are differentiated. The framework is located through consideration of local physiographic and hydrological character, with particular attention to the chorological (vertical) connections of natural flows and functional hydrological relationships. Connections between landscape zones are often through the medium of water flows, and the seasonal and meteorological fluxes of groundwater connections often result in transition zones (Ecotones) of exceptional ecological richness (van Buuren 1991: 93).

There is much overlap between this 'water-related landscape structure' and the landscape matrix mentioned under Criterion Landscape and the habitat linkage (wildlife corridor) principles related to Biotics and Connectedness. It is arrived at through a Regional Hydrological Systems

⁸³ 0.5-2.5 million gallons/hr compared with the usual then, 100,000 gallons/hr (Yeomans 1986: 9).

Analysis (van Buuren 1991: 91, 93-106). This approach sets out to heal and prevent ecosystem damage. Planning is subjugated to topology and water behaviour.

Dr William Sopper's Living Filter system relies on spray irrigation as an energy-intensive but uniform application method that never floods nor saturates the soil. This is suited to the very permeable Pennsylvanian soils and undulating topography. It is not suited to sandy soil with a high water table in very high rainfall periods or places. High rate infiltration, a small area flooding system, relies on sandy soils. Sopper counsels to take his data cautiously, as local terrain, climate and soil combinations are so individual (Plenary Session 1986: 29-30).

Again, the Keyline arrangements read the land and the water flows, determine the Keyline connections, and all this determines first the roads and then the Planning subdivisions.

Mollison's water design principles, also starting with observation of natural flows and topography, are summarised in **Table 75: ES: Water Design Principles: Mollison's Designer's Checklist.**

Australia, and particularly the Murray River, has not yet reached the stage of water pollution found in the United States or in many other countries of the world ... Australia's vulnerable environment may need some special consideration. Many nations ... are all on the same boat, becalmed on a rising tide of municipal and industrial waste. The threat ... is urban pollution, over-clearing of forest land and excessive agricultural development and irrigation in vulnerable catchment areas and drainage systems. The Murray River, except for the salinity problem, is still a relatively unpolluted river ... (Sopper 1986: 7).

Dr Sopper's prescient remarks, unheeded until very recently by Federal, State and local governments along the length of the Murray-Darling system, were made to a group which was then and is still, engaged in research into large Scale effluent forestry. For instance the Werribee sewage treatment facility in Victoria⁵ and Flushing Meadows, NSW.

On a smaller Scale, the 'Block 6 Project' in Berlin takes over the quadrangle enclosed by four blocks of high density apartments, and treats all the sewage and waste water from these buildings through the soft engineering approach of constructed wetland, garden and lawn irrigation and small effluent forest.⁵

MultiFunction Polis Australia's New Haven Project models on-site stormwater capture and reuse on gardens and non-personal use, mainly achieved through the shaping of roads as collectors, and the harnessing of the adjacent recreation area for the underground water storage and treatment system (Sinkair treatment and recycling with gaslocked syphon decanter and subsurface drip irrigation). Many new approaches to water management become available once the 'end-of-pipe' mentality is transcended, but for EPPs, any such manipulation must be based on an initial physical reading of the land, and the Scale of (re)solution for water management is

made as small as feasible, household Scale if possible, or neighbourhood cluster for economy. The New Haven system uses ultraviolet disinfection. This would be regarded as a 'technofix' by an EPP purist, who would probably choose such options as composting toilets, constructed wetlands, or solar-aquatic systems. However this system has recently been forced on Aldinga Arts EcoVillage due to official intolerance of the proposed alternative (a ponding system).⁵ *Energy Architecture*⁸⁴ in Adelaide now regularly designs in reeded stormwater ponding systems, to complement its energy-efficient and often earth shelter style buildings, using composting toilets where permitted.⁸⁵

Most end-of-pipe solutions are dictated by a very large Scale, centralised approach. The Salisbury-Virginia Pipeline project initiated by MultifunctionPolis Australia, while pejoratively-speaking an end-of-pipe solution, has the virtue of connecting up an ecocycle loop, thus preventing the discharge of large quantities of eutrifying sewage effluent onto very damaged sea grass meadows, and providing suitable water to market gardeners suffering from depletion and salinisation of over-harvested aquifer water.⁵ Once a city has installed expensive infrastructure it is obviously difficult to change due to sunk costs and a strong path dependence. Thus a preventive approach with a commitment to the demonstration of new strategies, is seen as the height of Planning virtue by EPPs.⁵

With adequate response to Climate Change (Kyoto, The Hague) and sequelae now appearing unlikely, proactive concern in site selection and Design for such eventualities as extreme climatic events, '100 year floods', salt water inundation of aquifers and coastal land, destruction of protective barrier reefs, and development on islands (such as Ecotourism facilities), need to be borne in mind, probably beyond prescribed regulations.

10.7.4 FIRE

This subsection deals with heat and fire as such, in terms of natural fire régimes, various natural and anthropogenic hazards, explosiveness/chemicals/combustibles, and vulcanism, flammability of materials used, temperature as a physical issue, and fire regulations. It also deals with electromagnetic radiation (EMR)(electric waves/ microwaves (ELF, VLF),⁸⁶ radio waves, VHF, UHF, infrared, short wave, visible, including lasers (red, orange, yellow, green, blue, violet, ultraviolet [*near, middle, far*]), X-rays, gamma rays, cosmic rays; ionising radiations (again X-rays, β , γ ,

⁸⁴ A small eco-architectural business.

⁸⁵ Allowed in the Hills but not the city or suburbs in Adelaide. Downmus has had its systems approved for urban use in several states.⁵

⁸⁶ EFL = Extremely Low Frequency; VLF = Very Low Frequency; VHF = Very High Frequency; UHF = Ultra High Frequency.

particles [*alpha*, *electrons*, *protons*]) and fields (including magnetic). These interface with the health concerns of Organism, for instance radon in building materials, Faraday Cage effects from surrounding rooms with electrical wiring and VLF, ELF and X-ray emissions from computer monitors and TV sets (Maisch 1995: 22-31).

As an energy Criterion (fire), Elements fits in with Criterion Ecocycles, but is concerned more with the indicating momentary system status rather than the connected cycles or with measuring energy and materials flows, but the relations are close: a snapshot of structure, vs functional pathways. Thus anything to do with passive solar design for buildings, clever new building materials, solar-savvy site design (or subdivision), or solar power generation as a concept, could come to mind here, but is dealt with under Ecocycles because all the components of matter and energy transformations (natural and technological) fit best together, along with the aspects of design that seek to conserve, modify or provide alternatives. **Links: Criteria Ecocycles: Loop Work, Dematerialisation; Indicators: Energy Performance Standards.**

10.7.5 AIR

Air and its quality together with noise issues and the direction, strength, temperature and possible usefulness of wind, are the main concerns under this subset. Such items include: analysis (dust, vapours, ozone and positive ions from photocopiers, brown haze, ozone in cities, Nox, Sox, CO, Pb, ⁸⁷ & heavy metals especially from cars, particles from fire smoke and factory pollution, other pollutants/patterns), point and dispersed pollutant sources, odours, safety levels, health effects, mitigation, noise sources, aircraft flight schedules and patterns, noise regulations, barriers, ultrasonics, wind roses, diurnal, seasonal changes, cool breezes, cold winds, special & named winds, number of wind days, frost pockets, need for shelter, energy generation feasibility (presently >10kph) & potential mill siting, the effect of tall buildings (updraughts, wind tunnels, wind shadows, wind breaks).

This group is very commonly used for health-related environmental indicators, and air quality statistics are central to many industries and interests. Apart from inorganic chemicals and particles, water, pollens, bacteria, fungi and moulds may be relevant. Also indoor air pollution, air conditioning standards, ducting specifications, cooling tower protocols and maintenance.

The devices used to protect against air-related discomforts and hazards, from protective clothing to masonry or arboreal windbreaks, to sound walls on highways.

⁸⁷ Nox = Nitrogen oxides; Sox = Sulphur oxides; CO = carbon monoxide, Pb = lead: components of urban industrial pollution and photochemical smog.

10.7.6 CLIMATE

This includes both global scale climate and the weather patterns portrayed by meteorological data from medium scale (such as urban heat island) to the microclimate of tree shade and solar access. Depending on the issue, these are usually important to all designers, but especially to those seeking to harness and align with them rather than simply condition the microclimate artificially.

Concern with urban heat islands, urban albedo (colour and reflective qualities of roads, forests, exteriors, rooves), and microclimate (wind and sound walls, screens, solar access, storm protection), together with climate change (global warming, sea level rise, extreme events) and such larger scale consequences of short-term expediency have been troubling EPPs since the 1960s and 1970s, and are only recently being taken seriously in orthodox suburban Development, and then patchily.

This subset combines with Organism in its concern about the impacts on health of environmental change, a topic explored by McMichael in *"Planetary Overload"* (McMichael 1993) and dozens of others (for instance Commonwealth of Australia 1994a; Ewan *et al* 1991; Ewan *et al* 1993; Jones 1992; Lundberg 1998; National Health and Medical Research Council 1991; Norton 1995; Spellerberg & Hardes 1992; Switzer 1995; Wiesner 1992). This sub-Criterion gives the opportunity to ask in what ways a project is supporting Greenhouse gas overload and the release of ozone-impacting substances, which will lead on to other Criteria such as Ecocycles, Biotics and Landscape. And at the other end of the scale, to ask in what ways the project is contributing to micro-climate modulation for human comfort, and likewise indoor climate, and whether these aims could be served in eco-friendly ways. A matrix of climate change against all the other Criteria holds a warning for the longer term. **Table 76: CECM: UHSE Criteria x Climate Change** lists some of the concerns. **Link: Criterion Ecocycles: Molecular Pollution; Criterion Organism: Human Health.**

10.8 CRITERION: GENIUS LOCI

There is much confusion between land and country. Land is the place where corn, gullies and mortgages grow. Country is the personality of land, the collective harmony of its soil, life and weather. Country knows no mortgages, no alphabetical agencies, no tobacco road; it is calmly aloof to the petty exigencies of its alleged owners ... Poor land may be rich country, and vice versa. Only economists mistake physical opulence for riches. Country may be rich despite a conspicuous poverty of physical endowment, and its quality may not be apparent at first glance, nor at all times (Leopold 1966: 177).

10.8.1 ESSENCE

Genius Loci is about place. At building and neighbourhood scale it concerns the interpretive: stories, appurtenances, vibes and vistas that directly affect individual and community comfort, pleasure and sensory experience in general. Thus one may create a perfume garden for the blind (Hobart) or design uncomfortable street furniture to repel the homeless (Los Angeles). Or one may think of 'livable streets', 'defensible space' or 'housing as if people mattered' with an eye to crime prevention, friendly lifestyles or 'sensory management' (Lynch)(Appleyard *et al* 1981;Cooper-Marcus & Sarkissian 1986;Lynch 1991: 36;Newman 1973). 'Bioregion' is about eco-function, and its conception as 'home' is explored further below. Bioregion is a complex concept, also related to other Criteria, especially Biotics, Landscape, Community, Connectivity and Ecocycles. **Link: Criterion Biotics.** At higher scales Genius Loci may be about Patriotism, or Planetism. **Links Criterion Community, Connectivity.**

Genius Loci therefore has a potentially extensive related literature (not much accessed in environmental circles), on such topics as Sense of Place, lived space, place and space, human territory, crime and urban design, in Human, Social, Rural Social and Behavioural Geography, in Urban Design and Social Planning, Environmental Perception and Environmental Psychology, Gender Studies and Sociology. It can also access traditionally radical but increasingly important literature on Bioregion, including Catchment Management and Vegetation Associations (For instance see Aldous 1992;Alexander *et al* 1975;Andrew & Milroy 1988;Architecture-Research-Construction 1985;Australian Council for the IUCN Inc 1996;Brunckhorst 1995;Context Institute 1991b;Cooper-Marcus & Sarkissian 1986;Couclelis 1992;Davison *et al* 1993;Day 1990;Doxiadis 1966;Environment Agency 1998;Forsey 1993;Gaspar & Gould 1981;Gill 1990;Gregory & Urry 1985;Grigg 1967;Hägerstrand 1975;Hiss 1990;Katz 1994;Kunstler 1993;Lakoff & Johnson 1980;Levine 1989;Lynch 1991;Meyrowitz 1985;Mollison & Holmgren 1978;Moughtin 1991;Newman 1973;Nozick 1992;Parkes & Thrift 1978;1980;Pearce 1993;Plant & Plant 1992;Sadalla 1978;Sale 1991;Saunders 1985;Schneekloth & Shibley 1995;Schucking & Anderson 1991;Scott 1982;Snyder 1993;1995;Spellerberg & Hards 1992;Taylor & Stough 1978;Taylor

1986;van Buuren 1994;Walker 1995;Walker & Reuter 1996;Whyte, WH 1968;Whyte 1988;Yanitsky 1984).

10.8.2 GENIUS LOCI AND BIOREGIONALISM IN HUMAN DOMINATED SYSTEMS

The concept of Bioregionalism lies between Genius Loci, Community, Landscape and Biotics. It is little referred to by local government, orthodox planners or urban ESD proponents,⁸⁸ but consistently referred to by EcoCommunity proponents as the proper basis and scale for the human relationship to land, even though most of the latter would hesitate to push for the full implications iterated by Sale, such as extreme decentralisation.⁸⁹

While this impression needs confirmation, it appears that a renewed Sense of Place is emerging in response to the current trend to globalisation. A new sense of catchment-based Regionalism is supported by community education and consultation for the development of Strategic Catchment Management Plans, with funding of Catchment Boards from the Natural Heritage Trust.^{90, 91} However this new type of consciousness is already running into strong resistance from the vested interests that focus on a local level in a self-interested way.⁹²

A Bioregion is not simply a Biogeographical Region as used by governments in biological surveys and vegetation audits, or a Catchment as managed under the authority of the various Catchment Boards. Catchments are often the physiographic basis for Bioregion, a significant shift away from the political definition of boundaries, and more ecologically appropriate, however in Australia a smaller catchment may be more realistic (as with the enormous Murray-Darling system). **Link: Criterion Biotics: Biodiversity Conservation.**

The National Reserves System Cooperative Program of the Australian Nature Conservation Agency put together an interim report in 1995 for the purpose of identifying deficiencies and

⁸⁸ Total Catchment Management and other bioregionally-oriented actions are now being taken under those terms. The MultiFunction Polis Australia in its Gilman incarnation was doing exemplary work in TCM at the time of its dismantling. In the last decade it appeared that the word 'Bioregion' had joined the word 'green' as politically incorrect for conservative South Australia, but NHT funding of Catchment Boards has done much to change this, as long as Bioregion means 'catchment'.

⁸⁹ Comment by Dobson in introduction to Sale reprint (Dobson 1991: 77).

⁹⁰ This may be a short-term phenomenon if the Australian Government fails to persuade Parliament to sell the rest of Telstra.

⁹¹ See Gary Snyder **Link: Criterion Elements: Water: footnote.**

⁹² For instance the Premier of Queensland is implacably opposed to the concept that the jurisdiction of the Great Barrier Reef Marine Park Authority properly extend to the entire Eastern side of the Great Dividing Range from mountains to coast. It has been scientifically established that this World Heritage Area is under threat from a combination of fresh water impact from tree clearing causing increased river runoff, eutrophication and toxicity from farm fertiliser and pesticide use, plus bleaching episodes from global warming and storm surges (floods and cyclones) from which the hard coral has no chance to recover. The area is slowly changing from a marine 'desert' (low nutrient with hard coral ecosystem) to an algae-dominated ecosystem (high nutrient, soft coral and algae). The Commonwealth Minister for the Environment recently-announced his intention to consider bringing the external powers of Australia's international commitments to bear on continuing clearing of which the Queensland contribution to Australia's total represents 80% (Background Briefing, ABC Radio National 26/09/99).

setting funding priorities for the national systems of (ecosystem type) reserves (Long 1999;Thackway & Cresswell 1995: 1). This defines 'biogeographic region' eco-functionally as:

A complex of land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. Region descriptions seek to describe the dominant landscape scale attributes of climate, lithology, geology, landforms and vegetation. Biogeographic regions vary in size with larger regions found where areas have more subdued terrain and arid and semi-arid climates (Thackway & Cresswell 1995: ix).

The term 'Bioregion' (contracted from biological + region) was coined by Berg and Dasmann in the 1960s, but the best known and most radical proponent⁹³ is Kirkpatrick Sale (Sale 1991). Sale's anthropocentric but realistic (at least pragmatic) definition sees Bioregion as an ecologically defined human range or territory:

A bioregion is a part of the earth's surface whose rough boundaries are determined by nature rather than human dictates, distinguishable from other areas by attributes of flora, fauna, water, climate, soils and landforms, and the human settlements and cultures those attributes have given rise to. The borders between such areas are usually not rigid ... But the general contours ... Are not hard to identify, and will probably be felt, understood or sensed, in some way known to the inhabitants, and particularly those still rooted in the land ... (Sale 1974: 79).

Mathews asks what difference there is between our primate ancestors and human society in terms of relations to the local Ecosystem. She argues that our ancestors lived in fully reciprocal relationship with the local Ecology, but that human behaviour is a function of Culture as well as Ecology. She identifies Culture or 'nurture' as a genetically determined, necessary human characteristic, without which language-mediated symbolic representation and communication about the world can not take place. This aligns Culture with ecological processes. The reciprocity between Culture and Nature, upon which our intrinsic value as participants in Nature depends, is well documented for primitive communities (for instance Bird-David 1993;Rappaport 1977a;1977b;Rappoport 1979a;1979b).

However as soon as cultural symbolism is globalised or extended beyond the local ecosystem, the essential bioregional connections are usually severed. Work by Smailes⁹⁴ on spatial patterns of identification with place, indicate a surprising stability in feelings of identity associated with place and rural community networks, despite recent commuting patterns, attractions of larger centres and loss of community population.

For urbanites, this connection can be partially restored by intellectually acknowledging our deep dependence and groundedness in Nature, and by choosing to celebrate the 'conatus', the selfness, the intrinsic value of Nature through the structure of our cultural values, thus restoring reciprocity. Alternatively, Nature may be disconnected through misrepresentation as

⁹³ Regarded as seminal work.

⁹⁴ Department of Geographical & Environmental Studies, University of Adelaide, personal communication, unpublished paper in press.

purposeless, dead, blind and so on, which amounts to malfunction, not transcendence, with the ultimate cost being extinction (including ours) through natural selection (Mathews 1991: 135-142).

Bird-David describes four cases with different categories of Culture-Nature relatedness, arrived at through a Lakoff & Johnson-type Cognitive-Metaphoric Analysis. These ultimately serve conservation principles: "adult-child caring relatedness" (Parent-Child) or "sexual relatedness", "procreational relatedness" and "name-sake relatedness" (Bird-David 1993: 112-3) (Lakoff & Johnson 1980).

But Lewis takes to task the "reinvention of the myth of the noble savage by late twentieth-century scholars ... not a few ... blinded by their own desire to rediscover Eden", and the support of this position by Deep Ecologists. He points out (from the anthropological literature), examples of primitive cultures that did and did not exhibit evidence of 'primal purity': concepts of relative affluence, leisure, harmony with Nature, gave way to a realisation of ecological and cultural collapse as a result of enmeshment of locally-focused economies with the larger-scale ones of industrial society. He then goes on (without relating differences in outcome to type of Cosmology), to give examples of discord, inequality, sexism, pollution, environmental impact and large-scale ecosystem damage with extinctions, caused by tribal societies in early times (Lewis 1992: 49, 54, 48-75). It is mentioned elsewhere that examples in history of human settlement collapse due to abuse of local ecological relationships, are legion (Ponting 1991).

This merely serves to underline the wisdom of having a cosmological system that supports ecological (and social) sustainability - the subject of a key *Fundamental Questions Paper* (Cock 1991b) and a number of other works that attribute our environmental issues to psycho-spiritual and ethical disorders, and/or requiring core level transformation (for instance Collins 1998; Fox 1988; Grove-White 1993; Harries-Jones 1993; Ingold 1993; Kunstler 1993; Luhmann 1987; Milton 1993b; Spretnak 1986; Warren, MA 1995). **Link: Confluence: Cosmology.**

A search for lost roots and a desire to reconcile with Australia and its native people is driving many to study the Aboriginal relationship to land, sometimes in order to get a feel for what radical eco-sensitivity could mean in this country.⁹⁵ Others, knowing no Aborigines, do romanticise Aboriginal knowledge of Ecology.

⁹⁵ Two excellent, short descriptions of Aranda and Murngin relationship to land are recorded in Suzuki & Knudtson's *Wisdom of the Elders*, and many other works (Brock 1989; Charlesworth, Morphy, Bell & Maddock 1984; Knudtson & Suzuki 1992: 129-136, 138-141).

My experience with Aboriginal communities and individuals has led to the understanding that Australian Aborigines, whose Cultures have tragically been assaulted in this way, had an intense and highly specific identification with their land. This included the intimate intermeshing of belief systems with Landscape, calendars based on local food availability and a cultural and behavioural system which specifically took care of their country. This system can not be described as ecological knowledge in a generic sense, and is specifically scaled to the land area in question, nor does it imply automatic respect for ecology in modern Aborigines. The old knowledge was wondrously detailed, and in some areas associated with permanent settlement, animal and fish confinement, or leaving residual resources for next year's crop, even planting a few bush potatoes for self-propagation. The knowledge was not transferable to other places, and the system was constrained by a low energy level of technology and the specificity of the behavioural programme that in most areas included a nomadic lifestyle (entailing relationship with quite extensive spatial scale). The enforced settlement of Aboriginal communities in fixed locations, often far removed from traditional land ties, has resulted in the complete devastation of the surrounding areas in many, perhaps most, places, unchallenged by any general *Aboriginal Theory of Ecology*, and exaggerated by the loss of culture. The introduction of Western technology has resulted in local collapse of such Constraints, the availability of axes, shovels, guns and Toyotas providing a devastating increase in the efficiency with which the environment may be impacted, including damage by owners to traditionally held land.

However, what those Aborigines with traditional knowledge can teach, with generic applicability, is a way to spiritual connection with the land, to respecting a Spirit of Place, and between people, to renewal of Community and to a bioregional knowledge of Biotics, which is where we need to start anyway. Aboriginal spirituality has much in common with other First Nations perspectives. In the USA, a Cherokee approach known as "Original Instructions" has emerged, available for training concerned people: Honour the Old People; Tell the truth; Listen to Nature; Honour all beings; Be grateful; Work hard; Get out and enjoy life.⁹⁶

I learned at first hand about the local specificity of Aboriginal knowledge of land in the course of investigating the huge site for the Jerrabomberra Valley National Ideas Competition in Canberra in 1994. An Aboriginal person offered to 'walk over the land' with me. I discovered in the course of this that he came from Yulara in Central Australia, and had no local knowledge. He had good general advice however, which we followed together: "Go to the high place and to

⁹⁶ The "Original Instructions", Part 4 of *The Bioneers, New Dimensions*, 5RN, 2/1/01: "There will be no peace until you stop the war with your mother".

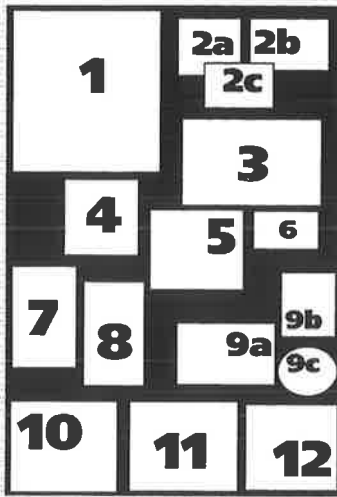


Plate 8: Collage: Placemaking - Key

1 North Terrace Adelaide Under Grass

Populations move In when Attractors replace Repellers: Proclamation Day, Adelaide, 1999. In 1994, a number of concept plans for the redevelopment of North Terrace mentioned the reduction, interruption or removal of traffic. A dramatic shift of Genius Loci, attracting thousands of curious people, followed the laying of lawn on this major thoroughfare, now to be an annual event. **Links: Chaos Theory; Criterion Population.**

2a-c Market Scenes

No EcoCommunity without a farmers' market: ubiquitous globally, one of the most ancient human activities, and a potent expression of local culture and produce: Market scenes from Manaus Brazil, Port Adelaide South Australia and Istanbul, Turkey. Markets are ubiquitous globally, and one of the most potent expressions of local

culture. **Link: Criterion Organism.**

3 Ventura County California 'Re-Placing'

Global common practice: the unfortunate and ecologically disastrous habit of razing (even to bedrock) all hint of local 'Place' prior to re-Placement with ego-icons of the developer and (usually his) customers. Property adjacent to Ahmanson Ranch.

4 Traffic Calming St Peters Street Adelaide

Established in the 1970s by an enlightened Council, this former straight 'airstrip' with a longitudinal central drain was converted into a delightful winding road with interrupted sight lines, roundabouts, flower beds and heavy plantings of native trees.

5&6 Place Icons

5: Bamberton, Vancouver Island, Canada: Disputed site of a 12,000 population ecodevelopment, located around an old cement factory. The developers (DPZ) intended preserving this impressive mess as a central icon for Community identity.

6: A Plaque on North Terrace, Adelaide alerts us: we stand near a big historical story. **Link: OCV Project.** In Gungahlin, ACT, developers made much of a small plaque they had created and built around, hoping to sell their dreary suburb with a point of differentiation. In JVNIC, two entries advocated building community around a sense of place (ante hoc): one sought stories in history, the other sought future benefit from local endangered species preservation.

7 Human Scale (medium-rise) Residential-above-Commercial

Commonplace traditionally and outside Australia, this concept is extremely difficult to have implemented in downtown Australia or USA (eg Berkeley has different systems for approval of residential and commercial, so mixed use is delayed for months⁵). With wide, useful verandahs, it is a particularly friendly arrangement for ageing people, who have quick access to supplies and can engage in Community by watching. Rural town in Anatolia Turkey.

8 Aborigines & Supporters Rest at Canoe Tree Outside Goolwa SA

Over 3000 people participated in a 'long Walk' in 1996, many travelling on foot >100km over the old Aboriginal family route from Adelaide to Goolwa, to make a statement about Hindmarsh Island Land Rights and misuse of Government power. A few months later another canoe tree near here was desecrated and ringbarked, the attackers understanding full well the iconic reverence and place identity commanded by these historic trees: an efficient way to inflame and damage the Aboriginal heart and polarise the community.

9a-c, 10 Keep Out! Antithesis of EcoCommunity Placemaking

Razor wire; a double-protected entrance to an Adelaide suburban gated community, a large external alarm on a suburban house - announces vigilance against potential intruders. A tall wall the first structure of a new tract (10). An emerging paranoid positive feedback loop.

11 Should We Restore to Former Appearance?

Ingenious German method of inviting public feedback: painted façade on fabric allows visioning of proposed restoration (Berlin). A Postmodern façade or this?

12 Bioregions vs Biogeographical Regions

SA's Biogeographical Regions mapped as soil-vegetation associations (scan: Thackway & Cresswell 1995). They underpin the National Government's fragmented approach to the conservation of biodiversity, an internationally-approved 'library/museum' strategy that aims to preserve from development, a small percentage of each system type. **Links: Criteria Genius Loci, Biotics.**

Background: stone lace, *Bridge of Sighs*, Venice; Author's photos, Adelaide Advertiser (1); citation.



AFTER 24 HOURS OF FURE, SHOULD NORTH ICE BE ...



VERDANT MALL Greenery 27th Anniversary with the North Ice at South Kamala Day. Photo: SUREKA PRASAD



the low place, and let the land speak to you". I later visited a local Aboriginal elder, who turned out to be one of six groups quarrelling over ownership of the land in question. This person's son spent time with me, sharing local archaeological information. The local Aboriginal culture was understood to have been lost, and no further knowledge was forthcoming.⁵

The loss of region-consciousness in Western societies and the need to address this as a first stage in Planning has been addressed by Hiss, Lynch (Lynch 1991), MacKaye and others. For instance Hiss writes:

Areas can conceal density only by working directly with connectedness; and the process of working with connectedness is ... basically a democratic procedure ... Additional, equally compelling reasons for building a region around connectedness ... Before you could hope to make the public values of a place part of the local process of thinking about land-use decisions you had to take a preliminary step, which involved connecting people to their own sense of connectedness ... The first part of any Yaro project, urban or rural, has involved revalidating connectedness and helping it to find a voice (Hiss 1990: 203). A new approach to community development is in the making – one that asks people to think about the long-term needs of a place and of all its residents. We're in the process of building local institutions that take over the job of looking after public value on a volunteer basis, and we're learning how to reinvest in areas so that they'll be more valuable to the next generation than they are to ours (Hiss 1990: 207, quoting Yaro).

Urban ecologists, conservator society proponents (Trainer 1985; Trainer 1991) and Permaculturalists, are now nominating functional Bioregions and using them in their addresses⁹⁷ and to organise and name their regional meeting groups.⁹⁸

Examples of artificial construction of a Sense of Place as a design strategy are MultiFunction Polis Australia, developers in Gungahlin, ACT and participants in the Jerrabomberra Valley National Ideas Competition.⁵ The MultiFunction Polis' "multifunction city of villages" concept plan was much derided for its pretentious 'three visual axes' supposedly representing land/humanity, water/environment and monument/technology (MFP-Adelaide Management Board 1991b: map 2,3): (visual axes - Plate 5). This is a modern extension of the crystal city, intending to be spiritually uplifting or inspiring. MFP also resolved in its early idealistic stages, to identify places around the Port Adelaide area (for instance the Sunday fishermen's and produce market), that could be thought of a 'local sacred sites' for preservation (Rounsefell 1993b). **Link: BP 5.1: Helsinki Paper: MFP Australia.**

In Gungahlin, the developers apparently hoped to add value to their neighbourhood by installing an historical marker and actively referring to its story.^{5,99}

⁹⁷ For instance the proponents of the Halifax Project address themselves 'Tandanya Bioregion'.⁵

⁹⁸ South Australian Permaculture Association.

⁹⁹ The Crystal City was reportedly an underlying theme of the design of Canberra (Proudfoot 1994).

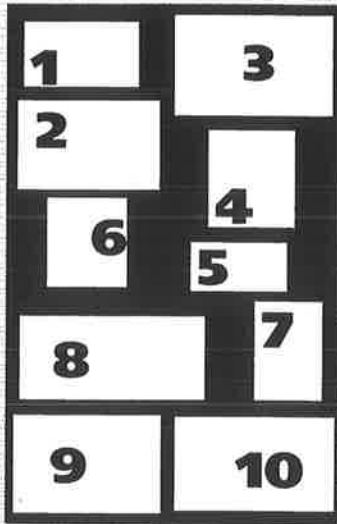


Plate 9: Collage: Places 'Of the Soul' - Key

A strong theme for EPPs is 'natural': natural materials, shapes, patterns, useful 'ethnic' and hand-crafted Western artefacts. These notions are often discussed in a context of environmental healing: healing buildings, locales, vegetation, colours, odours, vistas, and the healing effects of contact with Nature, directly or symbolically. The *Patterns* developed and his *Pattern Language* are rich in such life-enriching concepts: more commonly implemented at Crystal Waters Permaculture community than Permaculture gardens. **Link: Plate 16.**

1 Northern shade at noon

Pleasing simplicity and softness of line in a remote Anatolian peasant house. As we stopped to photograph a stork, the owners rushed out with a huge jug on airan (a chilled yoghurt drink). We experienced similar generosity of spirit wherever we went in rural Turkey (4 days after the 1996 Habitat II Conference).

2 Turkish mud brick, timber and thatch:

Another common housing form. Note similarity to Roman's Hut (Plate 4: 7a & b). Many other houses, charming to Western eyes are still built semi-underground for thermal and vital protection, just as they were 10,000 years ago (eg Çatal höyük in the same region). The simplicity of extreme poverty is a healing 'look' for the cluttered more fortunate.

3 Interior of Ökostation, Der Seepark, Freiburg im Breisgau

This community meeting and education centre was planned and built by the community itself. **Link: Der Seepark, Plate 18.**

4 & 5 Views of Nature through Rounded Windows

Reminiscent of primal views from caves. 4 is one of a set of upper level earth and clay windows, designed to anthroposophical (Steiner) principles. Nibble School, Järna, Sweden (scanned from Pearson 1994: 53). 5 is at Crystal Waters (home of a carpenter, who is also one of the few to practise Permaculture gardening). Urban-rural and indoor-outdoor are spiritually important EPP linkages in design.

6 The Female Response to Plate 7: 1, 2.

Catholic Church at Paks, Hungary (scanned jacket photo by Imre Makovecz in Pearson 1994).

7 Wooden Bath, Crystal Waters

Same house as 5 above: set up for cool reading with good light.

8 Hundertwasser (1928-)

Mad, colourful designs, eco-architecture, bizarre retrofits of drab old buildings using off-the-shelf items - appeal to the inner Child: pure fantasy, fun, anti-authoritarian, rich primary and metallic colours: Hundertwasser's buildings are such strong magnets for visitors that residents are driven crazy tripping over people (Richard Register pers. comm.) (Scanned from Rand 1991:213).

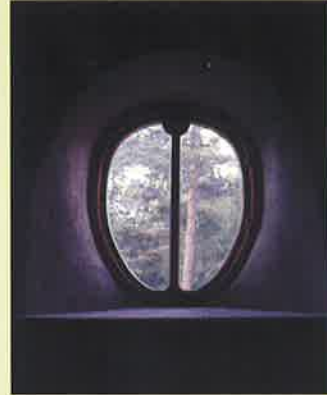
9 Glasshouse Architecture, Tübingen Germany: Nature indoors

Small architectural firm set up in a glasshouse amongst functioning agricultural glasshouses. One tiny heater copes with entire building, modulated by heavy plantings, including Eucalypts (evergreen advantage). Specialise in Baubiologie and large scale glasshouse architecture. Published in German on species lists & indoor air.

10 Prairie Hotel, Parachilna SA: Arid Outback

Award-winning retrofit and extension by Energy Architecture SA. Does have air conditioning available, but rarely needed, due to passive solar design and complementary technologies (fans, whirleybirds, strategic shade). This bedroom in the extension wing has the glow of natural materials, warm, earthy colours, recycled timbers. These physical and psychological comforts are spiritually complemented by stunning views of the Flinders Ranges.

Sources: As indicated (4, 6, 8); Author's photos; Energy Architecture Adelaide (10).



Entry 125 in the Jerrabomberra Valley National Ideas Competition proposed that villages be centred around existing historical buildings to “provide context, community focus and services for the early settlers of the village.” Entry 131 says:

We recommend all the sites supporting significant biota be preserved and localities be named after them, with a view to linking in with promotion of the concept of local stewardship, captive breeding programmes associated with tourism, and protection of six local endangered species by channelling visitors and locals into interpreted walking trails and observation posts (Rounsefell 1994a: 123).⁵

“Bioregionalism” ... Fundamentals are: it relates to knowing land directly, not just intellectually; with one’s body, commitment, time, labour, walking. Maps, charts, botanic lists, histories, are just the menu. You’d starve on that ... Although it is clear we can no longer have seamless primitive cultures, or the purity of the archaic, we can have neighbourhoods and community. Communities strong in their Sense of Place, proud and aware of local and special qualities, creating to some extent their own cultural forms ... people who live where they are and work with their neighbours, taking responsibility for their place, and SEEING TO IT: to be inhabitants, and not retreat ... The process becomes educational, even revolutionary, when one becomes aware of the responsibility that goes with “rootedness”, and the way the cards are stacked against it. Gary Snyder *The Real Work*.¹⁰⁰ Icons of Place and Place Repellers were illustrated in **Plate 8: Collage: Placemaking** above. Many modern constructions transmit extremely negative, socially-destructive 'vibes', especially 'keep out!!' and 'you're not OK (untrustworthy)!!'

10.8.3 PERCEPTION OF PLACE

Contact with Nature is mentioned under Organism as a basic human psychological need, and normal humans are deeply sensitive to bio-rhythms of Nature, the more so as their vocations relate to the Ecosphere. Thus the condition of Nature in any locale is the key local intangible and highly significant to human perception of Place. Celebration of (now relatively) pristine Nature has of course been a preoccupation of generations of artists, romantics and travellers over the centuries, the steady loss of true ‘pristine-ness’ notwithstanding. Design that mimics the patterns of Nature is used by eco-conscious architects as the core of their place-making activities (for instance see Day 1990; Doczi 1985 and *Criterion Landscape*). **Plate 9: Collage: Places of the Soul** above gives some examples.

The Sense of Place of non-human biota is interesting to contemplate. Most place-recognising and territorial behaviours would probably be attributed to resource and reproduction issues, and

¹⁰⁰ Excerpts from full quote, Editorial (page 1) in every edition of *“Inhabit: a Bioregional Journal for Australia”*.

the activities of migrating animals and birds are well known (Opportunity Hierarchy). Animals and birds clearly have ranges or territories, and behaviours or indeed, fates, which hinge directly on whether or not they are able to establish a territory large enough to sustain them. This is of course the core issue in the endangered species debate.

Beyond this, there are many stories about the negative responses of animals, especially cats, birds and dogs, to certain places. We speak of good and bad 'vibes' around some locales, and those who claim supernatural sensitivity attribute such perceptions to spirits and other supernatural phenomena.¹⁰¹⁵ The behaviours of animals and birds in particular may be related to their ability to perceive stimuli not available to humans, such as broad spectrum ultraviolet and infra-red radiation and magnetic fields, or to enhanced auditory, olfactory or thermal sensory ability (Downer 1999). Reliable access to such mysterious powers would radically change a human appraisal of place.

¹⁰¹ Study tour Brazilian spiritist healing centres, 1988.⁵

10.9 CRITERION: BIOTICS

10.9.1 ESSENCE AND THEMES

A few basic principles should guide urban wildlife management, whether the goal is to increase diversity and abundance of desired species or to control the numbers and spread of pests. Wildlife are linked to each other and to plants by the sum of the relationships between the eater and the eaten, known as the food web. Every species has requirements for its habitat, without which it cannot survive (Spirn 1984: 217).

This Criterion of vitality lies at the heart of sustainability, in that humans are not immune to the threats to other biota and the very integrity of planetary systems as we know them is biota-dependent. Allen & Hoekstra emphasise the Constraints that enable different Biomes to survive, retarding runaway positive feedback in any one Population, keeping balance.

Although Biomes as such do not emphasise the exact species in the biotic mix, but rather their ecological roles and the biotic or physical Constraints holding the system in place, the other side of this coin is the description of which species have made it or can, in the face of a particular régime in that place. Thus we should support our coevolved native species to perform the ecological functions required for the system, rather than have a set of exotics come in which may compete for niches but not fill the crucial multifunction roles so intelligently provided by the indigenous. We may decide not to allow burning of forest remnants after clearfelling (if we are unable to stop clearfelling), as this can permanently change the Constraint system in that area (for instance by nutrient loss).

Biological diversity (Biodiversity) is normally considered by ecologists under organisational level categories (genetic, species, ecosystem), but as these are not clearly demarcated, diversity of function and habitat diversity are also recognised (Possingham 1993: 11). Others add geomorphological diversity (The Biological Diversity Advisory Council n/d), which if recognised as a Constraint issue, should perhaps be coupled with climatic diversity, or edaphic diversity, but one would want to know exactly what diversity of Constraints would be an appropriate goal and why (how they work together).

Thus the main mechanisms of biodiversity are indirect or subtle, while the indicators of biodiversity are species and genes: enough individuals of a species to survive long term through the resilience of a diverse gene pool, and to replenish those lost to environmental calamity; enough species to provide the functional redundancy required for ecological niches in their service functions; and of ecosystem, either diversity of Community or habitat, all with enough relative biomass to perform the ecological services necessary for the whole system. Habitats

need space, and there are biological limits on how that space can be appropriated or even shared for other purposes (Possingham 1993: 11).

At a coarse-grained biogeographical scale, in the literature on indices, diversity as species counts and interspecies encounters may be a useful concept. In an urban human-modified ecosystem, or at the scale of a single organism concerned with biological survival and its own policies of cooperation, competition and resource capture, diversity may have more to do with guild composition or functional redundancy, but species counts as such have little functional meaning (Allen & Starr 1982: 184). But Biotics and Biodiversity include all these things at once in fact.

Potentially useful species, especially those with exploitation potential for Biotechnology, are the cornerstone of the anthropocentric argument for preserving Biodiversity (meaning the survival and function of biota other than humans). An ecocentric position respects Biodiversity in its own right, not for Utilitarian reasons. With the present situation EPPs need to appeal to both. **Links: Criterion Ecocycles: Ecological Services; HST: Energy & Thermodynamics.**

It is noticeable that conservationists often focus on the habitat level, governments on the species and animal liberationists on the individual animal or tree.¹⁰² Proponents of unSustainable Development often revert to geological timescales, pointing out (for instance) that the planet has warmed and cooled before, so we should not be concerned about our relative role in global warming. To be serious about 'aligning with Nature', multiple scales and their co-dependencies must be considered simultaneously: the system or organism in question should be approached from its own functional scale, but as a complex of 'entity-in-its environment'.

The encroachment of human activity on Earth's eco-productive systems,¹⁰³ has been articulated for decades now. Notwithstanding the broad awareness of cumulative impact, the application of this knowledge on a day-to-day basis in human settlement design and development can only be described as poor.

Ultimately, all the other Criteria can be subsumed under Biotics. Thus the inclusion of Biotics at every scale of human settlement development and integrated within each discipline is seen as critical to the sustainability question. And not just 'What can live here?' but 'What can live here well'.

Ignorance ends today, negligence starts tomorrow!

William McDonough, 1995 at a presentation to Urban Land Institute leaders (Rocky Mountain Institute 1998: vii: foreword, James J. Chaffin Jr).

¹⁰² An important aphorism in Psychotherapy is: 'you get what you notice'. Hence the importance of looking for Indicators of ecosystem health rather than just those for damage.

¹⁰³ **Links: System Condition 3, The Natural Step, Criteria: Ecocycles, Indicators.**

10.9.2 BIODIVERSITY CONSERVATION: BIOREGIONAL SCALE OF APPROACH

Despite failure to honour it in practice, most groups and authorities agree that the appropriate primary scale for ecological intervention is the region or Bioregion.

The draft National Local Government Biodiversity Strategy (1999) recommends the regional organisation of biodiversity management, noting the scale benefits (Berwick & Thorman 1999: 7), but the differences between catchment, bio-, eco- or geographical regional and LGA boundaries are not simple: it is a matter of local intuition. Norton & Ulanowicz provide a theory of scale for biodiversity protection, that could help such a project (Norton & Ulanowicz 1992: 244). The potential savings in resource costs available from Bioregional governance were unfortunately not ever considered during major local government amalgamations recently, despite the fact that much regional cooperation already occurs, and planners are open to more.¹⁰⁴

The bioregional approach is specified as a strategy for Australia under the Global Biodiversity Strategy that responds to Article 6 of the Convention on Biological Diversity (signed and ratified in 1993) (Commonwealth of Australia 1998: 5). This was developed by the WRI, IUCN and UNEP¹⁰⁵ by collaborative international effort from 1989-1992 in the lead-up to UNCED¹⁰⁶ in 1992:

Biodiversity Planning must involve bottom-up and participatory negotiations, and priorities must be set at a bioregional level (World Resources Institute, International Union for the Conservation of Nature & United Nations Environment Programme 1992: 35).

The National Strategy for the Conservation of Australia's Biological Diversity, (signed as an Inter-Governmental, State-Commonwealth Agreement in 1996), sets Objective 1.2 thus:

Manage biological diversity on a regional basis, using natural boundaries to facilitate integration of conservation and production-oriented management (Commonwealth of Australia 1996c: 8).

This is reiterated in *"Australia's National Report to the Fourth Conference of the Parties to the Convention on Biological Diversity"*, but in both cases the term 'regional' is tending to rely on catchment definitions rather than including humans and their local cultural attributes as part of the ecosystem in question (Commonwealth of Australia 1998:20). There is still the feeling that 'regional Australia' is 'somewhere in the country', as the term 'regional' has recently come to mean 'rural' in national political parlance, and urban communities do not yet see themselves as

¹⁰⁴ My Masters Qualifying Dissertation in 1991, which questioned planners from every local government in Adelaide metro and some rural, (n= 49), found a 61% enthusiasm for regional (not bioregional) collaborative local government, as long as resources/funding were available and the needs of LG were not crushed by heavy-handed State Government interference (Rounsefell 1991a: 65).

¹⁰⁵ World Resources Institute, World Conservation Union (International Union for the Conservation of Nature), United Nations Environment Programme.

¹⁰⁶ United Nations Conference on Environment & Development, Rio de Janeiro.

inhabitants of catchments.¹⁰⁷ The National Heritage Trust funding available in recent years has done much to advance the concept of urban bioregional consciousness, as evidenced by the Adelaide Urban Forest Biodiversity Program,¹⁰⁸ which amongst other things, is engaged in developing an Adelaide Region Biodiversity Strategy and providing special Project Officers to work with Local Governments and Catchment Management Boards.⁵

As mentioned under Genius Loci, the National Reserves System Cooperative Program (NRSCP), has produced the Interim "*Biogeographic Regionalisation for Australia*" framework (IBRA) (Thackway & Cresswell 1995).

The South Australian Biological Survey, is producing five Regional Biodiversity Plans, and refers to the "*National Strategy for the Conservation of Australia's Biological Diversity*" above. It's Biological Inventory of the Mount Lofty Ranges refers to IBRA, to the PIRSA Natural Heritage Trust Biodiversity Planning Regions and to the smaller regions as defined by Laut *et al* in 1977 (Laut, Heyligers, Keig, E., Margules, Scott & Sullivan 1977).

Similar activities are occurring in other States. For instance the Lower Hunter and Central Coast region of NSW is linking seven local government councils, unifying their Development Plans and their approach to developers, including running workshops, posters, education, resource kits, biological inventory and organising shared resources between councils.¹⁰⁹

10.9.3 MANAGEMENT OF REMNANT VEGETATION

Natural Heritage Management involves eight conservation processes: regeneration, restoration, enhancement, reinstatement, preservation, modification, protection and maintenance, all affecting vegetation and the fauna it supports (Australian Heritage Commission 1998).

Since in much of Australia only 5-10% of the original vegetation remains (or worse), protection and appropriate management of remnants is crucial. Indeed we have gone beyond even this - Sustainability is no longer adequate: being in deficit, we need not only to sustain what we have left, but to actively heal.

When you only have 3% left, you save it all.¹¹⁰

Patch dynamics, island biogeography, edge effects, wildlife corridors and remnant vegetation are commonplace concepts in Biogeography, Ecology and Landscape Ecology, but apparently not in most urban planning or local government asset management.¹¹¹

¹⁰⁷ A fact being addressed by Environment SA, the Yellow Fish Road Program in Calgary Canada, the Creek Critters Project in Berkeley and the Davis, CA.⁵

¹⁰⁸ Budget \$A300,000.

¹⁰⁹ Tony Proust, Planning, Lake Macquarie Council, Meredith Lang, Strategic Plan Coordinator, personal communication.

¹¹⁰ Biodiversity Conference Adelaide June 2000: unsourced comment.

A patch is “an ecosystem with uniform physiognomy or floristic composition” (Mattiske 1987: 383). Patches are one resilience strategy Nature has used to repopulate lost habitat. Ecotone management, creation or modification may have ecological benefits through increased diversity and protection of remnant habitats, inter-ecosystem buffering at small scale, low cost management of long transport corridor remnants, biodiversity conservation, enhancing genetic diversity and providing refuge for species displaced from elsewhere. Risks may accrue from the use of exotic or otherwise inappropriate species (monitoring, assessment and ecological consultation being advisable) (Mattiske 1987: 383). **Table77: ES: Ecotone Management to Control Patch Size** summarises a conference workshop on patch management strategies.

A wildlife corridor is “a narrow strip, stepping stone or series of stepping stones of hospitable territory traversing inhospitable territory providing access from one area to another” (Dendy 1987: 357). Corridors are naturally established by the species that use them within larger habitats or in natural corridors (especially riparian and aerial), and these form part of natural Connectedness in Nature. However where patch sizes fall below 10,000ha, or uncleared area below 30%, approximate Indicators¹¹² of areal adequacy, corridors become important for their ability to extend mobility, territory, genetic balance and feeding options. They may be a mixed blessing however, as seen from the table of advantages, disadvantages and design guidelines: **Table 78: ESCM: Wildlife Corridors**. Again, informed local judgment is essential. **Links: Criterion Landscape: Landscape Ecology; Criterion Organism**.

A small Local Government study in South Australia, found that apart from direct damage due to failed inter-departmental communication or lack of supervision, systemic damage to Biodiversity was being presided over by engineers, landscape designers and development approval planners who were not working within a regional framework. That is, the system focuses on a scale inappropriate to the espoused policy on protection of Biodiversity (Rounsefell 2000).

... the protection of Environmentally Sensitive Areas has often been based on drawing an artificial zoning line around them, while ignoring adjacent natural areas that lack ‘special’ features. Consequently many of the protected ‘special’ areas are no longer able to support the species and features that gave rise to the designation in the first place (Hough 1995: 184).

¹¹¹ For instance in 1999 a local government council well known for its progressive attitude to sustainability nevertheless somehow managed to preside over two incidents where threatened remnant vegetation was wiped out in the course of maintenance operations.⁵

¹¹² Rules of thumb used by natural resource managers.

10.9.4 HUMAN-RELATED IMPACTS AND 'NATURALNESS'

A shift to universal respect for non-human biota would require a biocentric view of humanity, that is, that humanity be regarded as part of Nature. Such a view is central to Deep Ecology¹¹³ and the EPP group. Those seeking 'Sustainable Development' still commonly see Nature as an optional extra:

Nature's ability to survive in cities is clearly demonstrated by many studies ... (Goode 1998: 589).

There can be no question that it is highly desirable to integrate nature into the development of cities ... (Wittig 1998: 593).

Taylor sees no qualitative difference in perturbational terms, between successional processes which involve humans, Aboriginal, European or otherwise, and other natural perturbations such as fire, climatic events and diseases. However the quantitative, spatial and temporal issues are extremely significant because European impacts involve the accelerated impacts enabled by technology, and the qualitative difference of fragmentation and replacement with biota far removed in space and time from Australia's own (Taylor 1990: 415).

But what is '*native vegetation*'? An ecologist I interviewed for JVNIC suggested that we should look to a big picture, pre-Aboriginal, fire-sensitive model (*Casurina* and *Callitris* woodland, not eucalypt). Only two to four decades have elapsed since Australians were exhorted to fill their gardens with native plants, without distinction between indigenous and exotic native species (for instance see Brooks 1967; Wilson 1975).

To qualify as natural native, there must be spontaneously occurring, indigenous native flora dominant in both canopy and understorey. Other combinations incorporating cultivated or adventive alien exotic, cultivated endemic and non-indigenous native, and relict (transient remnant native without understorey¹¹⁴), indicate replacement of natural native vegetation systems with human dominated systems that support a dominant exotic vegetation matrix (Taylor 1990: 415-7). The cutoff for a definition of vegetation as native depends on the species dominating the composition of the canopy, but still requires knowledge of pre-existing associations. Taylor expects that her classification of cultivated, adventive and relict types for human-dominated 'ecosystems', will need further categorisation in terms similar to the

¹¹³ For instance Gary Snyder, Pulitzer Prize-winning poet and essayist and Deep Ecology icon, explains the difference between Nature, which covers everything on Earth including computer chips (which could not after all exist without being based on the Laws of Nature), and 'wild Nature', the (actually self-disciplined) non-human natural world, evolved through complex processes and having value independent of human notions of superiority ("*Deep Ecology for the 21st Century*" Series, #7, New Dimensions, repeat ABC Radio National December 1999, Michael Thoms interview). "Until you're a member of the community [*of living beings*] and give time and effort to it ... doing some work in your local community ... meet the neighbours [*know the names of different sorts of woodpeckers* ...] ... learn something about nature ... you can't call yourself a Deep Ecologist. You have to know something about the neighbours. Loving nature is nice, but you have to know something about it, have met it ... work with your Watershed Council – most watersheds now have one; it's one of the best ways." See www.newdimensions.org/.

subcategories for native vegetation, which relate to structure and composition (Taylor 1990: 417).

It is usually assumed that in conditions of relative environmental stability, an indigenous community will have co-evolved with an array of mutually accommodating biota, floral, faunal and microbial, and that apart from edge effects, will essentially be able to take care of itself.

Exotic species on the other hand, come without the co-evolved relationships, and very often do not support native biota in the same ways or at all, and often compete, overpopulating in the absence of natural constraints. For instance grass-feeding, large birds (or grazers like kangaroos) are often advantaged in human impacted settings with exotic canopy and poor understorey⁵ (the 'grass and trees' parklands pattern), over small and more specialised feeders which require a dense understorey. Small animals are isolated by fencing. Sometimes exotics such as pest boxthorn can provide the shelter and nesting opportunities required by locally extinct native species. Sudden elimination of boxthorn as a woody weed may then wipe out precarious populations of small birds.⁵ Similarly, Calicivirus impact on rabbit populations has affected wedgetailed eagle populations.⁵ European honey bees compete successfully with native bees, but are not specialised in the pollination of many Australian flowers, with serious impact on those native species.¹¹⁵

Permaculture makes much of the development of artificial ecosystems that evolve over time and have the purpose of food production, preferably on a perennial basis. These systems are self-contained and small scale, with closed ecocycles involving domestic animals and birds, and make no attempt to support native species. On the other hand, the biotic connections and wildlife corridors will be an issue for the property as a whole.⁵

If the purpose of classifying native vegetation associations is the understanding of the human role in landscape change, and ultimately, better management (Taylor 1990:411), then it would make sense if any further classification of exotic vegetation types were to refer to functional associations that indicate the degree to which they approximate the Backcloth functions for Australian biota and contribute to Ecosystem Services. It would be helpful to have the same information about Australian indigenous species, and ecological service information for both.

¹¹⁴ Relict = doomed: solitary specimens unlikely to propagate: the end of the line (for instance street tree remnants of former forests), unless their seed is collected for propagation.

¹¹⁵ Further damage is expected from European bumble bees, which are under consideration for import into Sydney for their buzz-pollination capacity and projected 10% increase in productivity. Accidentally released bumble bees have caused serious competitive native bee population reduction in Tasmania. An alternative would be to breed up Australian native buzz pollinators (Willis 1998).

Long-standing alerts to the issues of weeds, ferals and exotic indigenous plants have vindicated concern, as the extent of the damage done to wildlife by feral or exotic native predation and competition is scientifically demonstrable (Australian Nature Conservation Agency n/d; Dickman 1996; Serventy 1966). These issues are not just rural or 'regional'. They are suburban and urban, a point of insistence by EPPs. EPPs particularly acknowledge the appropriative, feral qualities of humankind, and seek to protect and correct.

Glanzign (Coordinator of the Australian Biodiversity Network) has listed Principles for the protection of Biodiversity at individual scale, summarised in **Figure 42: ES: Biodiversity Principles at Individual Scale** (Glanzign & Prideaux 1999).

Like winds and sunsets, wild things were taken for granted until progress began to do away with them. Now we face the question whether a still higher 'standard of living' is worth its cost in things natural, wild, and free ... These wild things, I admit, had little human value until mechanization assured us of a good breakfast, and until science disclosed the drama of where they come from and how they live. The whole conflict boils down to a question of degree. We of the minority see a law of diminishing returns in progress; our opponents do not (Leopold 1966: Foreword to 1948 edition: xvii).

10.9.5 ECOTONES

The Ecotone, the transition zone between Biomes or EcoCommunities, is both a boundary and a gateway, a purveyor of 'edge effects' and of creativity. Proponents of Permaculture in particular, revere Ecotones as places of creative evolution, change and species diversity, and have adopted the maximising of edge length through spiral, looped and keyhole shaping as a design strategy to augment productivity in working gardens Mollison, 1988: 481; Mars, 1996: 132; Mollison, 1991: 29}. Indeed humans as speedy opportunists, are typical Ecotone species: we plunder Ecotones and create them by fragmenting large patches and Biomes: all action and little stability, and a case of 'too much too soon'.

Van Der Ryn & Cowan speak about the character of natural Ecotones as the transition zones between two or more different types of environments or ecosystems.

An Ecotone is a transitional zone between two dissimilar ecosystems and it may be natural or man-made. It is a region of interaction of the two ecosystems and may include species that are specific to the Ecotone (Mattiske 1987: 383).

These are areas of soft (permeable) interface between systems (Folke, Holling & Perrings 1996: 141), and have many of the features of the *Edge of Chaos*, having maximum productivity, diversity, creativity. **Link: Criterion Landscape: Imitating Nature by Design.**

In a human settlement context, Ecotones often happen to take the form of marshland, and have been severely damaged and often drained and destroyed completely for development.

Wetlands, floodplains and pond microfauna are very diverse and locally specialised, and only recently appreciated as key organisms in arid land Ecology (food chain participants at least)

(Pyper 2000: 12-14). Much of the conservationist outcry about the use of the MFP Gillman site for housing was its important status as an Ecotone, in particular being a critical nursery site for the fish fingerlings which grow up to service the local fishing industry. A key point was that mangroves normally migrate many feet per year, with disastrous long-term effects if that migration were interrupted by fixed canal development.⁵ The MultiFunction Polis claimed it would possibly sacrifice some mangroves, but re-establish others.⁵ **Link: Plate 5: MFP Aspirations.**

Van der Ryn *et al* see constructed and accidental social Ecotones as fine strategy points for the promotion of human-nature contact (gardens, villages, diversified family farms) or human social contact ('town-gown edges': the coffee houses of university towns) respectively. The automobile, large development projects, especially highways, and land use separation zoning produce the characteristic simplified human fractal patterns, and militate against these rich and important interactions, often completely wiping out significant social Backcloths with little concern. An admirable detail of the MFP's early plans in the Port Adelaide area was the intention to discover all the socially precious sites such as the casual Sunday fish and produce market, in order to preserve them, using unemployed youth as part of the research team¹¹⁶ (Van der Ryn & Cohen 1996: 131-4). **Link: Plate 5.**

Ecotones should thus be recognised in design as Attractors, for both social and commercial purposes, and in conservation strategies: an excellent multi-function opportunity.

10.9.6 DIFFERING SCALES OF OCCUPATION OF LANDSCAPE

Different animals and plants are said to 'occupy the Landscape' at different scales. Where an animal has a large territory, sightings may be scarce unless there are daily or seasonal congregation patterns. Territoriality creates Population and Biotic problems when, for instance, animals are displaced by land use change for 'development', or when single native species are favoured by clearing or human contact. Such displaced creatures do not 'go somewhere else', they die unless they can adapt to human presence or appropriate another's territory, in which case the dislodged animal dies. If remnant patches of vegetation are fractions of adequate territory sizes, there will be ongoing competition and stress over survival (Allen & Hoekstra 1992: 87).

The apparent absence of a species from a Landscape may indicate a naturally large territory, or it may indicate a threatened population. Conversely, it is not ecologically wise to claim that displacement of a species from a developed Landscape is unproblematic since it is 'abundant

elsewhere'. Not only may the species run out of places to hide, or habitats elsewhere be wiped out by climate change or development, but in every locality the species present perform specific functions, and if there is no species redundancy to take care of perturbations, the niche will collapse and the relevant Ecosystem in its current form with it (Folke *et al* 1996: 1022).

Humans also occupy Landscape at particular scales, and the area occupied has extended substantially with the increase in mobility enabled by modern transport (many animals occupy similar group territories at enlarged scale, as well as smaller scale home ranges, as in habitual migration; but like humans, many plants and animals now occupy a global Landscape thanks to modern transport and trade).

Technology has enabled the concentration of many human domiciles in a small area, but this is dependent on import/export solutions to supply lines; the appropriation of other countries' carrying capacity is discussed under Indicators. **Link: Criterion Ecocycles: Ecological Footprint.** Human territoriality is supported by land 'ownership' systems, the entire Dominant Western Ideology, and ultimately, by guns.

Community Title, intended by the late Don Dunstan in SA, finally achieved on behalf of foreign investors in resorts, is now available for eco-villagers who want to experiment with new tenancy arrangements, including collective ownership of the matrix of a large residential property. This is creating interesting shifts in concepts of Landscape occupied and new options for local Biosis.⁵

Globalisation carries an invitation to world citizenship. We now more than ever need to personalise, integrate and take responsibility for all the scales we now inhabit.

10.9.7 BIODIVERSITY & HUMAN COMMUNITY

Biodiversity is just as important to humans as ecological beings and economically, as it is to the endangered species to which so many of us are indifferent, as we pursue the recommended market and consumption-driven lifestyles, and continue to clear natural landscapes for development at unsustainable rates.

Recent developments in Gene Technology signal the probability of a new era of private Eugenics, Agribusiness impacts on local species (for instance through pollen drift, trans-specific jumping), social and environmental effects (from displacing dairy farms or old growth forests with genetically engineered silviculture), or possible health effects (such as allergic reaction to

¹¹⁶ See BP 5.1.

undisclosed genetically modified proteins), which demand serious Community reflection and action, and soon.¹¹⁷

As the devastating effects of pesticides are revealed over time (for instance see Lappé 1991: 32-42; Shiva *et al* 1991: 8; Short 1994: 199-218), Integrated Pest Management and Organic or Bio-Dynamic methods are already emerging as alternatives to the above.¹¹⁸ **Figure 43: BIES: Biodiversity & Integrated Pest Management (IPM)** explains the principles of a more orthodox approach taking a convergence path to similar strategies.

Diversity within the human race is also a serious issue for us genetically, biologically, dietetically, agriculturally, personally, spiritually, economically, ecologically, culturally and politically: we have not evolved with such diversity, and our 'hard-wiring' appears to respond to an earlier advantage for vanquishing people who look different.¹¹⁹ The relationship between social and racial subgroups is the business of Population and Community. In situations of competition for scarce resources, xenophobic responses often lead to social injustice and ultimately war. In Australia we have been warned through the emergence of the Pauline Hanson phenomenon in 1996, and ugly responses to an increase in refugee numbers since 1998-9, that such sentiment lies at shallow depth. 'Peace' is a globally agreed component of the Earth Charter.¹¹⁹ There are signs of a return to Nationalism and NIMBY (paranoid) Localism as responses to globalisation processes. Control issues (both in design styles and community behaviour such as 'minimum tolerance' policing or promotion of 'stranger danger') become more prominent, the more frightened people become.¹²⁰ Human relations and conflict management are very likely to be strong preoccupations in the coming decades. I would argue that we must learn to see each other 'I-thou', or increasing suffering will ensue.

Yet at larger (slower) scale, an unprecedented process is unfolding: humans of all races and nationalities are moving all over the world and interbreeding. For instance, 400 years after Portuguese invasion, a large proportion of coffee-coloured, very mixed race people has emerged in Brazil.⁵ **Link: Models & Mindscapes: Human Settlement Ecology & Metaphor: Maruyama quotations re Malinké.**

¹¹⁷ For up-to-date discussion and news on this topic see GeneEthics Network listserv: geneethics@acfonline.org.au.

¹¹⁸ Organic and Bio-Dynamic producers are already unable to fulfil the demand from overseas: personal communication Organic Growers Association.

¹¹⁹ This is a global scale, multi-national, bottom-up effort, (albeit with powerful fire soul leadership), to write an ethical foundation for reference by all those seeking to implement an ecologically and socially responsible approach to life and behaviour on this planet. It was initiated at the Rio Earth Summit, and has since been driven by such luminaries as Maurice Strong and Mikhael Gorbachov. There was initial resistance to the inclusion of 'peace', until the recent war in Kosovo, after which there was suddenly unanimous approval.⁵

¹²⁰ It is well known amongst Transactional Analysis therapists that a paranoid position 'looks angry and feels scared', so that the appropriate transaction with such a person lies in soothing the frightened Child within until Adult reason can

10.9.8 BIOTECHNOLOGY

The Australian Government has placed most of its economic bets on commercial MicroBiotechnology, gene manipulation, drug development and the like. This risks being powerful mechanistic interference in natural processes, with the delayed side effects that usually plague technofixes, enabled by increasing knowledge of DNA structure and subcellular scale mechanics (for instance cell wall and receptor structure). From our experience so far with Genetically Manipulated foods, a respectful, ecological approach is definitely not being prioritised.⁵

The EPP approach to Biotechnology is based on careful observation and imitation of Nature. This has been emphasised by Mollison in *Permaculture*: Nancy Jack and John Todd (*Bioshelters, Living Machines*), Howard and Lyle (*working landscapes*) and Lovins *et al* in *Natural Capitalism* (*Biomimicry*) (Hawken *et al* 1999: 14-15; Mollison 1988; Todd & Todd 1994: 64-75). The types of technologies being developed through Biomimicry and Coevolution with the natural world, include enclosed EcoCycle systems linking sewage purification, aquaculture, other food production and gas production, constructed wetlands and toxic site rehabilitation.⁵ **Links: Criterion Landscape: Fractal Impact Assessment: Ebenezer Howard, Urban Landscape: Lyle; Content for the Framework.**

10.9.9 THE BIOTICS OF BUILDING

Habitats are cleared and biodiversity lost through 'development', which implies both clearing for housing and for the provision of building timber. Insult is added to injury with the use of pesticides for termite control, but termites are a serious economic problem, so must have effective management. EPPs would like to see a complete cessation of logging of non-plantation timbers, particularly of wood chipping of old growth forests, and particularly of tropical and temperate hardwoods. Regional Forest Agreements are seen as a sham providing certainty for the forest mining industry, a perversion of the intended Montreal Protocol process¹²¹ (see Commonwealth of Australia 1997).

A number of works are available to guide designers of housing and selection of timber products for structure and finishes, and in producing designs (MTR design – Minimum Termite Risk), moisture control and barriers (Termi-mesh, crushed granite), that discourage termites rather than poison them (for instance see Bonney 1997; Gray & Hall 1999; Verkerk 1990). **Table 79:**

again take the executive. This is a Nurturing Parent role, and frightening, Controlling Parent behaviour actually does much to escalate the paranoia and increase the danger, especially where children or the childish bear arms.

BIES: Ecological Status, Resistance & Durability of Australian & Tropical Hardwood

Timbers provides background for informed timber selection. The EPP purism would be 'no forest papers' and 'only plantation timbers', with the caveat that old growth forests should not be sacrificed for plantations to be established. **Link: Criterion Ecocycles: Molecular Pollution: Carbon Emissions Trading.**

A completely new threat is now arising from plans to sequester carbon through silviculture, again without adequate protection of forests, rather than restricting plantings to cleared land or particular species. Bonney has demonstrated that indigenous tree and shrub products have a wide range of highly lucrative but under-recognised commercial uses (Bonney 1997).

¹²¹ The targets set by these processes (usually saving in reality only 5-15% at best) are far too low to preserve the critical 30% matrix needed to sustain ecological habitat systems⁹ (workshop, Biodiversity Conference Adelaide 2000).

10.10 CRITERION: ORGANISM

10.10.1 CRITERIAL ESSENCE

Tangible and intangible boundaries (**Links: HT/CDS**) delimit system processes, define self/not self, and interface between interior and exterior. This Criterion is interested in how that delimited system functions and what its health needs are (needs to be met if it is to remain within its Sustainability Space). In a human settlement, boundaries are most commonly physical, social and statutory, but every Hierarchy type and every Criterion has its boundary type(s), and Criterion Organism is an appropriate heading under which to reflect on this (say through a matrix All Criteria x extent), although much action must be intuitive and is obligatorily local in planning contexts. **Links: Tool 3.7: Criteria of Observation x Boundary Types; Hierarchy Theory: Boundaries, Surfaces; UHSE: Scale & Scoping.**

As the essence of this Criterion is function, the themes it carries concern whole system function, system element function, and basic needs for system survival and beyond that, appropriate or optimal function, for which we use the terms 'healthy' or 'harmonious'. Thus health is the core concept.

The two main uses of this Criterion are (1) to design optimal context replacement for all organisms (all relevant biota including humans and ecosystems); and (2) the strategy of questioning overall function by using the thought experiment of questioning any functional element or entity as an 'organism' or 'animal'.

10.10.2 ORGANISM AS 'ANIMAL'

At some project stages, the Organism Criterion will be used to think through the functional integrity of design elements, at others, to consider the needs of individual biota or humans, while at other stages it will be used to think through the function as a whole.¹²² A cautionary tale illustrating failure to do this concerns a major public building in Adelaide opened in 1997. It's well-known designer had completely overlooked the disabled (a Population with legally prescribed design requirements). Expensive additions such as a lift and electronic door opening had to be added in haste and out-of-budget after the building was finished: "not a good look" as observers commented. There were many other ways in which this building was a bad 'animal': it didn't function as required acoustically, had a cold and un-nurturing Genius Loci, and certainly didn't take care of the needs of the Organisms (humans) it was supposed to be

designed for, even the non-disabled, with inadequate space distribution, and inconvenient functional arrangements. Local Ecocyclic and Elemental considerations were apparently ignored as well.⁵

Such a functional or 'physiological' (homeostatic) Criterion emerges from the functional interface between all the other Criteria, and so paradoxically, must be considered from the scale below that at which the other components are viewed (as N-1 functional components or mechanism/'organs'), and also from above (as N+x emergent function).

The nature of the entity defines changes with scale. At lower scales it may well be an animal or plant Organism, but below that scale it could be a cell or a sub-cellular body or organ, hierarchically nested in the larger whole. At higher scales it may be seen as a 'super-organism', such as an ecosystem, a Biome or Biosphere. Allen is somewhat diffident about the inclusion of superorganisms, but recent changes in nomenclature have allowed orthodox Science to accept that the Biosphere does behave in a self-regulatory, organismic fashion, as long as this behaviour is thought of as 'GeoPhysiology' and not in New Age goddess terms (Lovelock 1988: 3-14).¹²³

Certain other emergent entities are recognised and reified as organisms, the most obvious being 'the invisible hand' of the Market (after Adam Smith), and the Internet, which is a fascinating Complex Dynamic System operating beyond the control of the usual constraints,¹²⁴ and is actively spawning emergent features such as language, values, etiquette, and group behaviours (such as 'flaming'). Discussion groups also have recognisable life cycles. This has been labelled a "convocational noetic hyperentity" by Emma Rooksby and Dermot Pigott, in a paper presented to a conference on the Internet and ethics in Madrid in 1998: it is essentially an anarchistic system which is self-organising and influenced by human agency to produce agreed principles and cooperative behaviours of many kinds, along with the full range of behaviours and proclivities to which humans are prone, thus reflecting the collective character of its creators.¹²⁵

¹²² The Metaphor 'animal' is chosen rather than 'plant' or other representative, because it is clearly bounded and easier to relate to at human scale.

¹²³ Also from interview with Lovelock, repeated Radio National (Australia) 27/01/97.

¹²⁴ Governments are worried about the unpredictable, *Edge of Chaos* character of the Internet, and some are attempting to develop constraint systems, since humanity's reflection for all to see there and indulge in, is not always a pretty sight, and for some, represents anarchy and moral, even physical, threat.

¹²⁵ Radio National (729kh SA), 8/12/96, "The Moral Map".

Extending the term to human settlements, I have found Organism a useful concept for auditing the function of embedded entities, of systems within systems: such designed elements as paths,¹²⁶ buildings, recreation areas, wildlife refuges or technical entities.

Just as a natural organism has needs for healthy function and relies for functional integrity on appropriate design or structural characteristics, and needs for long-term health, so does any human-constructed system if it is to survive and continue to serve its clients well. Any aspect of a design that needs to function well can therefore be regarded as an Organism, and submit to such questions as 'Is this a good animal?' 'How does it function as a whole unit?' 'What are its needs for healthy function?' 'Is it well?' 'Who are its parents, children, dependents, friends?' 'Who will look after it long term?' 'What does it eat?' (maintenance needs) 'Who will pay for that?' 'Does it have an income, a budget – what will it live on?' 'How long will it live? How do the 'organs' function at the scale of emergence?

10.10.3 NEEDS-BASED DESIGN

An entity is attracted to a site by satisfying a set of needs required to sustain its function during a visit. For entities inhabiting a site long-term, the quality of such structuring is more critical and context replacement is required of management, not just the satisfaction of short-term wants and proclivities. Each of variable has its optimal range, with the whole system is vulnerable or rigidified if any one of these is constrained, to the extent that there is limited physical, genetic or other inflexibility.

Collectively, the Population itself will have a *Sustainability Space* (**Links: Criteria Feedbacks, Indicators**) with limits somewhat different from those of an individual. For instance the survival long term of a Population depends on genetic diversity. Survival of an individual relies more on individual fitness in a given environment. Survival of the Ecocycles in which these individuals and Populations participate depends on connecting loops and constraints remaining intact, on flows continuing and processes remaining functional. It has been usual to discount local extinction of species on the assumption that they are plentiful elsewhere. This is no longer true, and the EPP approach is to restore and preserve indigenous biota. **Link: 'library' or 'museum' approaches below.**

Whether focusing on Community, Organism, Population, Biotics, Landscape or Ecosystem, many of the processes in Nature rely on the presence of disturbance for survival: disturbance, such as

¹²⁶ A new Specialism has been defined: Path Design. This takes account of form, function, aesthetics, vistas and the equivalent of a Script where an unfolding story with puzzles, revelations, reverie spots, varying speeds, purposeful curves

the natural fire régime, is a major issue. Overall dynamics of an area to be disturbed must be understood and worked with if Nature's needs are to be met (Hobbs 1986: 238). Prey needs its predators, many Australian species need the fire régime that is often lost or seriously unbalanced by proximity to housing (with both fire bans and 'firebugs'), and weed sources to bushland areas.

With an Organism Metaphor, one idealises healthy catchments, healthy farms, healthy cities, healthy policies, healthy buildings, healthy environments. Indicators equivalent to biological pathology tests may be used, but 'wellness' or 'health' should be defined first. **Link: Criterion Indicators, Indicators & Sustainability.** There is much reciprocity between healthy function of people and of ecosystems (for instance see Baldwin 1993; Baum, Cooke, Crowe, Traynor & Clarke 1990; Boothroyd 1986; Boothroyd & Eberle 1990; Brown & Barnes 1991; Butz 1992a; 1992b; Collings & Thompson 1987; Commonwealth of Australia 1994b; Costanza *et al* 1992; Degenhardt 1979; Ewan *et al* 1991; Ewan, Young, Bryant & Calvert 1992a; 1992b; Ewan *et al* 1993; Haglund *et al* 1992; Houston & Ferguson 1991; Minister of Supply & Services 1989; Pholeros *et al* 1993; Roudebush 1993; Walker & Reuter 1996; Worsley 1990).

When such function fails and government does not act adequately, NGOs and CBOs tend to emerge. For instance over a dozen environment committees emerged in the East Toronto region industrial area in response to unmitigated health impacts from pollution (1970s-1990s) (Bertell 1993: 12).⁵ MFP-Australia was working with six environmental organisations from the Port Adelaide area. Most areas of Adelaide would not have or need six. Thus number and type of CBOs/NGOs could be a useful local government health indicator.⁶ **Link: Criterion Indicators.**

10.10.4 NATURE'S NEEDS

10.10.4.1 'LIBRARY' VS. KEYSTONE PROCESSES

Having given up on universal biodiversity conservation, biodiversity strategists now speak of saving representative samples of all major ecosystems (meaning habitat types):

OBJECTIVE 1.4

Establish and manage a comprehensive, adequate and representative system of protected areas covering Australia's biological diversity ...

... There are, however many gaps, including ecosystems in arid and semi-arid environments, and native grassland, wetland, and marine ecosystems (Commonwealth of Australia 1996c: 9-10).

However Folke, Holling & Perrings continue to argue that while preserving "genotypic diversity and megadiversity hot-spots", a 'library' or 'museum' approach, are of value to buy time, the

and straights, are all designed in to enhance the experience. Alleécture?

strongest attention should be focused on finding ways to work in with functional ecosystems everywhere, not just in reserves (Folke *et al* 1996: 1102). The patchwork structure of landscapes relies on the regenerative ability of the patches, which form a source for re-stocking after local catastrophes. But species diversity in patches depends on many variables, including patch size, shape (edge effects, interior-to-edge ratio), function, habitat characteristics, range requirements and disturbance régime (Forman & Godron 1986: 199-20). Most Australian reserves are smaller than 100ha, when 10,000ha is regarded by ecologists as an approximate minimum size required for an isolated patch to be able to sustain its species indefinitely (Matisse 1987). An alternative rule-of-thumb is to aim for a minimum 30% natural landscape matrix.¹²⁷ Extension of habitat size can be achieved by connecting patches through wildlife corridors, but most local, state or city governments have yet to take this seriously or follow through its implications.¹²⁸ If not based on ignorance, the library of representative samples proposed above probably has more to do with future commercial potential for human benefit.

Ultimately, economic systems are completely dependent on a sustained flow of biogeochemical services as absolutely “fundamental factors of production” (Folke *et al* 1996: 1019). This is because of the multi-equilibrial, self-organising Complex Dynamic Systems function of ecosystems. Each relies on a set of interacting organisms and Attractor processes, that remains in uneasy balance naturally. It must can cut in and out with environmental conditions, providing stability and resilience to perturbation. This is the great area of coincidence between the needs of all living macro-beings, human, other fauna and flora, macro and micro. **(Link: Criterion Ecocycles: Table: Biogeochemical Services). Table 80: CMES: Nature's Needs** presents Boyden *et al's* appraisal of the conditions necessary to sustain present levels of bioproductivity (Boyden 1990: 31).

Large scale (especially terrestrial) ecosystem studies demonstrate that under stress, individual Population dynamics are more sensitive than the Ecosystem itself, so that Population crashes can be an Indicator for an endangered Ecosystem. This is important because Ecosystems give little warning of trouble before sudden change onto a new Attractor, which can have devastating effect on dependent entities, including humans.¹²⁹ We should thus be extremely concerned

¹²⁷ Professor Hugh Possingham, formerly Adelaide University, North Terrace & Roseworthy: Personal Communication.

¹²⁸ For instance a poorly funded South Australian Government project (*Parklands 21*) is seeking to review the MOSS (Metropolitan Open Space System) to rationalise green space throughout the Adelaide region, by mapping and coordinating the conservation, recreation and other complementary land uses, and devise a 10-year management plan. The excellent opportunity for major, large-scale wildlife corridor linkage will probably be missed, however, as the project is being managed by Planning SA without the involvement of the Biodiversity Unit of the Department of Environment, Heritage and Aboriginal Affairs, and the winners of the tender have most strength in Development Project Planning and Real Estate. Nor will the \$120,000 funding anywhere near cover the public consultation such an objective would require.

¹²⁹ Note for example the sudden and devastating human effect of the ‘sudden’ collapse of the Nova Scotia fisheries in recent years, or the ‘sudden’ appearance of salinity across wide areas of Australia (actually an 80-100 year lag) and the

about the exponential rate of species loss across Australia: the cashing in of the Extinction Debt of 100 years ago, let alone current behaviour.

Animals are well known for their sensitive indication of habitat integrity (Forman & Godron 1986: 250), the more heterogeneous the Landscape and the Biota (which support each other reciprocally), the more resilient the Landscape (subject to the connectedness issues mentioned under Hierarchy Theory). However by an unfortunate socially-driven inversion, single species that happen to be endangered, are often selected for public attention and conservation campaigns. This makes it easy for people who do not understand the linkages between Population and Ecosystem, to decide that 'nobody cares about a stupid purple-eared fork owl anyway', or 'we can not afford to lose jobs', and easy for lovers of furry or feathered icons to not realise the importance of unattractive things like insects, snakes and amphibians, or the whole habitat.¹³⁰ Incremental change also tricks people into complacency, a condition readily reversed if one asks an 'old-timer' what a place used to be like. Link: Rheotics: Incremental Change.

Small numbers of 'key process species' ('ecological engineers') have been found to drive these critical processes. The identity of the set of species that exert this control changes according to environmental condition (Folke *et al* 1996: 1019-20), so that in a changing environment, a full range of sets is important for ecosystem resilience,¹³¹ acting as a type of 'insurance', maximising system capacity to buffer disturbance (Folke *et al* 1996: 1020).

The example given by Folke,¹³² referring to semi-arid grasslands in eastern and southern Africa, relies on a number of studies from 1986-1995. At least two ecosystems represent equilibrium states: grass-dominated and shrub-dominated (this balance is familiar in Australia, with an unstable Ecotone between grassland and woodland, often modulated by fire régimes, and in the past, by Aboriginal burning practices),¹³³ (Bowman & Brown 1986: 166-8; Clark 1979: 35; Horton 1982: 237-8, 242-3, 246; Nicholson 1981: 62-6). The grassland has two potential control systems, one deep-rooted system resistant to bursts of intense grazing and drought, and with high water-holding and soil stabilising capabilities, and another which does well in high rainfall and low grazing conditions, being less stable but better at accumulating biomass.

current 'sudden' loss of small bird species throughout the Adelaide Hills (personal communication Prof. Hugh Possingham, 2000).⁵

¹³⁰ Another unfortunate phenomenon has gained strength recently: a resurgence of TV-promoted germ-phobia, for commercial gain. This is a microbial scale discounting of biodiversity. The suspicion is emerging in medical circles that the worryingly high and rising level of asthma and allergy incidence in children may be related to households being 'too clean', that is young children may no longer be contacting enough microorganisms to tune their immune systems appropriately.⁹

¹³¹ Folke uses this term where Holling would say 'Stability'.

¹³² Refer also to the Allen & Hoekstra example under Hierarchy Theory.

¹³³ 'Firestick farming': term, coined in 1969 by Jones (Horton 1982: 237).

With such a system, a range of environmental conditions is covered, but this biodiversity is gradually reduced if the area is managed to have a steady grazing pressure, favouring the high biomass version, which reduces resilience, increases sensitivity to environmental change and sets up the conditions for a flip-over to a woody shrub Attractor following drought (Folke *et al* 1996: 1020).

Clearing forest or woodland to artificially create grassland leaves bare earth without established ecosystem structures. If this insult is followed by planting with shallow-rooted exotic grasses or monoculture crops which fulfil no ecological purpose, and forest functions are not replaced, or retained to a level in Australia estimated crudely at between 30-50%, then an 'extinction debt' based on ecological, climatic and genetic impact is created.¹³⁴

The role of constraints and limiting factors was explained under Hierarchy Theory. If humans remove constraints, these must be compensated for. In this sense, there would be no Australian vegetable garden, private or market, that is inherently sustainable (all depend on irrigation, if not artificial fertilisation and pest management). Since we must eat, and hunter-gathering is no longer an option, we accept these unsustainable practices, but EPPs invite people to consider using indigenous native plants for ornamentals, as they are capable of surviving under existing local constraint systems and take care of their own survival needs, in addition to providing a Backcloth that can meet the needs of local biota. Deep-rooted or perennial crops (such as native grasses, nut and fruit trees and vines), are better suited to ecosystem enhancement and emphasised by 'Permaculture': 'permanent agriculture'. **Links: Criteria Landscape: Landscape Ecology: Figure 36: Deep-Rooted Prairie Plants; Connectivity: Integrative Strategies.**

10.10.4.2 BASIC NEEDS OF URBAN BIOTA

Survival of wild biota in urban settings is even more critical than for semi-rural areas and outer suburbs: what can be done if there is no habitat to save? In fact, despite massive extinctions, a surprising amount of wildlife still inhabits the cities and suburbs. The full range of habitat conservation and matrix connection strategies is available, with techno-context such as artificial nesting boxes for some species to substitute for tree hollows. But there will always be

¹³⁴ The extinction debt reflects the species that are expected to disappear due to these impacts, but which are still present due to the lag of 50-200 years between the impact and their disappearance (Prof. Hugh Possingham, *Applied & Molecular Ecology*, Waite Institute, University of Adelaide, personal communication). Examples include long-term ecological changes due to damming and using River Murray water, preventing the regular flooding on which riverine biota depend; relict nature of old gum trees around Adelaide: surrounded by urban development are no longer in a position to reproduce, and genetic stock will be lost when they die unless seed deliberately collected and propagated: experience has shown that locally adapted indigenous species need to be planted in any locality for best regenerative effort (Carol Shields, owner of *Wirrascape Indigenous Plant Nursery*, Adelaide, personal communication); escalating species loss (especially small birds) in Adelaide Hills; expected loss of mulga (*Acacia aneura*) when mature trees die, in areas of outback Australia where rare seeding events (requiring wet Winter followed by wet Summer) have failed due to

differential effects from competition, shared spaces, children, domestic animals, exotic plants, changed diet (for example fruit), fence design, location of water, availability of breeding places (lack of tall trees, prickly shrubs) and population pressures. Local biodiversity knowledge is obviously required.¹³⁵ Other issues to consider are the mitigation of pollution, pesticide effects on reproduction, in diet and on balance of diet species, noise, lighting, road kill, heavy metals and other chemicals, gases (Spellerberg & Hardes 1992: 74-81).

(Helpful resources include Berwick & Thorman 1999; Commonwealth of Australia 1996c; 1999a; Dendy 1987; Dramstad, Olson & Forman 1996; Folke et al 1996; George, Brouwer & C.B. Alexander Agricultural College 1996; Glanznig & Prideaux 1999; Long 1999; Peck 1998; Platt, Rowntree & Muick 1994; PPK Environment & Infrastructure Pty. Ltd. 1999a; Saunders, Arnold, Burbidge & Hopkins 1987; Thackway & Stevenson 1989; The City of Newcastle 1997).

The most important characteristic of an organism is that capacity for internal self-renewal known as health. There are two organisms whose processes of self-renewal have been subjected to human interference and control. One of these is man [*sic*] himself (medicine and public health). The other is land (agriculture and conservation).

The effort to control the health of the land has not been very successful. It is now generally understood that when soil loses fertility, or washes away faster than it forms, and when water systems exhibit abnormal floods and shortages, the land is sick.

Other derangements are known as facts, but are not yet thought of as symptoms of land sickness. The disappearance of plants and animal species without visible cause, despite efforts to protect them, and the irruption of others as pests despite efforts to control them, must, in the absence of simpler explanations, be regarded as symptoms of sickness in the land organism. Both are occurring too frequently to be dismissed as normal evolutionary events (Leopold 1966: 272-3).

10.10.5 HUMAN HEALTH & SUSTAINABILITY SPACES AT DIFFERENT SCALES

10.10.5.1 INTRODUCTION

Health is an elusive concept, often defined by teleology or exclusion. Some positive definitions for individuals and collectives include:

The state of dynamic equilibrium between the organism and its environment which maintains the structural and functional characteristics of the organism within the normal limits for that particular form of life (race, genus, species) and the particular phase of its life cycle (Hoerr & Osol 1956).¹³⁶

Health ... 1. soundness of body; freedom from disease or ailment ... (Delbridge, Bernard, Blair & Ramson 1987).

A state of complete physical, mental, and social wellbeing, and not merely absence of disease and infirmity (Agnew 1965).

selective rabbit & sheep effect on seedlings: Assoc. Prof. Lesley Potter *Department of Geographical & Environmental Studies*, University of Adelaide).

¹³⁵ Casual quizzes on knowledge of local biota (eg by Permaculture Workshop leaders), consistently displays serious ignorance, even in the committed.

¹³⁶ **Links: HST: SOS; Criteria Feedbacks, Indicators: Sustainability Space concept.**

Human health in any society is that physical and mental state that would have been likely to ensure survival and successful reproduction in the primeval habitat (Boyden 1990: 42). [*One of three definitions*]¹³⁷

The WHO for its 'Health for all by the Year 2000' Project:

Health is defined as the extent to which an individual or group is able, on the one hand, to realize aspirations and satisfy needs; and on the other hand, to change or cope with the environment. Health is, therefore, seen as a resource for daily life, a dimension of our "quality of life," and not the object of living; it is a positive concept emphasizing social and personal resources, as well as physical capabilities (World Health Organisation 1986).

The respected UBC Centre for Human Settlements (communities):

A healthy community is a community in which all organizations from informal groups are to governments are working effectively together to improve the quality of all peoples' lives (Boothroyd & Eberle 1990:9).

This definition updates an evolutionary path through emphases on patient (medical model), personal responsibility (often 'blame the victim'), health field (without social quality), community of interest, geographical territory, and community as actor, to a process and partnership model (Boothroyd & Eberle 1990: 1-7).

The national Network for Healthy School Communities associated with the Australian Community Health Association and the Australian Healthy Cities Pilot Project circulated an application form to schools:

A Healthy School is one that is continually creating and improving those physical and social environments and expanding those resources which enable all members of the school community to support each other in performing all the functions of life and developing themselves to their maximum potential (Network for Healthy School Communities, ACT, adapted from Duhl & Hancock 1986).

There have been few attempts in the practice literature to define human needs or health itself exactly. Psychotherapy (Transactional Analysis and Logotherapy personality theories), alternative Economics (Max-Neef's Human Scale Development), marketing and personal growth (Maslow's triangle), Wholistic (and Preventive or Wellness) Medicine¹³⁸ (High Level Wellness), Nature-Guided Therapy (Burns), Clinical Ecology and Human Ecology (Boyden *et al*'s Integrated Wholistic Research) are the chief sources from which this work draws. Those I collected are summarised in **Table 81: CMES: Human Needs - Summary**. A considerable literature on Environmental Health, Epidemiology and poverty-related health in LDCs is available for global scales. **Link: Healthy Cities (below)**.

References to physical needs are elusive. For instance exercise is crucial but the optimal amount and type are very individual-specific; the RDAs (recommended daily allowances) for particular

¹³⁷ As a nutritionist, this is the definition I prefer. See "*The Stone-Age Health Programme: Diet and Exercise as Nature Intended*" (Eaton, Shostak & Konner 1989).

¹³⁸ Never in my 7-year medical training (1960-66) was the question of basic human needs discussed. The term 'health' was on one occasion defined in terms of non-illness. Review of all my texts and some others in Psychiatry, Psychology,

nutrients are often worked out by assuming that the average intake in Western societies is an indicator of optimality, and biological individuality can also be crucial. I will not dwell on this, but it was a subject emphasised in the Fellowship programme I undertook in Nutritional Medicine, which distinguished between individual requirements, minimal levels to prevent illness, optimal intakes and therapeutic dosages.¹³⁹

Such issues may not be felt to be relevant in MDC planning, but urban design needs (*inter alia*) to facilitate exercise (for instance see Wright *et al* 1996), to reserve land for communal food production as densities increase, to specify provision for the extra loads required for rooftop, wall and balcony gardens, and to retain a local bushland matrix undeveloped. Advice may be required for such products as Atlantis recycled plastic 'Drainage Cell' systems as a lighter option for rooftop garden structures.¹⁴⁰

10.10.5.2 WHOLISTIC & PREVENTIVE HEALTH

Like ecosystem health, human or other living entity health can be viewed as depending on maintaining the organism in a Sustainability Space. The EPP position of all such matters is preventive and precautionary **Links: Introduction to Dissertation: Precautionary Principle; Criterion Feedbacks: Minimal Models, Monocultures & Medical Models.** It is significant that the Australian Government Medicare system specifically excluded all preventive health consultations until about ten years ago, when it accepted Papanicolaou smears and other preventive monitoring suggested by mail notice.¹⁴¹ The Medicare Schedule for November 2000 announces a new item number for comprehensive 'health assessments'. But only for those over 75 years or Aborigines over 55 – far too late for measures to be truly preventive or cost-effective, but a bonanza for cash-strapped GPs. Health screening is still not supported, but health maintenance in symptom-free patients now is, as long as from ones own GP and no 'medically unnecessary' tests or procedures are undertaken (Commonwealth of Australia 2000b: 18, 32-4).

10.10.5.3 HIGH-LEVEL WELLNESS

This 25-year-old concept relates to positive EPP health attitudes.⁵ Ardell produces a 10-category 'Wellness Inventory' and 'Health Hazard Appraisal'. He uses the 'Wellness Continuum' developed by Dr John Travis of the Wellness Resource Centre, California, which is a simple

Medicine and Surgery, discovered no mention of basic needs for health, but note the very modern dynamic equilibrium definition from 1956! I have not traced this definition into more recent texts.

¹³⁹ Australian College of Nutritional & Environmental Medicine, 1998 & previous decade.⁵

¹⁴⁰ Also artificial aquifers, road construction and storm water management.

¹⁴¹ This was regarded as 'touting for business', and doctors were expected to pretend they were not running businesses, on pain of deregistration.⁵

teaching tool for health practitioners (Ardell 1977: 10-20). Travis' Continuum is reproduced in **Figure 44: BICM: Wellness Continuum**. A simpler tool is the continuum: Death ⇔ Clinical Illness ⇔ Subclinical Illness ⇔ Non Illness ⇔ Wellness ⇔ High Level Wellness. Very large numbers of people live in the Non-Illness – Subclinical Illness – Clinical Illness zone, evidenced by rates of health system costs, pharmaceutical drug use, obesity, unhealthy ageing, addictions, depression, suicide rates and many other indicators. Orthodox medicine is really illness medicine. Third Line Medicine picks up anywhere on the continuum, working as a resource to help the patient to move as far right as willing and able (Ardell 1977: 10).⁵ **Link: Table: Human Needs – Summary; Criterion Feedbacks: Minimal Models, Monocultures & Medical Models.**

In the early planning for the MFP villages, I noted that despite providing a wide range of social and health consultants for the Social Issues Design Team, there was inclusion of the usual Illness-Medicine facilities, but no consideration whatever for the Wellness group: alternative therapists, masseurs, nutritionists, health clubs and so on. I also precipitated a brawl with the Electricity Trust of SA by suggesting in my report that no underground powerlines be placed under footpaths, especially places frequented by children, and that any such lines be at least one metre below surface (ETSA's own environmental officer had told me that one can shield electro- but not magnetic wave-forms, which extended about 1 metre).

Proactive Recreation, Crime & Safety and Environmental Health and Fitness Planning are relevant to this category, as is Psycho-Spiritual planning (stillness, Nature contact, Genius Loci).

10.10.5.4 HUMAN ECOLOGY

Boyden, Dovers & Shirlow investigated the assessment of human life conditions as part of their Fundamental Questions Program. Their table of "*Universal Health Needs of Humans*" is integrated into Table: Human Needs above. Boyden & Dovers emphasise that needs have optimum ranges, and may be tangible or intangible (Boyden & Dovers 1997: 11). Similar material is presented in (Boyden & Dovers 1997).

Bridging the LDC-MDC divide in our own country is a particular challenge. A 1987 living environment study in the SA 'Pit Lands' identified nine design-related issues which were used as a basis for a wholistic plan: washing people; washing clothes/bedding; improving nutrition; reducing crowding; separating dogs & children; controlling dust; temperature control and reducing trauma (Pholeros et al/ 1993: vii). A series of publications resulted, useful for those attempting to assist remote Aborigines in developing healthy lifestyles through eco-design (Collings & Thompson 1987;Pholeros 1994;Pholeros et al/ 1993).

10.10.5.5 BUILDING BIOLOGY (BAUBIOLOGIE)

The subtle health aspects of building and urban lifestyle are usually discounted by mainstream builders and developers, and the orthodox medical profession. Bearers of symptoms ('Twentieth Century/Environmental Illness' and 'Sick Building Syndrome') have traditionally been disbelieved, had access to appropriate pathology tests withdrawn or refused by departments of Health,¹⁴² and they are often directed to Psychotherapy.¹⁴³ Yet Environmental Illness frequently includes sensitivity to environmental chemicals, is very common, and in my experience appears to be related to liver (enzyme) damage (inability to detoxify the chemical cocktail modern humans are subjected to, often post-viral)⁵⁹. As testing improves, so does our ability to identify subtle, physical (biochemical) conditions, and hopefully the impact of low levels of multiple toxins will eventually be recognised.¹⁴⁴

In 1994 the School of Biological and Environmental Sciences at Murdoch University, Western Australia set up its course on Pollutants and Toxicology, to support doctors practising Clinical Ecology.¹⁴⁵ At least two institutions actively train Australian doctors in its basics in Health¹⁴⁶ (Rousseau, Rea & Enwright 1988). The Whole Environment Centre (Sydney), once 'ratbag territory', is now often asked for comment on toxic issues (also see Short 1994).

Healthy Buildings International has been assisting large public and commercial buildings with indoor pollution issues since the mid 1980s.¹⁴⁷ Its database of over 2500 buildings shows fungi, dusts and bacteria to be the most common forms of indoor pollution, caused by inadequate ventilation, inefficient filtering and poor hygiene of air handling systems. Owners often reduce settings or shut down circuits to save money, but tenants also contribute through opening windows, excessive people densities, excessive VDU use, partitioning, poor ergonomics, odour generation, and psychological conditions (boredom, repetition). Contaminant levels are rarely dangerous, and a combination of Science and communication are needed.¹⁴⁸ This is clearly a preventive health opportunity; in particular, the need for air conditioning systems at all should be reviewed realistically.

Baubiologie is accepted in Europe, accounting for the insistence there on buildings that

¹⁴² If foolish enough to attend a clinic that specialises in such conditions.

¹⁴³ Which they certainly need by the time the mainstream had finished denigrating them, even if not initially.^y

¹⁴⁴ I would predict that the trouble caused by chronic multiple subtoxic exposures, will turn out to depend on liver enzyme function, as different enzyme systems detoxify different substances as a class, which may well be additive or more (interpotentiating).^y

¹⁴⁵ Course Notes N222.

¹⁴⁶ Australian College of Nutritional and Environmental Medicine (Melbourne); Australian Society for Environmental Medicine.

¹⁴⁷ According to an HBI presentation in 1990, polystyrene can be detected in the bloodstream three minutes after drinking coffee from a polystyrene foam cup. This same presentation advised that cigarette smoke was a good 'empirical air conditioning auditor': smoke detectable by nearby non-smokers indicates an inefficient system.⁵

¹⁴⁸ Information from HBI, 1989 and 2000.

'breathe', using insulation such as wool or newspaper mash, in contrast to North America, which specialises in totally sealed buildings with advanced technology such as multi-layered, synthetic insulation products and heat pumps.¹⁴⁹ The School of Architecture in Tübingen⁵ has Building Biology thoroughly embedded in undergraduate courses,⁵ a preventive approach also emphasised in Scandinavia,⁵ but sidelined by Australian Architecture schools, since it condemns such orthodoxies as steel structures for their 'Faraday cage effect', ordinary surface finishes and craft wood (MDF) for their unhealthy outgassing,¹⁵⁰ fluorescent lighting for its ELF and ULF¹⁵¹ radiation impacts (for instance upwards through the floors in multi-storey buildings), and the unnecessary use of air conditioning (few circumstances in Australia actually need artificial climate control where design is appropriate.¹⁵² See **Figure 45: BI: MDF (Medium Density Fibreboard)**: the toxicity of this product and other formaldehyde glue based timber products is in the public domain, but usually discounted.

Likewise glass and other fibrous insulation substances (<10µ), poorly vented workplaces (for instance photocopiers, Commonwealth of Australia 1988: cooling towers; Commonwealth of Australia 1989), and human habitat pesticides ... the list is long and invites attention from Criterion Biotics as well.

The CMHC¹⁵³ investigated housing strategies for and of hypersensitives in 1989-90. They produced guidelines for 'clean air housing' for the environmentally sensitive (Drerup, Mattock, Rousseau & Salares 1991).⁵ Their report, with 10 case studies, has an excellent overview of Clinical Ecology and related building/renovation strategies (Drerup *et al* 1991: 2-9). The SA Housing Trust produced a pamphlet on the subject following their experience in the late 1980s housing the hypersensitive King family on Kangaroo Island.⁵ Indoor pollution is gradually being recognised as genuine issue, but exponents are still denigrated by medical peers. Designing housing for the environmentally sensitive is a specialist area. Such designs usually require plastic-free, hardwood and stainless steel interiors. **Link: Criterion Biotics: Biotics of Building: Table 79: Tropical Hardwood Timbers.**

I visited a 'Healthy House' in Vancouver in 1993: a 'preventive' dwelling, but not energy conscious: a case of 'either/or'.⁵ I then visited a 'Green Home' in Waterloo: an all-recycled,

¹⁴⁹ As seen at *Innovative Housing Conference*, Vancouver 1993.

¹⁵⁰ Mainly the irritant & carcinogenic urea formaldehyde and melamine/urea formaldehyde (Canterbury Timber Products Limited NZ 1995: 2-3).

¹⁵¹ Extra and Ultra Low Frequency. (Maisch 1995).

¹⁵² For example see *Energy Architecture's* Award-winning work on the Prairie Hotel, Parachilna, arid SA interior; RMI headquarters in -30° Winter conditions).

¹⁵³ Canada Mortgage & Housing Corporation.

terminally clever, sealed dwelling full of recycled polyethylene bag carpets and CO₂-blown plastic foam insulation: another 'either/or'.

EPPs try to act preventively and wholistically through their choices of design, building materials and finishes (for instance see Talbott 1993: 1.04).⁵ Talbott's Manual, documenting Findhorn's Ecological Village Project, has tables on *Breathing Roof performance* (5.30), *Ecological Assessment of Building Materials*, *Embodied Energy In Building Materials* and *Performance Comparisons For Common Insulations* from the "Working Papers in Building Biology"¹⁵⁴ and Centre for Alternative Technology.^{155.5} **Table 82: ES: Building Biology Principles** lists the main principles from the Working Papers.

10.10.5.6 HEALTHY COMMUNITIES, HEALTHY CITIES

In 1984 the World Health Organisation proposed a new definition of health (above), and launched a 5-Year Plan the following year: the Healthy Cities Project. This aimed at 'health for all by 2000', particularly through setting up a global sharing network of voluntarily subscribed 'Healthy Cities' that would set up their own inter-sectoral programmes for health promotion, with linkage of competing interests, definition and implementation of action strategies, selection of core indicators, and communication of monitored progress through national and global networks (Worsley 1990: 11). The Ottawa Charter from the First International Conference on Health Promotion (1986) listed the prerequisites for health:

The fundamental conditions and resources for health are peace, shelter, education, food, income, a stable eco-system, sustainable resources, social justice and equity. Improvement in health requires a secure foundation in these basic prerequisites. [*A 'Backcloth' type of definition*].

There are now over 2000 Healthy Cities globally, with 170 in the South-West Pacific alone (90 in Japan). Australia undertook a Pilot Programme in 1987, based in three centres (Canberra City, Illawarra, Noarlunga). The national programme was de-funded a few years later, in favour of the 'Building Better Cities' programme, a top-down, mega-project affair designed to advance large scale sustainability, at a 'no regrets' standard in retrospect, and excluding community.⁵ In 1992 the National Better Health Program (ACT) reported on this replacement Healthy Public Policy approach (Butz 1992a;1992b). The Canberra Healthy Cities project vanished without

¹⁵⁴ C/- Hartwin Busch, Tara Cottage, Rectory Lane, Ashdon, Saffron Walden, Essex, CB10 2ET.

¹⁵⁵ Machynlleth, Powys, Wales.

funding, but has recently (2000) been restored by a committed Minister for Labour. Illawarra has continued on a restricted, medical model.⁵

Noarlunga, which retained its association with the Australian Community Health Network, with an emphasis on community, still has delicate linkages with local Ecology, with a representative on the Onkaparinga Catchment Water Management Board. The Onkaparinga Estuary was cleaned up as part of the Programme, wetlands were developed and 100 of the original 160 native plant species were restored. Healthy Cities Noarlunga includes the Noarlunga Health Promotion Service, of the Noarlunga Hospital, a world's best practice centre, receiving visitors from all over the world. It links with Professor Fran Baum¹⁵⁶ and the Flinders Medical Centre, which does social research and holds annual Healthy Cities Intensives. Healthy Cities has strengthened and extended, becoming an Attractor for large partnership-oriented grants.^{157,158} Dozens of associated projects have been enabled through the process, in Adelaide, Toronto and elsewhere. **Link: Criterion Community: Rebuilding Community.**

The implications of the UBC's process definition of Health Communities, start with a new ability to define HC projects: those that build a supportive Backcloth for inter-organisational and inter-community cooperation, coordination, synergy, proactivity, process-sensitivity, and comprehensive, long-term planning that gets implemented and monitored (action research: planning, indicator development, aware action, monitoring/evaluation). Individual and community health are different: individuals may be well or ill, but communities are judged on their ability to work together cooperatively. Strategic Planning, and particularly Process Planning are crucial. Systemic problems are identified; people are not scapegoated (Boothroyd & Eberle 1990: 7-10).

The 3rd International Conference on Health Promotion in Sundsvall, Sweden (June 1991) was one of a series of major international events in health promotion at the time. It again took a 'Supportive Backcloth' approach to healthy community. Its 'elements to build supportive environments for health' are similar to those of the Ottawa Charter above. In typical Scandinavian fashion, they also list the obstacles to be overcome and provide a workbook full of strategies (Haglund et al 1992: 3-7). Their seven generic strategies were: policy development; regulation; reorienting organisations; advocacy (many forms and voices); alliances/ mediating; enabling (resources, technologies, activities); and mobilising/ empowering (self-reliance

¹⁵⁶ Department of Public Health, Flinders Medical Centre, Head of Department.

¹⁵⁷ For instance \$200,000 for drug education, to a team from Health Promotion Unit, Local Government and others.

¹⁵⁸ Information from Kate Saint, Manager of Health Promotion Service, Noarlunga. See www.healthycities.org.au/.

activities) (Haglund *et al* 1992: 22). **Table 83: BIES: Sundsväl Community Health Strategies: Case Examples** shows the type of case undertaken through such programmes. EcoVillages-in-progress may well be able to identify as Healthy Cities projects. Other emergents at this time (the peri-Rio period) were The Natural Step (Sweden) and International Society of Doctors for the Environment (ISDE: Switzerland):

When, in 1986, I heard for the first time a group of doctors in the Basle areas were meeting regularly to discuss environmental problems, I was taken aback, as I would never have imagined that such a feeling for ecology could exist among Swiss doctors, especially in a region like Basle which prospers above all thanks to multi-national chemical industries. I was further amazed when they decided to launch an appeal by Swiss doctors to the government in order to save the forests. A good 3,500 doctors replied (1 in 4) ... from this initiative the idea to create ISDE in 1987 was born (Nussbaumer 1991).¹⁵⁹

Thus the *health and environment* movement has closely overlapping goals with EPPs: is indeed another version of the Ecological Paradigm.¹⁶⁰

10.10.6 HUMAN PSYCHO-SOCIAL NEEDS

10.10.6.1 INTRODUCTION

Stimulus and Recognition Hunger were the first psychological needs described by Eric Berne following the 1945 research of René Spitz on emotional deprivation. Berne proposed three basic Hungers, the core psychobiological need being Stimulus Hunger, (without which the "spinal cord would shrivel!") (Berne 1972: 21), which has many parallels to food hunger (biologically, socially, psychologically). "The stimulus-hunger, with its first order sublimation into recognition-hunger, is so pervasive that the symbols of recognition become highly prized ..." (Berne 1961: 84). These are core needs, without which the individual will die. They are equivalent psychologically to the lowest level of the Maslow triangle (physical survival needs). Human interaction is said to proceed through a series of Transactions, the unit of social recognition being termed a 'Stroke' (Stimulus Hunger is often referred to as 'Stroke Hunger').

Transactional Analysis also recognises basic needs for Time Structure (Structure Hunger: 6 kinds – Withdrawal, Rituals, Pastimes, Games, Activities, Intimacy) (Berne 1964: 35; Stewart & Joines 1987: 87-95); and Basic (existential) Position (Position Hunger) (Harris 1969; Stewart & Joines 1987: 117-124). All hungers were linked by Berne into the concept of Life Script, each of which is ultimately a unique solution to meeting these needs (feeding the Hungers).

¹⁵⁹ I met Nussbaumer and a colleague in Rio in 1992. They were keen to set up ISDE in Australia. I tried to interest ACNEM and ASEM, but received a very suspicious response: Australian doctors are very cautious about overtly political behaviours. I was approached in early 2000 by a retired activist doctor who sought support with the same goal, responded positively, but have heard no further news.⁵

In the absence of an existential position, one individual can not know how to respond to another. An organisation with a 'You're not-OK' position about its customers has to have an attractive, needed or well-marketed product or coercive power, to stay in business¹⁶¹.

10.10.6.2 STEINER'S 'STROKE ECONOMY'

Stimulus Hunger or Stroke Hunger, which is often displaced into Recognition Hunger, meets a core need for living beings to be stimulated, and can be positive, negative, physical, non-verbal, verbal, conditional or unconditional. The theory of the 'Stroke Economy' developed by Claude Steiner (Transactional Analysis) describes behaviour modification by the reciprocal (internal and external) manipulation of the human need for recognition (for instance in child rearing or the market system). Human individuals are vulnerable to such manipulation to the extent that their self-esteem is insecure, competitive and conditional. They develop 'Scripty' stroking expectations that confirm the Basic Position and distort dissonant realities (Steiner 1974: 105-117). Such Organismic needs and the style of their satisfaction are also culturally reciprocal. This theory is actively and unethically used by marketing personnel with outstanding success. **Link: Figure 46: Maslow's Triangle (Hierarchy of Needs).**

10.10.6.3 LOGOTHERAPY (FRANKL)

The Existentialist Frankl argues persuasively, following his experience of concentration camps, for a primary need for meaning in humans, and has a following of psychotherapists who use his insights (Frankl 1962: 99).

10.10.6.4 ECO-SPIRITUALITY

Spretnak, in a spiritual context, repeats Frankl's message:

Everywhere we sought clues to the adult worldview, which would replace the childish one we had proudly outgrown. We discovered that the adult world was brimming over with things to do, both work and diversions ... So endlessly varied and attractively marketed were the diversions that many of us moved unquestioning into the modern world. Others of us gradually realized, with a low level of horror, that there is no inner life in the modern technological society. We retreated with disillusionment we could not articulate into private worlds of reading books or making art or, for some, futile acts of rebellion (Spretnak 1986: 16).

This aspect of Criterion Organism has alignment and overlap with the values underpinning of Criterion Community. Most theories of Psychology do not specify a spiritual need in humans, avoiding the issue.¹⁶⁵ Anthropological works describing the Anthropology-Religion interface may not mention it, describing belief systems, but not speculating on basic needs (Douglas 1992: 300-

¹⁶⁰ One of my learnings from all this exploration has been the essential similarity between my medical work (Clinical Ecology: patient is a person) and my PhD research (Human Settlement Ecology: patient is a city). It is just a matter of scale after all.

302). Sociobiology describes a transcendent progression from nepotistic, reciprocal or phenotypical favouritism to Ascetic Altruism, explaining such behaviours in evolutionary biological terms, with true Altruism as maladaptive behaviour (Lopreato 1984: 195-205, 208). Works that link humans with other primate characteristics, do not mention it (Ardrey 1970: 91; Diamond 1991; Haraway 1989: 162-185)¹⁶² or refer to its possible presence as evolutionary steps or religious equivalents in such contexts as reverence for an alpha or master (Sagan & Druyan 1992: 388). But Jane Goodall reports chimpanzee behaviour that appears to represent awe,¹⁶³ and one news flash recently reported the discovery of a 'God Spot' in the brain.

Seeing the collapse of modern churchgoer numbers and subsequent responses to New Age¹⁶⁴ and fundamentalist resurgence, one may speculate that there is some need to respect a higher-order 'Other'. Many people no longer profess attachment to organised religion, but still claim to be 'spiritual', even following a Christ-inspired lifestyle but eschewing the Church.¹⁶⁵ We do appear to have spiritual needs: a need for meaning and transcendence, which some believe is another step along the evolutionary pathway: we need to reach above our programmed, instinctively-driven selves, because, writ large and accelerated by technology, the instinctive way now implies universal destruction. **Links: Criterion Community: Glue, Values & Spiritual Aspects; Nature Guided Therapy, Healthy Communities, Healthy Cities: this Criterion; Confluence: Ontology.**

In a planning context, the patterns, the Spirit of Place and Places of the Soul (Day 1990) have been mentioned elsewhere. Qualities likely to contribute to meeting spiritual needs are those often found in places of worship: quiet, reflection(s), beauty, presence of Nature, water, special acoustics, elements with symbolic significance, meeting and sharing. **Links: Criteria Community: Glue; Genius Loci; Plates 9 (Places of Soul), 13 (Findhorn: Nature Sanctuary).**

10.10.6.5 NATURE GUIDED THERAPY

Burns (following Pigram) sees human connection to Nature as genetically coded, and a *sine qua non* for health (Burns 1998: 4). His "*Nature Guided Therapy*" explores this relationship at depth and builds an 'Ecopsychobiological Model' for therapeutic application as 'Ecotherapy'.

Traditional wisdom has long held that nature not only promotes health but also heals. Health, according to traditional healers, is a wholistic concept, referring to physical wellness as well as to an emotional and spiritual well-being. A oneness of the person with his or her ecology and cosmology, in itself, means wellness. Disruption of that balanced relationship leads to illness, whether physical,

¹⁶¹ The major Banks?

¹⁶² Ardrey proposes three basic needs for all higher animals: identity, stimulation and security (Ardrey 1970: 91).

¹⁶³ "*Reason for Hope*", documentary, 1999.

¹⁶⁴ Findhorn community earns a very large income from psycho-spiritual training and personal growth groups.⁵

¹⁶⁵ I have a photo of a van in Paris marked 'Jews for Jesus'.

mental, or spiritual. Restoration of the balance, by re-establishing open communication with the forces of the universe, restores health ... (Burns 1998:8).

... an increasing body of research, especially in the area of environmental psychology, demonstrates how contact with natural environments can enhance positive affect reduce levels of stress ... improve parasympathetic nervous system functioning ... increase physical health ... promote more health-oriented behaviours ... reduce the length of hospital stays ... enhance self-concept, self-esteem, and self-confidence ... enhance staff-patient relationships ... and benefit the mentally ill (Burns 1998: 11-12).

All these needs are emphasised here because client, user and Community Consultation so often involves the discounting of real needs and eco-community interests, because this area is of special concern to EPPs, and because our whole market-driven system relies far more on short-term, Pseudo-Satisfaction than on meeting real needs. Pseudo-satisfaction is inherently unsustainable because it wastes scarce resources, is only transiently satisfying and systematically leads to long-term resource drains and Social Traps. **Link: Criterion: Population: Human Scale Development; Confluence: Ontology, Cosmology.**

If design is to centre around human needs and simultaneously around Nature's needs, then the designer must be familiar with what these are, and with the differences between genuine basic needs and discretionary wants and proclivities.

So we are called to wholeness and simultaneously to recognition of our incompleteness; called to power and to acknowledge our weakness; called to individuation and to interdependence. Thus the problem – indeed, the total failure – of the “ethic” of rugged individualism is that it runs with only one side of the paradox, incorporates only one half of our humanity. It recognises that we are called to individuation, power, and wholeness. But it denies entirely the other part of the human story; that we can never fully get there and that we are, of necessity in our uniqueness, weak and imperfect creatures who need each other (Scott-Peck 1993: 14).

Mathews' definition of vital needs is:

... those which a self is entitled to satisfy in order to secure its own flourishing” – in the spiritual, physical and emotional sense, not a narrow egotistical one - freedom from disease and chronic physical & psychological tensions ... consisting in a state of inner harmony and integration of the personality, which is expressed as a positive and creative attitude to life's challenges ... a built-in goal for any self ... Recognition of the equality of selves then does not require that one starve, that one adopt a totally “hands-off” approach. But it does require that one refrain from thwarting the interests of other selves if it is not necessary for one's flourishing to do so (Mathews 1991: 128-9).

And the radical Bishop of Newark, New Jersey says:

... if the Holy God can be understood not as a person, but as the depth and ground of life itself, then the ethical task of the Church becomes quite different. Christian ethics are not found in a system of behaviour control. They are rather found in a call to the fullness of life ... not to judge life, but to enhance consciousness, to expose ignorance and prejudice, and to remove the barriers to life in all its fullness ... to assist its people in plumbing the depths of their own humanity, where transcendence, mystery, being, and even love are discovered, and to bring those qualities found in the center of life into the world. I name that center of life God (Spong 1998: 166).

10.10.6.6 HUMAN SCALE DEVELOPMENT

Max Neef (economist, Chile), has elaborated a classification of a group of Satisfiers of the human needs he has identified through world-wide community consultation processes (**Link: Criterion Population**).

10.10.6.7 MASLOW'S HIERARCHY

Maslow is most famous for having brought an appreciation of 'higher needs' to the work of organisations, the advertising and promotions industry (including the political and media 'spin-doctors') and human resource managers. This has been the key that unlocked the gateway to modern consumerism. They have most effectively set about applying this knowledge by linking their products to unmet needs and especially wants, in the individual human psyche:

... belongingness, affection, dignity, respect, appreciation, honor [and] ... self-actualization and the fostering of the highest values – truth, beauty, efficiency, excellence, justice, perfection, order, lawfulness etc." (Maslow 1968: 221-2).

'Maslow's Triangle' or 'Maslow's Hierarchy of Needs', spells out a hierarchy of three broad categories of need. Those at the base represent survival needs (food, shelter, water, sex, safety); once they are taken care of we can focus on quality of life, and the needs here are more to do with the Basic Position and Recognition Hunger of Transactional Analysis: self-esteem, other-esteem and social recognition. The triangle's apex is taken up with 'Self Actuation'. creativity, ethics and spiritual mastery, and these are often said not to be fulfilled until the others are satisfied. This point is irrelevant to the marketing professional who is much more interested in creating dissatisfaction dramas around self esteem, rushing in with just the right product or infomercial to fill the hole created. See **Figure 46: BICMES: Maslow's Hierarchy of Needs.**

Links: Criterion Population: Human Scale Development & Satisfiers, Designing for Populations.

10.10.7 THE ORGANISM METAPHOR IN ARCHITECTURE & PLANNING: PATTERNS & THE 'ORGANIC LOOK'

Some styles of Architecture are referred to as 'organic', a quality to which EPPs tend to be strongly drawn. Natural, unsophisticated patterns, colours, materials and settings, curves, non-conformist archways, asymmetry and emphasis on function over form are common in traditional styles, especially where the materials do not demand square construction. Allowance made for future extension may result in somewhat incongruous additions and an appearance of having 'just growed'. Like ecosystems, there is something redundant and apparently messy about Organic design, so it is not usually appreciated by the obsessive, yet there is interest and healing in the asymmetric. Day's "*Places of the Soul*" illustrates well the aura of organic places, to which many humans feel drawn (Day 1990). Hundertwasser in his 'architecture doctor' role,¹⁶⁶ converted buildings of oppressive, sterile and soulless appearance (such as 1960s blocks or ugly old factories) to visions of fantasy and imagination by over-riding their square stolidity with mad ornaments, aberrant outlines and extravagant colour. Tenants in his house in Vienna are driven

to distraction by amazed and fascinated tourists (Rand 1991: 208-223).¹⁶⁷ Such buildings are wonderful tourist Attractors.

Downton's concept sketches for the Halifax Project, many elements of which can be seen to be inspired by the leafy complexity of Register's early illustrations of his vision, were regarded by the orthodoxy at the Cities of both Adelaide and Whyalla, as 'weird'.⁵ This is a matter for both ownership and education. Whether weird or not, Downton's strange-looking cooling towers, roof and wall gardens and curved rooves, are designed for function, minimising materials and eliminating the need for air conditioning. **Link: Plate 4: Collage: UEA, Halifax Site Plan.** But where looking 'weird' is a put-off for conservative potential eco-houses, eco-housing can also look very 'normal'. (**Links: Figure 59: Mariendalsvej; Plates: 7 (Metaphor), 13 & 14 (Findhorn).**)

As a citizen, if my project wanted to look for programmes to link into, to promote the eco-social health of my Bioregion and my Community, to obtain a list of the indigenous plant associations for my area, or to ensure that my plans fit in with the international Treaties to which our nation is signatory, is it clear to me where to turn? This should be common knowledge. **Link: Criterion Community (Formal Regulatory Sector; Community Cascade).**

Alexander used the concept of a 'Pattern Language' to help people gather historically tested and loved organic forms into beautiful, functional buildings¹⁶⁸ and precincts (Alexander 1979; Alexander et al 1977; Alexander et al 1975). **Table 84: ES: Organic Order: Principles of Building & Planning for Meeting Human Needs** and **Table 85: ES: 'Large Lump' vs Patterned, Piecemeal, Organic Developments** explain these principles as developed for the University of Oregon (a plan never implemented).⁵

The precise order that emerges as a result of the gradual coordination of hundreds of acts of piecemeal design cannot be known in advance; it can only arise slowly out of a community that is sharing patterns, responding to diagnosis and taking responsibility for its own plans and designs ... if it is to be an open, organic plan, it must grow from the hands of the community itself (Alexander et al 1975: 187).

The organic untidiness of Nature is a survival strategy: an open system needs plenty of redundancy. A Local Government Councillor recently took it on herself to order a Council worker to tidy up a messy area of roadside vegetation. The 'mess' turned out to have been a threatened grey box woodland.⁵ This controlling, 'tidy-it-up', bush-hating mentality lies behind a lot of local scale ecological impact.

The Extended Metabolism model used by Environment Australia as a Backcloth for their environmental Indicators development programme, reflects the Government's resource-focused

¹⁶⁶ A profession he invented himself.

¹⁶⁷ Richard Register (EcoCity Builders), tenant interview, personal communication 1991.

Ideology. Like the input-output model Boyden used for his MAB¹⁶⁹ Hong Kong study, this is really a machine model (Boyden 1979;1984). It would be regarded by some as an Organism model in the sense that it has inputs and wastes, but is not helpful as an ecological model, because its direction of desired change has no connection between the output and input (no Ecocyclic aspect), and has no ecological context (Commonwealth of Australia 1996b: 19). However Organismic Metaphor or not, a machine can still be asked the question 'Are you a good animal?'

Link: Criterion Ecocycles.

10.10.8 'SUSTAINABILITY' & HEALING

For many years we have had evidence of poor health in ecosystems, numerous species, modern ('Western') societies, indigenous societies, our own communities and now the biosphere. There is no point in sustaining a malfunctioning life support system: it and we can not function if not healed, so that must be the first priority, and we must restore it to health and sustain it indefinitely. Ecologically speaking, no development of any size should proceed anywhere without assessing the project against the healing needs of site, bioregion and biosphere, and identifying opportunities to synthesise the project with Community healing processes.

The development approval planner is the Backcloth protector, the strategic planner is the Backcloth vision-synthesiser, the social planner is the Backcloth ownership-builder, the environmental planner is the Backcloth health monitor and the policy planner is the Backcloth backstop, the System Saviour. Could anyone persuade these people to prioritise their holding regular role inventory meetings together with the Community, with a regional healing and maintenance purpose?

¹⁶⁸ Some examples can be seen at Crystal Waters, Maleny, Queensland.⁵

¹⁶⁹ Man And Biosphere.

1.11 CRITERION: POPULATION

1.11.1 ESSENCE OF CRITERION

The essence of the Population Criterion is what or who is where, when and why, or ultimately, the satisfaction of collective needs, from survival to maintenance. The underlying drivers for a Population pattern can be seen as a type of biosocial-magnetism (attraction/repulsion), with links to Chaos Theory, as described above.¹⁷⁰ A place is attractive to animals, plants and humans whose needs, wants, preferences or proclivities are provided for in that location. Populations tend to move about in an attempt to satisfy individual needs and urges. Where this fails, the population may 'crash'. **Links: Criteria Biotics, Organism.** This is most noticeable in animals, but plants also move about in different ways (including leaning towards light, climbing, Ecotone advancement and seed propagation) to optimise needs satisfaction.

Allen & Hoekstra's meta-research in Ecology has identified animals and small plants (species collectives) as the usual subjects of Population studies, as distinct from associations, especially of trees, which are the most popular subjects for Community studies (Allen & Hoekstra, 1992: 43-4). Population (N) is a collective concept, is distinct from its component Organism (N-1), a functionally unitary entity. Population Ecology, Population Biology, Population Geography, Epidemiology and Demography ask such questions through census, survey or head counts, studies of distribution patterns, movements about the landscape, and investigating the drivers of movement that emerges from local Attractors/Repellers ('multiplier effects'). Maps are ubiquitous.

Population studies in Nature often deal with predator-prey relationships and food webs ('eat-and-be-eaten' relationships). Such systems have been found to be well-described by types of Complex Dynamic Systems equations used for complex surfaces in general, in this case the Lotka-Volterra equations mentioned elsewhere (Begon *et al* 1990: 247-56). The same Mathematique can be applied to marketing. Criterion Feedbacks spells out the feedback loop structure for the system.

The Attractors between the individuals in a Population might include mutuality, competition, the strength or stimulus of crowd dynamics or a flocking strategy in response to danger or increased connectivity to scarce food supply, but Population is a Criterion concerning collective relationships between one or two species as a whole, or between subpopulations, including co-evolution: not the webby, mutual accommodations amongst all species considered under

Community. These relationships are clean and clear scientifically for Population (Allen & Hoekstra 1992: 44-5).

The appearance of large numbers of individuals (crowds of humans, infestations of parasites or vermin, aggregations of plants, animals, weeds, suburbs of houses), is an Indicator that points to satisfaction or pseudo-satisfaction's being in progress.¹⁷¹ Patterns of market fluctuations and signals can be seen as surrogates indicating how wants ('preferences') are being satisfied.

The Ecological Paradigm at its most critical, challenges the entire growth-based, market informed economy because it triggers massive consumption patterns and PseudoSatisfier driven productivity, an hubristic activity at the least, in a world where the formula below pertains:

$I = i * m * u * P$ where

I = impact; i = I/M = Impact/energy & Material flow; m = M/U = material & energy flow/utility, service; u = U/P = utility or service/capita; P = Population (Holmberg 1999: 17).

Link: Figure 53: 'The Funnel'.

Pauli expresses the concern we should have:

Time has come to realize that the going will get tough. With an additional 90 million people on the globe each year we have to produce more food every day. Demand for water, shelter, health care, education and jobs will rise exponentially. That we know. How to cope with this, we do not know (Pauli 1997: 1).

10.11.2 POPULATION AT LARGER SCALES

Malthus has frequently been criticized, both by contemporaries and more recent writers, for lack of originality ... But only Malthus had the vision to encompass the system functioning as a whole ... [his] ... approach resembles that of present-day 'system dynamics' ... Malthus was pre-eminently concerned with the behaviour of that system when out of equilibrium ... the most obvious starting point for worthwhile empirical tests of the Malthusian model (von Tunzelmann 1986: 65).

The overshoot and collapse of resource bases by ancient human populations is mentioned elsewhere. The famous views of Thomas Malthus (1766-1834),¹⁷² of Paul Ehrlich ("*The Population Bomb*"),¹⁷³ of *Friends of the Earth*, the *Club of Rome* (Douthwaite 1992; Meadows et al 1972), and modern incarnations such as *Earth First!* are again under examination or reiteration (for instance see Australian Conservation Foundation 2000: 32; Brown & Kane 1994; Gardner 1996; Hardin 1993: 26-38; Meadows et al 1992; Schumacher 1975),¹⁷⁴ but a very touchy subject at international and national levels, and usually ignored locally in all but sensitive ecotourism locations.⁵ Calls for a

¹⁷⁰ (See also Rounsefell 1995a: 396-405).

¹⁷¹ A friend introduced me to the Adelaide Central Market in 1971, a confusing bustle with bewildering choice. She advised: "Go where the crowd is!" It was good advice.⁵

¹⁷² (Blackburn 1996).

¹⁷³ "*The Population Bomb*" and "*The Population Explosion*" were first used in 1954 in a pamphlet widely circulated by the Hugh Moore Fund (Ehrlich 1968: ii).

¹⁷⁴ See <http://www.acfonline.org.au/blueprint> for full version of "*Natural Advantage: Blueprint for a Sustainable Australia*".

Population Policy in Australia are still being avoided by government,¹⁷⁵ and forcefully made most recently by the ACF (Australian Conservation Foundation 2000). One set of discourses concerns refugee intrusion, human rights and the xenophobia of perceived scarcity.⁵ Those concerned about population impacts on ecosystems, many believing 12 million to be optimum, are accused of secret Racialism.⁵¹⁷⁶ Australia presently feeds 55 millions more than its population already (Commonwealth of Australia 1996a: 2-24), and seeks to feed and clothe more, at a time when much of our productive land is under physiological threat. Major concerns involving food supply (Gardner 1996), Population Geography, Demography and Population Policy, economic and environmental migration, immigration (legal and 'illegal') and human rights: related to these Population issues, available for knowledge, but beyond this discussion.

10.11.3 POPULATION AT HUMAN SETTLEMENT OR LARGE PROJECT SCALE

Practical, human settlement work in Population can at least do its best in terms of the well-quoted formulae: optimising population, minimising resource use. Recent research has shown that population dispersal to urban fringes is the least resource efficient way to arrange people, and that high density central urban areas are the most efficient, despite their footprints (Commonwealth of Australia 1996b: 20). **Link: Criterion Landscape: Urban Landscape: Human Scale Landscape & Urban Form.**

The concepts of Satisfiers, PseudoSatisfiers, synergic Satisfiers and Destroyers (after Max-Neef, Chile), fit in here (Max Neef 1994;Max Neef 1991). **Link: Criterion Organism: Needs-Based Planning, Biotic/Human Needs.** Whereas these entities are the Attractors that may draw a Population to a particular place, the psycho-biological needs that draw an individual element of that Population to such attraction (including recognition, stimulus, structure and position hungers in humans¹⁷⁷) are dealt with under Criterion Organism, with overlap emerging at individual house scale for the occupants, but still concerning Criterion Population for non-domesticated and pest biota.

For the purposes of this exercise, human sub-groups are conveniently treated as if they were different species, for instance age cohorts, minorities and interest groups, which can be identified as having distinctive characteristics. This lends itself particularly well to the

¹⁷⁵ Labor parliamentarian Barry Jones coordinated a report on population in 1994, which recommended a number of ecological strategies and the development of a Population Policy for guidance, but no action ensued (House of Representatives Standing Committee on Long Term Strategies 1994: 147-50).

¹⁷⁶ Australians for an Ecologically Sustainable Population membership is in ongoing argument about the best name for the organisation, partly based on this problem.

¹⁷⁷ Recognised in Transactional Analysis as the core psychological needs (Berne 1964: 13-20;Steiner 1974: 36-8;Stewart & Joines 1987: 72-123).

consideration of markets and in business, however this is a dangerous concept, notwithstanding its functional usefulness, as at competitive extremes it can be co-opted to justify unfair remuneration levels, genocide and Eugenics. An EPP would assert that it must be balanced by a caring, collaborative and generous approach that appreciates diversity and community, to be based on love as Maturana understands it. To the EPP, competitiveness as the core virtue is anathema, as it sees Nature as a balance of cooperative and competitive dynamics.¹⁷⁸

In human systems, economic surrogates tend to represent basic needs, wants, values and proclivities. We will move to where we hope or expect to gain economic benefit or basic services; industry shifts to co-locate with cheaper labour forces or with those having particular skills or lack of them. Urban centres of a certain size exert a multiplier effect to the detriment of smaller centres. All these processes have been impacted and many augmented by increased economic Globalisation. Population is the Criterion that measures the outcomes of a supportive Backcloth in terms of located collectives. **Link: Confluence: Cohousing.**

10.11.4 HUMAN SCALE DEVELOPMENT AND SATISFIERS

Human scale Development (HSD) was developed by Chilean economist Manfred Max Neef, through workshops in dozens of countries, both LDC and MDC, in the late 1980s and early 1990s. His 1994 visit to Adelaide was supported by *Urban Ecology Australia*, and a number of us (UEA members) had the opportunity to run his workshops for the public. His basic claim is that development should be for people, and with their participation, as it concerns the manner of satisfaction of human needs, and these are circumscribed and classifiable. This process should create a supportive Backcloth for self-reliance and provide organic linkage in the areas of:

Development \Leftrightarrow needs
People \Leftrightarrow Nature \Leftrightarrow technology
Global \Leftrightarrow local
Personal \Leftrightarrow social
Planning \Leftrightarrow autonomy
Civil society \Leftrightarrow state
(Max Neef 1994: 2).

Max Neef's cross-cultural, global research established a group of nine generic, invariant 'Satisfiers', through which needs are actualised. Examples of these included life conditions, dietary practices, processes and attitudes, and systems of health and education. He discovered that cultural change was about the exchange of traditional Satisfiers for a new set, and he classified the Satisfiers as in **Table 86: CMES: Max-Neef Social Needs** and **Table 87: CM: Satisfiers after Max-Neef.**

¹⁷⁸ The more extreme EPP polarises with the Competition proponent, claiming cooperation as the *sine qua non* for

Max Neef sees poverty and unemployment as an economic pathology caused by revering the system over people, and classifiable in terms of any of the Satisfiers, (such as poverty of subsistence, protection, affection, freedom and so on). He describes a series of stages of identity crisis leading from frustration to stagnation: shock, optimism, pessimism, fatalism with upset basic needs system (due to losses of protection, affection and participation, and isolation and marginalisation) (Max Neef 1994: 2-4). The HSD workshops, which take a number of sessions, and have a community development-and-ownership objective, help communities or organisations fill out a matrix for themselves under the headings shown.

I would add that PseudoSatisfiers and Destroyers can also be synergic, and indeed that singular Satisfiers are actually rare, because people rarely act for a single reason. Satisfiers are not black-and-white good or bad either; they tend to be mixed, and to the extent that they are multivalent (having multiple connections to us), are very difficult to dislodge, for instance car-dependency and cigarette addiction (see **Table 88: CEBI: Multi-Level Policy Implications Of Action To Reduce Impact Of Motor Vehicles Based On Car As Attractor**). The '**Car Table**' was constructed from a combination of author and other entrant recommendations for JVNIC (Rounsefell 1994d: 154-7). It illustrates the extreme complexity of confronting a powerful synergic Satisfier/PseudoSatisfier/Destroyer like the motor vehicle in an Australian context. If a genuine goal of reduced private transport use were acted on, eco-socially supportive alternatives to all Satisfier and PseudoSatisfier components would have to be thought through and prioritised, together with the types of policy levers known as 'sticks', which I would term 'Discomforters'.

Addictions represent a high level of (over)connectedness to a multivalent PseudoSatisfier (eventually a Multivalent Violator). Stimulus addiction is now a serious social problem in Western societies, stimulus being a basic need missed by Max Neef but covered more than adequately by Transactional Analysis. Our market system relies heavily on PseudoSatisfaction, and it seems unlikely that sustainability will be achieved to any great extent until educated consumers come to understand that at least half of the environmental decisions available could be made through the marketplace. As 'groupies' of all types know well, the stimulus of psychological Intimacy, the candid 1:1 personal sharing under conditions of trust and goodwill, is more satisfying, healthy and durable than PseudoSatisfaction or artificially-induced altered states. But a TA rule-of-thumb is that negative stimulus is twenty times more exciting than positive, so if there is indeed a scarcity of positive stimulus, negative is better than none, and 20

times more compelling, despite feeling bad: an important piece of information for parents, social planners and governments.⁵

10.11.5 *DESIGNING FOR POPULATIONS*

If we want to attract a particular species of bird, we need to design a supportive Backcloth to meet *all* its needs and replace artificially any components missing, what Allen *et al* call 'replacing context'. Likewise, if we want to attract people, we need to have a clear idea of the 'market(s)' for which we are designing, and design in some Satisfiers.

For EPPs there will be heavy emphasis on true needs satisfaction, having a full range of Synergic Satisfiers, which differs substantially from the PseudoSatisfiers and Destroyers usually built into the modern venue. For instance a Permaculture conference, often attended by many hundreds, is typically enriched by a wide range of healthy alternatives to the caffeinated hot drinks also served; polystyrene and plastics are avoided; people feel good because trees are planted (usually by them) to account for those destroyed for the paper used; the scraps are recycled or composted; somebody usually offers massages and other hands-on therapies; dancing features local folk-style bands and meals are deliciously prepared from local organic produce. The theme will be related to celebrating, nurturing or healing human relationships to the Earth and/or each other, and the effects of the meeting are typically long-term and beneficial. Newcomers are specially welcomed, billets and ride-sharing will often be organised before or during the conference. Smart dress is irrelevant, but beautiful, hand-made items are often worn with pride and much admired. Venues are unpretentious, costs are low and arrangements inclusive. Alcohol is present but little used, and the whole ambience is of caring cooperation, sharing knowledge and mutual enjoyment.⁵ The hedonistic, self-centred Individualism of (say) a medical conference or any Royal Show¹⁷⁹ event is typically a short-lived and multiply-unsustainable affair.⁵

PseudoSatisfaction appeals to superficial wants, pandering to markets seeking mindless resource consumption for short term gain (such as unhealthy food, poor quality, mass market products of dubious usefulness and durability). Developments seeking short term profit offer 'quick fix', 'bread and circuses' or 'Luna Park'¹⁸⁰, hyperstimulating experiences which in the long term lack meaning and waste resources. Allowing time and opportunity for conversation, topic-related exercises and shared activities turns an 'eat-and-be-eaten' consumer, Population event into a memorable Community affair by which learning and personal growth are advanced.

¹⁷⁹ Institutionalised, annual, rural-based, industry, produce, sports and skills showcase-cum-fair.

¹⁸⁰ Australian amusement parks (Melbourne opened 1912; Sydney, unrelated, 1935).

In designing and suggesting Attractors for a particular site, an ecological approach would start with the basic needs of people and other living entities sharing the site (not excluding fun) (**Link Criterion: Organism: all needs sections; Maslow's Hierarchy**). It looks for ways to enhance a local Sense of Community, in the belief that real satisfaction, which stimulates laughter, play, theatre, mastery, social interaction and other forms of excitement, needs to be based on a celebration of nurturing and diversity in a resource-respecting milieu, rather than mindless consumption.^{5,181} PseudoSatisfaction may be what the television has trained us to think we want, but for those who participate in the deep humanity of Synergic Satisfaction, a vision of humanity at its best is available, worthy of *"The Possible Human"* (Houston 1982).

The OCW Project had a number of subpopulations for whom it was designing (including): casual recreation groups (usually individuals and students from City West campus), sports teams and followers (rowing), young skateboarders, students (accommodation, Planning, Community Arts, Architecture, Landscape Architecture, Eco-science, Horticulture), tourists (international, interstate, local), historians, home gardeners, families, arts and culture patrons, and museum visitors (Adelaide history, Aboriginal, railway, art, sculpture), and buyers of local and Aboriginal art, green technologies, temporary accommodation and healthy meals, tourist packages, rail journeys and local indigenous plants.⁵

For ecological reasons one may also need to design in Repellors and negative Constraints, such as bylaws, fences, visual or acoustic barriers, arduous approaches, strategic species selection or lack of amenity. **Link: Criterion Connectivity.**

¹⁸¹ Transactional Analysis Conventions are renowned for their poor level of consumption of alcohol, social drugs being of low priority when people are having an exciting time directly engaging each other.⁹⁵

10.12 CRITERION: ECOCYCLES

10.12.1 ESSENCE

The decline is not inevitable. To avoid it, two changes are necessary. The first is a comprehensive revision of policies and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used ... the transition to a sustainable society requires ... an emphasis on sufficiency, equity, and quality of life rather than on quantity of output. It requires more than productivity and more than technology; it also requires maturity, compassion, and wisdom (Meadows *et al* 1992: xvi).

Links: (Geobiochemical transformations): HST: Thermodynamics, entropy, Ecosystem Services and cycles.

Complete integration into ecological cycles would require systems thinking, confine human activities (and their impacts) to the smallest scale possible (Bioregion), would limit absolute resource use (with radical dematerialisation, efficiency, parsimony, substitution and similarly management of renewables, reuse, recycling, repair and redesign) produce zero molecular emissions or emit within ecocycle capacity, and would connect waste streams with resource inputs: restoration of EcoCycles, or 'loop work'.

It would above all require capping and reversal of damage to Nature's productivity, reversal of human population trends and a complete redirection of what we value and reward, how we time structure, what we consider work to be, what we count as 'capital' if we are to remain Capitalist, and how we allocate and distribute resources. Hopefully the *Information Age* will facilitate this by 'shifting information, not people', rather than triggering accelerated destruction. Stress, Economic Rationalist conditions, war, disease, famine, climatic extremes and toxic chemicals seem already to be reducing the rate of human population expansion.

This context justifies the presence of Criterion Ecocycles and our attention in human settlement development to minimising flows and pollution (by design, during and after construction), optimising function through our choice of lifestyle, design, materials, location and example to set.

In particular, this Criterion asks the user to put aside the usual linear, 'end-of-pipe' approach to materials, energy and wastes, to take instead, a cyclic thinking approach. This is a key area for imitation of Nature's apparently messy but ultimately highly efficient recycling systems, the medium through which ecological services are maintained. While we call our 'take-make-waste' society 'linear',¹⁸² the pipes export or import our wastes and materials to a higher scale: the system is still cyclic, but so slow as to appear un-moving, especially when the materials dumped

¹⁸² TNS terms (*The Natural Step*). **Link: Figure 49: Urban Metabolism (below).**

are designed to be indestructible (plastics, persistent pesticides and so on). Thus we should say: 'stick to your own spacetime scale!' and go looking for pipes for dismantling or conversion to cycles.

The topics mentioned below barely scratch the surface of what has become an embarrassment of information. Hence the usefulness of such concepts as 'the 4 Rs' and 'the four system conditions'.

Link: HST: Energy & Thermodynamics.

10.12.2 ECOLOGICAL SERVICES

SUSTAINABLE CITY – what an oxymoron if I ever heard of one.

Cities are inherently unnatural and, today, an excellent example of something totally unsustainable. They are places that require enormous concentrations of food, water, and materials in small areas; concentrations far beyond anything nature is capable of providing. Then when all of this is consumed they generate enormous quantities of garbage and sewage that greatly overtax the ability of local natural ecosystems to absorb and breakdown these nutrient-rich wastes ... over two thirds of the nutrients present in human waste are released to the environment as unreclaimed sewage ... closing the nutrient cycle is one of the required building blocks for cities to become ecologically sustainable ... Professor Gerald Smith, Landscape Architecture, Keynote Speaker, Habitat Congress, Altona Victoria, 1994 (Smith 1994).

Basic ecosystem structure and services were described under Energy & Thermodynamics.

Nature's Ecological Services include many systems and cycles of different sizes and frequencies, such as the geo/biotic services local soil building and pollination, and nutrient cycles of carbon, sulphur, nitrogen, potassium, phosphorus, calcium and magnesium, and their larger scale relations with systems for global climate, temperature and atmosphere maintenance, and cycling of energy, matter and water (Begon *et al* 1990: 681-710). Although invisible to markets, the economic value of these services was recently assessed as between 44% and 88% of total world output (minimum \$US2.8 trillion p.a.)(Alexander, List, Margolis & d'Arge 1998: 69-70).

Table 89: BIRR: Ecological Services - Ecological Society of America Metastudy

summarises a massive metastudy released in 1997 which spells out for doubters the serious level of dependence of human economies on ecological services. **Links: HST: Energy & Thermodynamics; Criterion Biotics.**

Ecologists are particularly aware of the cycle of conversion of solar energy to plant biomass by chlorophyll-containing plants ('primary producers'), which flows on to incorporation into carnivores through one consumer chain (direct, simple, classical, such as vegetation-rabbit-fox or grass-cow-human), and which at the same time in varying proportions (indirect, complex, often more important), joins the carnivore chain remains to feed another, detrital food chain. This operates on dead organic matter, to glean the remaining energy, and release structural

nutrients into the general pool: Nature's rubbish disposal and soil building system, courtesy of a large array of detritivores) (Begon *et al* 1990: 361-89; Odum 1963: 45-6). **Link: HST: Energy & Thermodynamics: Figure 9.** Policy makers, urban designers and planners, developers, local governments, householders and agriculturalists have long ignored these connections. For eco-community proponents however, it is a high priority concern, and an area for active application of scientific knowledge, as in composting (for instance see Bell *et al* 1991; Citizen Planners of Ventura County 1992; Clements 1992; Lipkis 1992; Register 1992b; Shireman 1992).

This is often expressed through recommending recycling, Permaculture, organic and Bio-Dynamic gardening, agriculture and horticulture, community gardens, rooftop gardens, urban forestry, composting, vermiculture, food self-sufficiency and EcoCommunity development. Perhaps the most potent change that could be suggested is to reorganise most governance and indicator systems to bioregional scale, with a long-term commitment to zero net inflow and outflow of materials and wastes, working with Ecocycle Net Budgets and reporting progress as described under Criterion Indicators. **Link: Criterion Indicators: Ecological Footprint.**

10.12.3 APPROPRIATE TECHNOLOGY (AT)

This term emerged in the 1970s at the international scale, before technology transfer was contemplated. Famines in India ran in parallel with the dumping of surplus corn into the sea off the USA coast. Hundreds of AT organisations emerged to try to assist LDCs struggling to survive.

The concept was invented by E.F. Schumacher and emerged from a Gandhian Philosophy (Willoughby 1990: 15). Appropriate Technology is defined as "a technology tailored to fit the psycho-social and bio-physical context prevailing in a particular location and period", and its chief goal is the maximisation of efficiency. It overlaps with both Mainstream Technology and Alternative Technology, and is not preoccupied with primitive, low-efficiency, old-fashioned or inadequate approaches to transformation, nor with the high level, efficient, popular nor modern. It is concerned with choice and best fit for the situation (Willoughby 1990: 15, 306-8).

Although proponents of Appropriate Technology been more interested in some fields than others, its practice is applicable to most, if not all fields. It is primarily an innovation strategy aimed at achieving a good fit between technologies and the contexts in which they are intended to operate¹⁸³ (Willoughby 1990: 308).

¹⁸³ Such as new fields like information technology.

This concept is no less relevant in DCs than in LDCs. For instance Dr Bob Fuller¹⁸⁴ in his paper "*Appropriate Technology – a Key to Human Development*" at ANZAAS 1997 described John Neuenhausen's 'technical literacy' approach, which speaks to the lack of environmental, social and economic Impact Assessment in technical studies courses. His simple 5-Criterion AT Evaluation for Technologies covers social, environmental, political, technical and economic impact issues (for example local public participation in decision making, renewable energy use, economic benefits or dysbenefits, local resources and materials, low maintenance). Several examples were described of its highly successful application in Australian Conditions.

10.12.4 SYSTEMS THINKING & INDUSTRIAL ECOLOGY

Industrial ecology is the study of the flows of materials and energy in industrial and consumer activities, of the effects of these flows on the environment, and of the influences of economic, political, regulatory, and social factors on the flow, use, and transformation of resources (Powers & Chertow 1997: 27).

10.12.4.1 Urban Metabolism

The literature on cities as ecosystems started to appear with Systems Theory and the Organic Metaphor in the 1960s, after a quiet period is re-emerging as attempts to synthesise knowledge and strategies after a period of more specialised focus on energy, life cycle analysis and embodied energy studies (for instance Cole 1993; OECD & IEA c1993; Peet 1992), with waste management, and water/catchment management more recently and currently (City of Adelaide & Torrens Catchment Water Management Board 1997; Clements 1992; Hassell Pty Ltd 1997; PPK Environment & Infrastructure Pty. Ltd. 1999a; 1999b; van Buuren 1991).

Much recent ecosystem literature is Landscape-based as described above (for instance Hough 1984; Kunstler 1993; Manning 1979; Platt 1994; Platt *et al* 1994; Spellerberg & Hards 1992; Spirn 1984; Todd & Todd 1994), or Environmental Policy based (Adriaanse 1996; Brown 1996; Bunker & Minnerly 1992; Caldwell 1972; Chertow & Esty 1997; Commonwealth of Australia 1995c; Community Information Services 1993; Cornwell 1997; de Vries & Keuzenkamp 1996; Dietvorst & van Bolhuis 1994; Dillon 1985; Dryzek 1987; Hahn 1989; Hughes & Westoby 1994; Jones 1992; Morah 1990; Norton & Ulanowicz 1992; OECD 1990; Pharoah & Russell 1991; Seneca & Taussig 1979; Shiva 1991a; Troy 1996; Warren 1993; Westley 1995; World Commission on Environment and Development 1990; Zonneveld 1994).

Ecocycles as such are not quantitatively integrated into these, tending to be separated off into such subjects as Human Ecology (for instance Boyden 1979; 1984; Boyden 1990; Boyden & Dovers

¹⁸⁴ Senior Associate, *International Development Technology Centre*, University of Melbourne.

1997;Diesendorf & Hamilton 1997;Dovers 1994), Industrial Ecology and Ecological Economics (Chertow & Esty 1997;Durney 1997;Hinterberger et al 1997;Powers & Chertow 1997;Simonis 1990), Process-Chain Analysis (Breuste,Feldmann & Uhlmann 1998;Simon & Fritsche 1998); Urban Footprint (Foran 1997;Rees 1996;2000;The City of Newcastle 1997;Wackernagel 1999;2000;Wackernagel et al 1993;Wackernagel & Rees 1996), and energy and materials performance. The term 'ecocycles' has mainly been used in Scandinavia (for instance Rolén 1996 written for Habitat II).

The September 1965 edition of the Scientific American was devoted to The City, one article covering "*City Metabolism*" (Wolman 1965). The same journal had an article including all the modern metabolic issues, by Lynch on the need to humanise, green and clean up cities (Lynch 1965).¹⁸⁵

Suddenly after all this, an American group has announced "*Cities are ecosystems!*":

Embarked on a major new trend, educators and scientists are joining forces to build a more comprehensive, interdisciplinary understanding of cities as ecological systems (Breslav,Berkowitz,Nilon & Hollweg 2000: 337).

The major indicator development programme funded by Environment Australia in 1996-8, used the '*Urban Metabolism Model*' to underpin its urban indicator work¹⁸⁶ (Newton, Flood, Berry, Bhatia,Brown,Cabelli,Gomboso,Higgins,Richardson & Ritchie 1998). The linear nature and its old input-output heritage of this supposedly 'systems' model can be seen from **Figure 47: CM: Extended Metabolism Model vs Linear & Ecocycles-Adapted Societies**, which also includes a TNS '*Compass*' overhead projector image and an artist's cartoon of an ecocycling future city. **Links: Loop Work (below); Criterion Indicators.**

The integrative work associated with Boyden through the Man and Biosphere Program (MAB) Hong Kong Study was mentioned elsewhere (Boyden 1979;1984: 7-29;Yanitsky 1984: 37). A wide range of Indicators for materials flows and human life conditions was developed for assessment (not design) purposes, to some of which the reader is privy. This is a general, input-output model (Machine Metaphor), used for comparing cities, with a two-stage approach to scale (environments near and far), and connectivity not emphasised.

Yanitsky refers to its application in Urban Planning in 1984 in terms of "*The Ecology of Town Planning*" (Yanitsky 1984:31-9), although in MAB, cities were not thought of as ecosystems, since

¹⁸⁵ This article is interposed with a 2-page spread by Upjohn announcing a scale change: advanced Biology used to speak of cellular events, but now with the arrival of chromosomal Biochemistry and Pharmacology: "Disease, the enemy of the city ... The increase in non-infectious disease ... The subtle enemy ..." was all now about to be solved through the new miracle of Genetics.

¹⁸⁶ From Project Brief.

they "build themselves by destroying nature" (Yanitsky 1984: 37). They did, however, have the potential to redeem themselves by becoming "included completely in natural cycles" (It is argued here that there is no inherent requirement that ecosystems be perfectly behaved in order to deserve their description, as other natural systems are also capable of positive feedback and destructiveness at a particular scale and simultaneous 'advantage' and 'disadvantage' at different scales.)

The Yanitsky discussion involved and recommended interpretation of data through interdisciplinary effort, at the same time as working at multiple levels simultaneously under the direction of a good generalist.

An extensive, systems-based integration of societal values and ecological principles in Australia, has been the work of the Centre for Resource and Environmental Studies (CRES)¹⁸⁷ at the Australian National University, some of which have already been cited. The *Fundamental Questions Program* (FQP: CRES, 1988-91) sought "to engender and inform public discussion of the implications for Australian society of the need for long-term ecological sustainability". Part I of FQP generated Boyden, Dovers & Shirlow 1990,¹⁸⁸ and Part II produced a series of eleven FQ Papers by a range of social and environmental scientists on different aspects of sustainability.^{189,190}

Boyden *et al's* (anthropocentric) definition of ecological sustainability (for humans) for the "Our Biosphere Under Threat" volume is:

... an ecologically sustainable human situation is defined as one in which the bioproductivity (production of organic matter through photosynthesis) of the ecosystems of the biosphere is indefinitely maintained and in which prevailing conditions satisfy the universal health needs of the human population. (Boyden 1990: 334)

Any response to information flow implies a sensing apparatus. Such apparatus include human sensory systems and technologically constructed sensors, tuned with sensitivity to an array of functional changes triggered in ecosystems. **Link: Criterion Feedbacks: Fuzzy Sustainability Space.**

The flows of energy, materials and information, including technological/industrial processes and their transport by whatever means (modes, vectors, including air, water, wind, transport, wings), are treated under Ecocycles Criterion, but the specific study of the connections and routes has also been accorded a Criterion 'Connectivity' in view of the importance in human settlements of

¹⁸⁷ Of which Boyden is the former Director.

¹⁸⁸ "Our Biosphere Under Threat: Ecological Realities and Australia's Opportunities".

¹⁸⁹ Available from CRES, ANU, GPO Box 4, Canberra City, 2601.

¹⁹⁰ Since this time Boyden has retired as head of CRES and has been instrumental in setting up the *Nature & Society Forum* which seeks to keep the Australian dialogue on ecological, including social, sustainability, active and well-informed.

transport, other infrastructure and service access Planning. These latter connections are not necessarily related to material transformations directly, although they will eventually have that impact. They may be related to design for efficient movement, access to recreation, education or social justice.

Links: HST: Energy & Thermodynamics; Criteria Feedbacks, Indicators, Connectivity.

Commoner and Robèrt (*inter alia*) both use a systems approach to sustainability. Commoner¹⁹¹ inspired environmentalists in the 1970s. Mollison has centred Permaculture around designing working ecosystems.

Distinguishing between 'laws and principles' (top-down attempts at centralised control versus a system for continuous learning, the one nature-based law being the Law of Return), Mollison iterates "sensible principles for our guidance":

Life Intervention Principle:

In chaos lies unparalleled opportunity for imposing creative order ...

Law of Return:

Whatever we take, we must return", or "Nature demands a return for every gift received" or "The user must pay" ... [*referring especially to ecocycles, waste management, replanting to replace trees used for paper*]

Policy statement: [*implementing the Law of Return*]

Every object must responsibly provide for its replacement; society must as a condition of use replace an equal or greater resource than it used (Contracted from Mollison 1988: 12-13).

Mollison also points to our basic and inescapable submission to the Laws of Thermodynamics, and the need to understand their implications in translating sustainable design principles to a site. In this context, constructed systems should have long lifecycles, be low maintenance, be solar-fuelled, sustain themselves and their builders, and offset any energy used in construction by a greater amount of energy stored or conserved over their lifetime. He distils a set of Design Principles for Permaculture:

1. WORK WITH NATURE, RATHER THAN AGAINST IT.
 2. THE PROBLEM IS THE SOLUTION.
 3. MAKE THE LEAST CHANGE FOR THE GREATEST POSSIBLE EFFECT.
 4. THE YIELD OF A SYSTEM IS THEORETICALLY UNLIMITED.
 5. EVERYTHING GARDENS
- (Mollison 1988: 15-16).

Robèrt¹⁹² at the turn of the 1990s used a large international team of scientists to identify what seemed to be the basic conditions for sustainability. A process of distillation finally arrived at four, iterated and explained in **Figure 48: ES: The Natural Step: System Conditions for Sustainability.**

¹⁹¹ In 1992 Commoner was Director of the Center [*sic*] for Biology of Natural Systems at Queens College, Brooklyn.

¹⁹² Robèrt is actually a Paediatric Oncologist at the Karolinska Institute in Stockholm. He initiated the sustainability programme now known as The Natural Step, with the backing of the King of Sweden in the 1980s. This has been so

"If we do not meet these four system conditions we will cut away the very foundation that supports and sustains life"¹⁹³ (Robèrt 1996).

Robèrt claims that to see a lack of energy resources as our biggest threat is a misdiagnosis.

Instead, he says:

... long before we run out of fuel and resources we will have poisoned ourselves through the bringing up of metals (cadmium, lead and other heavy metals). The constantly increasing concentration of heavy metals brought up from below the earth's crust cannot be integrated into the cycles of nature.

The simple System Conditions structure, being absolute, is 'self-auditable', and can be applied in any sector and at any scale. Clearly, in auditing extraction and manufacturing processes, in addition to energy and materials consumption (embodied), life cycle, pollution, transport, distribution and packaging, ecological footprint and rucksacks need inclusion, and a zero emission policy target makes sense (as argued by Pauli 1997). At the same time, economic justice demands that MDCs urgently transfer technology and knowledge to LDCs.¹⁹⁴ Robèrt explains:

These four system conditions are not negotiable, and they are absolute. Furthermore they are not dependent on scale. Either a company is leaning harder and harder on economic dependence on minerals from the Earth's crust, such as oil, or it isn't. Either a company is leaning harder and harder on economic dependence on persistent unnatural compounds, or it isn't. Either a company is leaning harder and harder on economic needs for more Traffic systems - growing out asphalt on green surfaces - or it isn't. Since we now have five billion people on earth, trying to become ten, it is as if humanity were running into a funnel, where the walls of that funnel are those four restrictions. This means that if a company is investing its money in such a way that it is heading towards the wall of the funnel instead of toward its opening - the way to sustainably meet its needs - it will also hurt itself economically. It will be out of business, because the laws of nature are above man-made laws. We already have bankruptcies ... and success stories ... The wall of the funnel is defined by those system conditions that we are not meeting today. The area within which we must maneuver [*sic*] decreases as we become more and more people ... narrower and narrower, because the resources - the fresh, healthy and good resources left to do something with - are continuously decreasing due to violation of the system conditions (Robèrt 1996).

The Funnel topic is resumed under Criterion: Feedbacks (Constraints). TNS also expresses 'systems thinking' by 'simplicity without reduction' or 'thinking at trunk and branch level without getting lost in the leaves'.⁵ This means finding the appropriate scale of consideration, or organising thought and strategic Planning at the level of ultimate cause. **Link: Hierarchy Theory: appropriate scale of study.**

10.12.4.2 Loop Work

Loop work, or refuse-resource coupling, consists in the imitation of natural cycles ('Ecocycles'), returning a 'linear' system to a cyclic one, or 'back to scale'. **Link: Urban Metabolism.** This may be done at different scales. For instance MFP Australia set up the Virginia Pipeline Project in Adelaide, which connected a sewage treatment works to market gardens, taking effluent water and nutrients back to market gardens: a sub-regional scale. At similar scale in China, consultants

successful that it has been taken up all over the world, including by President Clinton's Environmental Advisory Committee (Mollie Harris-Olsen, 1998).

¹⁹³ Robèrt presents these *System Conditions* in many versions; this semi-quoted presentation conflates two versions given in a recent interview.

and multi-national corporations have largely disrupted the traditional ecocycles (nightsoil to fertilise gardens) and persuaded communities to dump sewage in rivers while they buy fertilisers for their crops.¹⁹⁵ The cycling may be at site scale, (composting, reusing own materials), designing lifestyle and loops into family or small community scale systems, as in Permaculture, or house scale, where recycling bins for district scale and worm farms for site scale may be incorporated into kitchen design and site layout (for instance Mollison's Zone and Sector Analysis and functional layout).

Boyden *et al* also advocated keeping resource cycles local through an 'ecocycles' approach to development. Refuse-resource loop coupling attempts to deal with resource and waste management within a city-region.¹⁹⁶ This was a MultiFunction Polis-Australia strong point. The MFP Services research scientist¹⁹⁷ identified 51 opportunities to close refuse-resource loops amongst factories in the Port Adelaide area (MFP Services Company 1992: 27). **Table 90: FRRRES: MFP and other 'Loop Work' (Ecocycles)** presents examples.¹⁹⁸ The brick and paver business was sold as a going concern, only to be withdrawn after tests revealed unexpected heavy metal instability (the project depended on the understanding that HMs were locked into the structure of the brick).⁵ **Figure 1: MFP Industrial Ecology Figure 49: FRRRES: MFP Industrial Ecology**, from an MFP Services Management Report (1992) describes opportunities found in the Port Adelaide industrial region by an Industrial Ecology Analysis of factory inputs and outputs.

As point sources are dealt with, urban-derived pollution is increasingly considered to be from diffuse origins. But intellectual fragmentation misses the export of polluting industries and wastes in its totals. It is well known that the 'urban footprint' extends not just to a city's region but to the global scale (Wackernagel *et al* 1993), with DCs historically importing the carrying capacity of LDCs to their great detriment, and continuing through food and other resource imports and export of wastes and polluting manufacturing and mining processes¹⁹⁹. Dealing with modern human systems that appear to reside at a small scale is problematic. For instance, I phoned our domestic recycling contractor in 1998, asking his opinion of the divided green bin

¹⁹⁴ As promised at Rio and reneged on since (United Nations 1992).

¹⁹⁵ International consultant personal communication.

¹⁹⁶ A number of books published in response to the Habitat II United Nations Conference in Istanbul in 1996, especially those from Scandinavia, referred to 'ecocycles-based' societies without actually defining them (Berg 1996; Girardet 1996; Rolén 1996).

¹⁹⁷ Dr Malcolm Hall.

¹⁹⁸ Others included local social loop closures: identification of local 'sacred sites' for preservation, education strategies (partnership with local high schools) to encourage local availability of skilled and semi-skilled workers, and attention through community group interaction to negative Genius Loci issues (especially local pollution and water contamination), plus community tree planting (Rounsefell 1993b).

¹⁹⁹ And criminals is past times.

system (local recycling pickup). He told me that it was false economy: it appeared cheaper, but the proximity of paper to potentially broken glass and wet organics meant that much of the paper became contaminated. If this happened, the NSW plant (none in SA), could not handle it, and it 'must' be sent by ship to Indonesia for processing, with net increased costs to local government.

As mentioned elsewhere, if the whole entity does not fit spatially or temporally (or conceptually) within the universe of discourse, then the subject is not the whole entity and either a smaller entity is described or the description of the nominated entity is inadequate. Whatever scale, resolution, structure or definition the researcher chooses acts as a filter (Allen & Starr 1982: 18, 21).

Such terms as 'Sustainable Development' or local 'sustainability' are nonsense in the context of urban footprint, with import of carrying capacity, the 'ecological rucksacks' (**Figure 50: ESCM: Process Chain Analysis & Ecological Rucksacks**) that are 'carried' along with (implied by) mineral extraction activities (Durney 1997), export and end-of pipe solutions for wastes instead of materials/waste loop closure, and the multiscale failure of society to address the eco-social necessity of import replacement, a concept now unfortunately considered old-fashioned and inappropriate in a globalised economy.²⁰⁰ **Link: Criterion Indicators: Ecological Footprint.**

Sustainable economic policies must therefore seek to minimize the mobilization of "mass and energy flows relative to the total mass and energy flows of the relevant ecosystem" (Zarsky, 1990). One of the key aims of ecologically sustaining policies must be to ensure that the scale of impact of society in toto is such as to keep the global and regional ecological processes functioning normally. For industrialized societies, this entails a major reduction in per capita resource throughput ... a key example of an approach which explicitly acknowledges and establishes targets for the scale of natural resource use is the Netherlands National Environment Protection Plan (NEPP) (Hare, Marlow, Rae, Gray, Humphries & Ledger 1990: 14).²⁰¹

10.12.4.3 Dematerialisation: Mips, Wasps & Wasds

The *sine qua non* of a successful LDC transition to Western values (which is predicted to be catastrophic, but appears inevitable as things presently stand), appear to be dematerialisation (by everyone, but especially the resource-greedy West, and those who would model on us), and preservation of a functional level of Ecosystem Services. According to Hinterberger and his colleagues, a 'constant natural capital' approach to sustainability is completely impractical and impossible to work with or measure. They propose an easily assessable surrogate for environmental burden, material inputs, given that dematerialisation is a key sustainability goal. This measures materials flows per unit of service (MIPS), and proposes dematerialisation by a

²⁰⁰ (See Jacobs 1984).

²⁰¹ **Link: Criterion Feedbacks: NEPP.**

factor of 10 as a rule of thumb or plausible goal (Hinterberger *et al* 1997: 12). This is a type of Benchmark that could be used for any scale.

If the baseline Indicator scale were agreed to be region/bioregion, this would be a more manageable and tangible level to work at. Calculations of weighted average source points (WASPs) and weighted average source distances (WASDs) have been used as a practical way to quickly assess the dependency of local people on non-local consumption. This is a good educational device and a useful Indicator, but does not give information about environmental impacts as such (Carlsson-Kanyama 1997: 22). **Link: Criterion Indicators.**

10.12.4.4 THE '4 Rs'

The '4 Rs'²⁰²) are now a familiar popular response to waste, pollution and resource scarcity. Parsimony is now an excellent term. Other approaches include policy/economic leverage, resource pricing, internalisation of costs, carbon trading, tradeable pollution rights, and carbon sequestration through plantation timbers.

Apart from the CO₂ and energy embodied in new materials, the development and building lobbies are a significant force against sustainability in their insistence on the constant opening of greenfields sites and the promotion of new housing, appliances and finishes, with enormous waste of all kinds of resources: natural, especially habitat, material, energy, social, sunk capital. Retrofit was a strong message from the three most systems-oriented entries of JVNIC. Recycling of building materials has reached a fine art in the ACT (Revolve waste management near Hume), and with committed architects around Australia,⁵ and a recommended strategy of the RAIA²⁰³:

Figure 51: BIES: RAIA Natural Environment Policy.

I was told at Revolve recycling centre ACT that approximately half the rubbish dumped there was building waste, making on-site waste management an important issue generally, and at Revolve, its organisation and sale by order, a profitable business opportunity. Despite common statements of waste minimisation and management policy, one rarely sees it implemented across the suburbs. The Australian National Training Organisation (ANTA), SA Water, Transport SA and the Local Government ITAB²⁰⁴ are all involved in developing training for waste and water management on building and other worksites: Loop Work in action.⁵

²⁰² 'Reduce, Reuse, Recycle, Repair'. Or as The Natural Step says: 'Recycle, Renew, Reduce, Reform'.⁵

²⁰³ Royal Australian Institute of Architects.

²⁰⁴ Industry Training Advisory Board.

Recycling is not necessarily of economic advantage in a market-dependent system. In disposal terms, it costs no less environmental impact than landfill (Powers & Chertow 1997: 28). However it cost an order of magnitude less impact than using new materials for manufacture. When local government raced to do recycling in the mid 1990s, believing they would have a new income source, I could have told them of the Californian experience I discovered in 1993. Berkeley had been the first place to use the 'blue box' recycling system. It rapidly discovered that one can collect recyclables, but if one does not simultaneously assist the setup of small and large industries to take and use the waste streams, all that work goes to landfill anyway. Exactly this has happened in Australia. Meanwhile, with economic downturn, even with waste loops in place, significant drops in revenue are now occurring from pilfering by the unemployed. I have seen well-organised people with trailers in Adelaide too, picking up recyclables in advance of Council collection. There is social comment in this, but environmental indifference.

10.12.4.5 Molecular Pollution & Energy Issues

Where local molecular production exceeds local system absorptive capacity, leaving a net pollution with health impacts. Indoor air has the characteristics of outdoor air, while also sustaining outgassing and other insults from indoor building materials, furnishing and finishes. This becomes a Biotics issue at critical levels (interfering with or modifying lifeforms). Local point source pollution is a regional scale equivalent of indoor pollution. Again, the EPP position on this is preventive, questioning whether zero emissions are possible or whether the item is needed at all (for instance see Pauli 1997). But the greatest concern has now become the global scale effects of the Accelerated Greenhouse Effect (AGE). While CO₂ is the most discussed, many chemicals contribute, and some, while smaller in quantity, have very much longer half lives than CO₂ (for instance methane: 500 years) Table GHG half lives . In the language of emissions trading, the Global Warming Potential is expressed as converted equivalents to one metric tonne of carbon dioxide over a 100 year time horizon.

Figure 52: BICM: Kyoto Protocol: Global Warming Potentials of Greenhouse Gases lists the six substances of most concern to Climate Change, and argues that carbon trading is a mistaken path. Climate Change substances impact both AGE and Ozone Hole Depletion; some are implicated in both. These are all relevant to preventive design, materials selection or lifestyle change. Links: Criteria Elements: Earth, Climate; Organism: Human Health & Sustainability Spaces: Baubiologie.

10.12.4.6 GREENHOUSE GASES & EMBODIED ENERGY

Part of respecting Ecological Services consists in attempting to live within ecological limits and minimise resource use. As The Natural Step puts it, in our 'Take-Make-Waste', linear society, 80% of the wastes are molecular, such as CO₂.²⁰⁵ This links into the vast Greenhouse literature, transport systems (alternatives to the car), urban form and energy generation through its links with fossil fuels.

The Australian Greenhouse Office is presently overseeing an array of projects, including Housing Energy Rating Scheme and educative materials (as above), a National Greenhouse Gas Inventory, a national Greenhouse Challenge scheme for industry, with a national sectoral Energy Benchmarking programme⁵ and a national carbon Emissions Trading System (ETS) (See Commonwealth of Australia 1999b; Commonwealth of Australia 1999c; 1999d; 1999e). All major industry sectors in Australia are currently doing benchmarking studies with a view to reducing their CO₂ and energy use impacts.⁵

Local government has its *Cities for Climate Protection* network and activities. ICLEI (International Council for Local Government Initiatives), a global local government institution, is committed to broadcasting news of successful programmes and strategies to all member councils.⁵

The Global Action Plan (GAP)²⁰⁶ is being set up for Australia by a local government in Victoria. This is a sustainable lifestyle training programme, being implemented country by country.⁵²⁰⁷ This works with a different environmental issue each month for six, with (national) data, local action exercises and followup networking.

There is much talk of using renewables, but these also have their impacts, including embodied energy and emissions, and a more thorough analysis of full life cycle comparisons with people-friendly reporting is overdue. Secondary effects are relevant. For instance burning biomass removes it from ecocycles, may release CO₂ or particles, just as burning forestry waste (and logging itself) removes nutrients from the area through increased water runoff. What vegetation should I plant for maximum CO₂ conversion?

... renewable resources are by no means exempt from ecological extraction costs, as they must usually be grown on plowed fields, irrigated, transported and processed. Ultimately this also means that every emission-avoiding provision, energy recycling effort, every solar collector and every disposal has its ecological cost ... when analysing the ecological significance of economic efforts, all resource and energy

²⁰⁵ TNS Advanced Training Program.⁵

²⁰⁶ As distinct from GPA, the Global Plan of Action for the implementation of the Habitat II Agenda.

²⁰⁷ I visited GAP International in Stockholm in 1993. At that time manuals had been produced for USA, Canada, Sweden, UK, and I believe a total of 12 countries. It is based on the Diffusion Principle, and targets 20% of the population in the largest 20% of centres, which should then catalyse message dissemination under its own momentum.⁵

inputs - from the cradle to the grave - as well as the respective land use must be taken into consideration. We refer to these as the 'ecological rucksacks' (Hinterberger *et al* 1997).

An information loop lag is hampering action by concerned individuals. Lenzen²⁰⁸ is one worker starting to correct this, by following up a series of energy and greenhouse gas studies at national and sectoral scales for Australia (Australian final consumption embodiments, Greenhouse and energy cost of living and transport industry), has branched into Environmental Education, and released (April 2000) a simple personal "*Greenhouse Gas Budget*" with instructions for public use (Lenzen 1998a;1998b;1999;2000). But Lenzen's extensive research into energy use and emissions concludes:

... two conclusions can be drawn, which are (1) that personal consumption in industrialised countries like Australia is the main constituent in both total global emissions and their growth rate, and (2) that it is unlikely that emissions in industrialised countries will be reduced to an equitable and sustainable level by technological measures. In view of political inertia and the limited technical potential of limiting greenhouse gas emissions, these conclusions point to an alternative, individual response (Lenzen 2000).

Lenzen's research shows that individual awareness and concern about climate change²⁰⁹ are not borne out in lessened impact, partly due to available information having the focus on electricity saving and recycling, partly due to embodied energy's being ignored by nearly everybody [*excluding architects*], and partly because despite concern, the path dependence of car use, lifestyle, dietary choices and heating requirements continue as usual. Sadly, the only significant behavioural changes demonstrated have been not through better information but through coercion, where the consumer had no choice (Lenzen 2000: 5).

Embodied energy in consumption, of goods, services and food, accounts for almost 2/3 of total per capita emissions, with meat and dairy products commanding "extraordinarily high" greenhouse gas intensities augmented by their additional association with land clearing and animal methane production (10% of total) (Lenzen 2000: 7). Electricity consumption and private car use also stood out (**Table 91: ESBI: Lenzen's "Greenhouse Guide"**).

The strategies recommended by Lenzen to be the most powerful for individual action are shown in **Table 92: ES: Individual Greenhouse Strategies**.

Vale & Vale have worked out the secondary domestic energy consumption figures for the UK, and expect Australian figures would be similar. They specialise in designing buildings with as close as possible to zero bills (running costs). Their advice is that the single most effective personal strategy to save energy and CO₂ emissions is to grow your own food, as food now draws 50% of these expenditures (clearing, diesel cultivators and other technologies, chemicals

²⁰⁸ Research Fellow, Department of Applied Physics, University of Sydney.

²⁰⁹ "70% of Australians over 18 consider environmental protection as important as economic growth" (Lenzen 2000: 5).

and fertilisers, packaging, global freight, waste and spoilage) (Vale & Vale 1997, workshop 7/2/01).

Link: Criterion Elements: Climate.

10.12.4.7 'ECOCOST' OF BUILDING MATERIALS

With building materials, the EcoCost system developed as a PhD thesis in 1994 by Stephen Sainsbury²¹⁰ of Launceston indicated that all else being equal, distance transported was the most significant factor, and so local materials should be a first option.

Other attempts to produce green indices and similar, have been narrowed to too few impacts and have not attempted to provide a composite index able to provide useful comparisons in practice. These include USCEU²¹¹ air quality rating (narrow scope) USA, USEPA Green Seal Program (no comparative appropriateness rating), Canada and EEC 'Ecologos' (a non-transparent private certification system), SCS USA Environmental Report Cards (unintegrated, limited impact set, ignores transport & land degradation, private & non-transparent), Ecological Assessment Factor Partridge Partners Australia (weighted points system, allows comparisons but verifiability & comparative aspects weak). Sainsbury does this by weighting impact contributions from raw materials extraction and production, processing, transportation, construction, reusability & recyclability, robustness/longevity/durability.²¹²

Sainsbury links all these through a unitary scale (0-1) and relates each to land degradation (impact on ecological surface area & biodiversity) toxic impact (toxins, effluents & emissions), energy (generation, toxic outputs) and "*The Bonus Factor*" (indirect ecological impacts [*such as Ecological Rucksack*]), building an algorithm (Sainsbury, S 1994).

His system is designed to address the second of two ecological strategies: to make a trading rule "nothing in – nothing out", or to determine an "*Ecological Balance of Trade*". This was to inform a handbook of EcoCost evaluation with location matrix tables (an office manual for eco-designers) (Sainsbury, S 1994: 16).²¹³ **Link: Criterion Indicators.**

²¹⁰ Special Mention, JVNIC Entry 101, recommended no development and provided Patterns for **Models & Mindscapes: Table 11: Patterns for Sustainability (Sainsbury).**

²¹¹ USCEQ = US Council on Environmental Quality, USEPA = US Environmental Protection Agency, EEC = European Economic Community, SCS = Scientific Certification Systems.

²¹² Source: Paper by Sainsbury for JVNIC Entry 101 paraphrasing PhD, University of Tasmania, Launceston, 1994.

²¹³ Attempted followup of Sainsbury in 11/2000 in Launceston & Hobart failed to discover his present whereabouts.

10.12.4.8 SOUTH AUSTRALIAN RESEARCH INTO DOMESTIC ENERGY USE

Energy is a major component of housing costs and maintenance, and public housing is a convenient captive subject for research, local figures are crucial for making good design decisions. On January 21, 2000, Dr Monica Oliphant²¹⁴ presented results to the South Australian Housing Trust (SAHT) from a long study begun in 1992 in SAHT buildings, which compared the \$ and CO₂ costs embodied in a range of energy-saving strategies and combinations, of water heating (solar, solar shared, gas), tank insulation, thermostat settings at 60°C or 70°C, energy efficient appliances, energy-saving behaviour and household characteristics. Efficient appliances, insulation, solar water heating and zonable houses with good solar access gave the best options for reduction.

Of interest, gas and electric heating had similar CO₂ emissions²¹⁵ (full embodied energy data), and clocks and standby lights in appliances can equal draw for all cooking plus lighting (domestic). Selected results are summarised in **Table 93: RRBI: Domestic Energy**. Pilot flames have similarly been found to waste very large amounts of gas, to the point where they are banned in the USA.²¹⁶

10.12.4.9 URBAN FORM AND GREENHOUSE

The Victorian Greenhouse Neighbourhood Urban Village Study compared the conventional neighbourhood type with a 'greenhouse neighbourhood' (Traditional Neighbourhood Design - TND, of 25 dph), which outperformed the conventional cul-de-sac, 10dph suburb and the more compact VicCode neighbourhood type development (NRD 15dph),²¹⁷ in terms of tonnes CO₂ for heating, cooling and car travel, and had a number of other benefits²¹⁸ (3.7, 6.4, 4.8 tonnes pa/household respectively) (Loder and Bayly Consulting Group and others 1993: 25, 1-5).²¹⁹ It found:

- The design principles that underlie a successful Greenhouse Neighbourhood are based on the concept of an area being highly self-contained in the provision of leisure, employment, shopping and other services.
- The mix of land uses and densities must be such that a large proportion of a household's travel destinations can be satisfied by choices within the locality, particularly for employment.

²¹⁴ Principal Energy Research Scientist, ETSA Power (Electricity Trust of South Australia).

²¹⁵ Electricity in SA is generated from a mix of gas and brown coal from Leigh Creek, with top-up contributions from the Victorian grid that is mainly from brown coal from Yallourn.

²¹⁶ Senior staff, Energy Office Adelaide, Department of Mines & Energy, personal communication 1998.

²¹⁷ Net Residential Density, dwellings per hectare.

²¹⁸ House and garden type and size diversity, service, activity and employment diversity and opportunity, access, amenity and health benefits, sense of community, identifiable place and resource benefits (Loder and Bayly Consulting Group and others 1993: 26).

²¹⁹ These improvements were achieved mainly by increasing residential density, local employment and retail (mixed use, local self-sufficiency), solar orientation and shared walls and floors, together with open grid street system (accessibility), Traffic calming, increased public transport provision and domestic gas appliances rather than electric (:25).

- Of those trips which still need to be made beyond the neighbourhood, as large a proportion as possible should be practicable by public transport as this will minimise the use of cars for regional travel

(Energy Victoria *et al* 1996: 21).

The specific design principles emerging from this study are listed in **Table 94: RRES: Design Principles for Greenhouse Neighbourhood**.

Housing footprint reduction and urban consolidation are gradually becoming established, probably less for environmental reasons than for rapidly reducing free time in dual-career families, and economic rationalist issues in developer budgets. Three JVNIC entries refused to design EcoCity structures on the basis that there was enough development already.

Redevelopment and infill were recommended instead. This approach saved site costs for the Body Shop in the North Carolina, as it reused an abandoned building with trees and parking established already, reused building materials and sold surplus materials for salvage (Rocky Mountain Institute 1998: 12). Cold climates can benefit even more from increased densities (apart from funding better transport systems), as they can set up district heating using cogeneration. **Table 95: RRES: Advantages of Higher Density** lists the findings from a similar study in the UK (1993) by Owens, a participant in the OECD Ecological Cities Project (Owens 1993).

Adelaide is still blighted with empty office space from the 1980s' speculative building boom – buildings that had no supportive Backcloth in terms of need or function. It is good to see that many of these are now being converted to residential, which is needed, but the Traffic they will support, the serviced apartment market, is still questionable as there is a serious shortage of large, affordable, family-sized accommodation, and families who would prefer a city address need a strong supportive Backcloth. Schools are closing and families head for the suburbs once their children need good schools, space, safety and Community.⁵ **Link: Criterion Feedbacks: Cost Feedbacks.**

10.12.5 STRATEGIES: RECAPITULATED

Strategies to work with Ecocycles thus could include:

- 1). Systems Thinking and bioregional rescaling. 'Think in cycles!' and 'Be mean with materials & energy, generous with information!' The Natural Step systems thinking approach to sustainability (The Natural Step 1999a;1999b).
- 2). Protection and restoration of the living providers of ecological services and their habitats.
- 3). Personal, domestic and neighbourhood design approaches to saving energy, materials and Greenhouse emissions.

- 4). Responsible lifestyle, implementing '4 Rs' resource management (doing more with less), personally and in business and industry: the Reduction of materials and energy used (parsimony, efficient design, waste reduction), the Reuse, Recycling, Renewal of the resources used, and the Repair, or long-life modular and/or design.
- 5). The closure or recoupling of refuse-resource loops (MultiFunction Polis Australia (Rolén 1996): rubbish is a resource.
- 6). Rethought housing: solar-, energy- and CO₂- savvy housing, local materials; materials selection for buildings guided by EcoCost, BREEAM, R-2000, other systems.
- 7). Comparative Ecological Footprint studies (Rees 1996;Wackernagel & Rees 1996). See Criterion Indicators.
- 8). The analysis of materials and energy flows (MIPS, WASPs, WASDs). (Hinterberger *et al* 1997).
- 9). Industrial Ecology and Ecological Rucksack analysis (Durney 1997;Hinterberger *et al* 1997):
- 10). Process-Chain Analysis of materials or energy (or any flows at any scale) (Breuste *et al* 1998;Simon & Fritsche 1998).
- 11). Life Cycle Analysis (energy, CO₂, emissions, wastes).
- 12). Environmental Management Systems (EMS) including indicator development, ISO 9000 and ISO 14000 Standards Series.
- 13). Factor 4, 10, X (Von Weizsäcker, Lovins & Lovins, LH 1997). See Factor Four: Doubling Wealth - Halving Resource Use. Refers to factors by which various elements of resource use or productivity equation could or should be increased or decreased in the process of seeking sustainability.

Links: Criterion Feedbacks: Catalysts, Cost Feedbacks, Policy Feedbacks, Social Constraints.

We are not running out of oil. We are running out of air to put it into.
 Robbie Kelman, Greenpeace spokesman on Climate Change (Carson 2000).

10.13 CRITERION: CONNECTIVITY

10.13.1 CRITERIAL ESSENCE

This Criterion concerns inclusion and exclusion, relative disconnection, contact and interaction, and is inherently integrative. Its foundations lie in Subatomic Theory, Organising Principles and Hierarchy Theory. There are a number of integrator concepts upon which a designer can draw. Examples of these are shown in **Table 96: CECM: Integrative & Connector/Linkage Concepts**.

The technical purpose of this Criterion for a large scale project is to clarify in a visual manner current and future design proposals for all methods of transport (including pedestrian) to and on the Site, and the way services and utilities are dealt with. For instance the New Haven project connected many other functions to the design of the roads, as roads normally have for convenience, but in more efficient and socially sensitive ways (common trenching of utilities, common metering, remote metering, stormwater collection for reuse on gardens, pedestrian friendliness, slow vehicle access, and kerbless, space-sharing, narrow roads, overlapping private and public garden space).⁹ This is the locus for considering alternatives to end-of-pipe solutions (which export carrying capacity to a larger scale) – how the Ecocycles may be connected, avoiding the export of wastes to other scales, and likewise, considering the necessity for flows of resources from other places, and longer range plans for import replacement: water, food, energy, building materials and so on. We are trying to build holonic, internally connected structures, as far as possible on the same scale. **Links: Criterion Ecocycles; Hierarchy Theory: Holons, Containment.**

And more eco-socially, it is the locus for considering who and what should be connected to and disconnected from where. What biota are to be designed for? Can animals, birds and insects (such as butterflies) be connected to their needs for food, shelter, private breeding places, territorial needs, international migratory stopovers; can plants be connected to their needs for water, nutrients, climatic conditions suited to evolved capacity, reproductive strategies, co-evolved associations? Is this to be a gated community or free public access? Or gated vegetation with buffers to intercept exotics? Will a fire break provide access to humans and weeds, even fires? Will children and other transport disadvantaged people be able to move about freely and safely? It works well to take each Criterion in turn and ask what connectedness issues may apply in the given situation: **Table 97: CECM: Connectivity x Criteria.**

Connectivity aligns with Community to ask 'who are the stakeholders?' including Nature as a stakeholder, and to invite them in. Or asks 'what regulations are we connected to here?' Or 'are we connecting our pets to the local wildlife?' Or 'how close are the shops?' 'How closely are we connected to our food supply? Our water supply?' 'How well is our waste stream connected to our input systems?' Does our building design include easy access to recycling bins internally and externally? 'Where does the water come from and go to?' 'How does our design connect or disconnect things?' 'How could a disabled person access this place?' 'Is there something nasty that might come out of the river into our garden or vice versa?' 'What does a close connection to the bush imply?'

10.13.2 URBAN CONNECTIVITY

10.13.2.1 ACCESSIBILITY & RELATIVE DISCONNECTION

Population and Economic Geography have traditionally, and increasingly with rising public mobility, concerned themselves with 'relative accessibility' and 'population potential' of a place (Gould & White 1974: 26), now addressed by computer. Population movements and locations (Criterion Population) are of course of great interest to planners, government and commerce. Since movements are modulated by attraction and accessibility (Connectivity), locational preference significantly depends on image and environmental perception (including Biotics, Landscape, Genius Loci), economic potential.

Some of the worst impacts and fragmentation of habitat, are the direct result of policy requiring public access by car, access of power and other utilities, or access of stock and urban runoff to watercourses through stormwater or farm arrangements respectively. Thus sustainable Connectivity relies on policy to entrain the unconcerned and the concerned bureaucrat of lower rank. Some of the important rediscoveries of rare and locally 'extinct' species have been in corridors still fenced off for disused railway lines (for instance Hume ACT/ NSW).

Strategic fencing and designation of 'no-go' zones is increasingly necessary to protect biota, especially breeding sites, from public access. Kakadu National Park has modelled this for many years.⁵ Urban equivalents are island bird refuges in suburban wetlands (for instance Torrens Lake Adelaide, Davis California⁵). Roadside remnant vegetation is becoming an increasingly important resource of seed for endangered flora. It is presently under threat from uncontrolled seed collecting, and an comprehensive licensing system is under development to control access in South Australia at least.⁵

Overall, the thought pattern needs to be established: who uses this place (Population)? Who needs protection (Organism/Needs)? Who needs to come in/not come in (Connectivity)?

10.13.2.2 TELE-ACCESS

One of MFP-Australia's early theoretical preoccupations, just before the exponential expansion of email connections and Internet development, was the concept of Telecottages.⁵ As a small business concept, especially for rural or low income situations, collective IT&T centres have worked well. The MultiFunction Polis was an early financial supporter of Telemedicine, providing crucial seeding funds for the first field trials in 1992 (at which I was present⁵), which indicated the nature of the equipment needed for a purpose-built Telemedicine suite which was subsequently developed at the Royal Adelaide Hospital. Telemedicine and Telepsychiatry now have dedicated units especially at the RAH and Glenside Psychiatric Hospital, Darwin, Alice Springs and Whyalla Hospitals, Adelaide gaol, other country hospitals, and overseas. The concept has been taken to Queensland to the Department of Psychiatric Services, and is spreading fast in that state. This special type of videoconferencing has already saved huge costs in medical specialist and ambulance travel to remote and inaccessible areas, at great savings in fuels and materials.⁵²²⁰

Another MFP goal was to have every home in its villages cabled for ISDN. Mawson Lakes houses all have this as access, not necessarily supplied. Home businesses, students, shoppers and the aged were all envisaged as potential beneficiaries. Electronic road network positioning systems were also contemplated, mainly to assist emergency vehicles, but there are many other uses and possible privacy issues.⁵

10.13.2.3 TRANSPORT & TRANSIT ORIENTED DEVELOPMENT

The Transit Oriented Design model promoted by Newman & Kenworthy, EPP favourites, has been mentioned in connection with JVNIC elsewhere, its chief virtue being its 5-10 minute walking access to all usual amenities (for instance see Commonwealth of Australia 1994c; Newman & Kenworthy 1991; Newman *et al* 1992). **Link: Criterion Landscape: Urban Landscape: Human Scale Design & Urban Form.** While urban form is a key issue, the following suggests that it is too narrow a goal.

Brindle (Australian Road Research Board) attacking Newman & Kenworthy's presentation extolling the Toronto transport system (for instance see Kenworthy 1991; Kenworthy *et al*

²²⁰ Personal communication Bob Hancock, Director Information Technology, Royal Adelaide Hospital.

1997;Newman & Kenworthy 1989)²²¹, redefines the lessons: Toronto has long-term, high quality transport data and modelling, high-level committees, and asserts that Australia should not attempt to adopt its land use concepts 'off the shelf'; Toronto is a model of process, not product; there is no substitute for professional competence (models, exquisite quality data, long time series, respect for research, political involvement and commitment to energy-efficient planning, to process and to action, 'knowing your patch'); "The swing of the urban pendulum towards urban design has made its use more prone than ever to fads"; and "Newman & Kenworthy are advocating aggressive goal-oriented planning against many of the dominant trends shaping our cities ... their naïvety ..." (quoting Bull) (Brindle 1992: 129).

Brindle says Toronto has had a successful 'sub-centres and corridors' policy since 1980, research-justified, and supported by increasing high density residential nodes in city centres for revitalisation, not to increase employment, a trend now emerging in Australia. **Link: Criterion Landscape: Ecological Restoration Development; Urban Landscape.**

Toronto's success seems to lie in successfully operating well patronised, cost-efficient public transport that delivers environmental benefits ... and equity ... in a sprawling city that faces all of the problems found in Australia. The secret ... of success appears to be many decades of comprehensive planning and public ownership, that have knitted trains, trams and buses into an integrated, 'seamless' network that comes close to matching the 'go anywhere, anytime' convenience of the car. Melbourne, with its legacy of competing train and tram systems, and a plethora of private bus operators, provides a working example of the 'economic rationalist' model (Mees 1997: 282).

Mees suggests that the equity and resource efficiency of TOD should be combined with the New Urbanist concern for developing structural social Backcloth. This should include dedicated commuter and recreational cycling pathways, as seen in many European cities (such as Almere, Tübingen, Freiburg im Breisgau, Denmark in general).⁵

On a smaller scale, Adelaide has a supposedly 'world's best practice' traffic control system modulated by road hierarchies, traffic lights with pressure switches and computer controls. However a 3/4 hour trip across the city and suburbs will commonly involve up to 50 controlled intersections, including many replacing former roundabouts (which are superbly self-adjusting, but which timid, unassertive drivers have trouble handling), and at most of which, one has to stop. Many narrow suburban roads have recently been 'rationalised' to eliminate obstruction by turning vehicles. It is now extremely difficult for non-priority cars, bicycles and pedestrians to cross these continuously streaming 'thoroughfares'. A worthy Honours dissertation could compare the fuel consumption and emissions associated with present practices compared with a coordinated system.

²²¹ "Cities and Automobile Dependence" and other references are listed in Brindle's article.

Appleyard has demonstrated the community level benefit derived from increased visiting where ready cross-road access to neighbours is enabled by taming cars (Appleyard *et al* 1981: 21). Heavy traffic (10,000 vehicles/day, 1900/h peak hour) supported 0.9 local friends/person and 3.1 acquaintances. Light traffic (2000, 200) was associated with 3.1 and 6.3 respectively, on an apartment-lined street. EPPs quote uncited work²²² of Southworth & Owens, that supported a traditional gridiron pattern of road design, which, although insensitive to ecology and geomorphology, "created a fine-grained, well-connected and diverse urban fabric" (Anonymous 1993: 13). Where road frontage is minimised to developer's advantage, with 'lollipop' type development and few entry points, cycling and walking are difficult, cars travel huge distances extra, and traffic is very much worse for being concentrated onto a few, over-busy arterials. Thus for the same area, a gridiron (1900) pattern (a distributive network) may have 25 intersections for 20,800 lineal feet of streets; fragmented parallels (1950s) 22/ 19,000; warped parallels (1960s) 19/ 16,500; loops & lollipops (1970s) 12/ 15,300 and lollipops-on-a-stick (dead-end culs-de sac) (1980s and to present in Australia) 8/ 15,600. Thus paradoxically, the more a road system is hierarchically connected (actually disconnected), the more attracted onto a few routes, the more constantly heavy and poised for interruption the traffic flow. **Links: Tool 3.3 (Traffic Reduction Spider); Criterion Landscape: Pattern in Nature & Table 70; Criterion Connectivity; Confluence: OCW Case Study.**

10.13.3 FUNCTIONAL CONNECTIVITY: INTEGRATIVE STRATEGIES: SYNERGY

The concept of Q-connectance includes the 'valence' of connection: the number of ways in which a set of entities is connected. **Links: BP 5.3: q-Analysis; Hierarchy & Scale: Constraint (Connectivity topics); HST: Nonlinear Approach to QRA.** This can be used to analyse existing webs or networks of relations, such as human and eco-communities, risk pathways and food webs. Or it can be applied conceptually in the design of synergistic, multi-functional, functionally redundant and other webby associative elements in the design of ecologically sustaining projects.

In 1993, I found good examples of webby integration at small scale in intentional communities (USA, Scandinavia and UK for smaller scale). At small scale functional redundancy comes from the generalist involvement of all participants and the close internal relations. Everyone is involved in everything at some level, but some specialisation emerges.

²²² Unable to locate original.

A cold type of integration is seen with larger, top-down developments. For instance I saw high quality high density development involving sophisticated public transport interchange at neighbourhood scale in Arabella Park, München²²³ and Der Seepark, Freiburg im Breisgau, Germany and False Creek Vancouver; in a lower density small city region in Almere, The Netherlands (integrated transport, experimental energy housing, pedestrianised downtown design with residential above office above commercial), at urban scale Calgary, Alberta (undercover pedestrian city system), at regional scale, in Toronto, Canada, (reconceptualised in integrated bioregional terms), and also Calgary's 'Yellow Fish Road' project (an integrated environmental systems, stormwater & drain management campaign). There was evidence in Toronto of considerable activity at community level, particularly initiated through the Healthy City processes. **Link: DB 4.1: Places & Learnings; Criterion Organism: Healthy Cities.**

Integrative strategies were specifically asked for by the organisers of the Jerrabomberra Valley National Ideas Competition. The challenge with ECD is to weave together all the strategies that need to be present together. This has led to the concept of 'multi-functional design': the integration of several different functions into an area of land, for instance see (Mollison 1988; Spirn 1984). In suburban Development, it is now becoming commonplace to use a floodplain or watercourse, which is unsuitable for building, to double as a recreation or sports area (Organism/Population), a bicycle path (Connectivity), a wildlife corridor (Landscape/Connectivity), a habitat conservation strategem (Biotics), an education opportunity (Community), a public participation - weed control, planting opportunity (Community, Biotics, Population), a water conservation and flood mitigation measure (Elements) and an icon of place (Genius Loci).

Having a feel for Criteria enables the generation of such concepts in design. The Multi-Function Polis. saw itself as integrating people, economic development and environment, since then coined 'Triple Bottom Line' Planning. Many of the Information Spiders in the "Report to the OECD and Australian Governments" represented integrative strategies (Rounsefell 1994b: 125-153). **Table 98: ESCM: Ecological Site Guidelines from Rocky Mountain Institute (RMI)** demonstrates another integrative approach with ecologically excellent recommendations that cover scale and all UHSE Criteria. The RMI and its affiliates' (such as Hawken) publications are an excellent source of multi-functional ideas.

²²³ I met a female architect on the train to München. When I mentioned that I was heading for Arabella Park she snorted: this was a coldly efficient development, all integrated, certainly, but not designed to live in, not designed for people, not involving the users in the design. **Link: Plate 19: Collage: Arabella Park.**

Designers and planners can steer these syntheses to be functionally and appropriately planned and managed: that a riparian zone is not filled up with insensitive, wide, straight, concrete bikepaths and outdoor furniture; that bushland is not 'tidied up', that plantings are indigenous native and mimic local vegetation structure, especially understorey, lighting and overlooking are provided if crime is an issue, inappropriate rubbish dumping is prevented and water contamination is avoided (for instance pesticide contamination from sports ground turf or septic tank spillover)²²⁴

Perusal of the specifications for thirty-two MFP environmental projects in progress in 1994-5-6 did find a respectable array of functions, partnerships and linkages in each case. While poorly skilled at community aspects, the MFP did make considerable investment in the integrative strategy of working with a broad spectrum of partners. But Mawson Lakes has missed its potential as ESD, let alone as EcoVillage.⁵ **Link: Criterion Ecocycles: Loop Work.**

Multi-function does not mean the more uses the better, as in the disturbing recent moves by the South Australian Government to allow oil and mineral exploration in hitherto protected (and hard won) National Parks. It does concern strategies that perform a number of ecologically sustaining functions simultaneously, so that they are all designed together (co-evolution), much as Nature behaves. Multi-function and multiple use are confused. Figure 36: Deep-Rooted Prairie Plants (Criterion Landscape) and **Table 99: CMES: Integrating Natural Plant Communities into Conventional Landscapes**, give an example of one such key generic strategy that can have multi-functional benefits. Ecodesigners need a repertoire of such strategies to weave into their work. **Links: Criterion Landscape: Imitating Nature by Design & Landscape Planning; Table 73: Mollison's Design Approaches.**

- Every element (plant, animal or structure) must be placed so that it serves two or more functions.
- Every function (eg water collection, fire protection) is served in two or more ways (Mollison 1988: 35-69).

'Multiple use' is usually a euphemism for allowing inappropriate commercial or mining activity into protected places. When oil exploration, mining, tourism, human settlement or agriculture demand access to pristine areas they predictably perturb an established system. This is a misuse of conservation, but is proving often to be the 'best of a bad lot' in that conservation may be funded by wealthy mining companies, but there are always tradeoffs, usually at regional scale and beyond, even if minimal-impact locally.

As said before, if the system can not incorporate the perturbation, that is, if it is unable to constrain the perturbation, then if artificial constraint is not available (say through legislation or

²²⁴ The Paddocks wetland project North of Adelaide fulfils most of these Criteria.⁵

restricted access), the system will collapse to a larger scale, where a whole new set of laws and rules pertains. Without specific Constraints, this can not be expected to directly support vulnerable biota at local scale. Therefore, the return of overview, policy and regulatory control of activities impacting on ecosystems at National or International/global scale (forests, endangered species, Greenhouse effect, coastal reef damage from urban/rural runoff and eutrophication), to State governance as in Regional Forest Agreements, is inappropriate, through conflict of interest, and because the scale of impact is larger. That is, a most important integrative strategy is for the larger scale government to keep its overview, constraining role on behalf of the common interest. But its intermediary role extending both upscale and down (international and state) is fraught with politically self-serving indiscretion.

While mining exploration may in itself create minimal local impact, (although the exploration grids of arid lands exploration remain clearly visible for decades, and probably hundreds of years), every local leakage of mine tailings or discharge of chemical pollutants into waterways and aquifers, takes the system to a much larger scale, and the argument that (say) marine exploration will not upset the whales (SA Gulf waters) holds no water (so to speak), in the event that oil be found. Local impact from oil exploration is one destructive thing, oil spills are quite another, and participation in the global scale of whale population and migration, and the geological scale of carbon cycling, are also inherent in a decision to explore. It makes little ecological sense to claim low risk statistics: if the q-connectivity is there, then responsibility must be taken for the connections and the increase in connectivity that an activity entails. **Links: HST: Surprise, q-connectivity; Hierarchy Theory: Connectivity.**

Nature is multi-functional, multi-connected, and full of redundancies (alternative pathways) that confer tremendous resilience in a changing environment: our present context. ESD proponents see resource opportunities, efficiency and cost reduction in multi-function. EPPs see stability and resilience from imitation of Nature. The efficiency fetish in Economic Rationalism is going too far, costing us dearly in loss of resilience plus increasing instability, with horrendous resource waste as unfit entities succumb, enterprises and habitats alike. A multi-redundancy fetish would serve us much better and create more employment. On the other hand, as Biotechnology attempts to go beyond imitation, to 'improve' Nature, it would do well to remember the embedded character of the finely-targetted strategies with which it plays God.

10.14 CRITERION: FEEDBACKS

10.14.1 CRITERIAL ESSENCE

... what I believe is important is that we should know more precisely what the effects of our actions will be. The various management plans recommended in the NCP²²⁵ for several aspects of the natural environment will not be really effective unless this is done. In the United Kingdom the principle has now been embodied into environmental policy of "protecting the countryside for its own sake." This creates a presumption against development unless specific reasons can be demonstrated that the development in question should take place in a particular location. Perhaps such a principle could be applied here (Hall 1991: 30).

The chapters on Metaphor, Complexity Theory and Hierarchy Theory form the Backcloth for this Criterion. It is used by identifying and working with the web of positive and negative feedbacks that underpin the research object and those that are designed to underpin the desired project, event or emergent entity: a complex dynamic far from equilibrium system, poised at the *Edge of Chaos* by Design.

We want a designed complex process to hover within an eco-socially appropriate Sustainability Space, with enough constraints to keep it reasonably stable, but with enough flux to ensure the continuation of creative and adaptive processes. Although somewhat more difficult to grasp Complex Dynamic System theory than to ascribe infinite supportive capacity to the biosphere, infinite ability of technology to dissolve constraints, or infinite substitutability to economic goods, serious consequences are predictable if we do not recognise the role of constraints, and the long-term side effects of reversing them. Prey actually needs its predators ecologically. Governments need opposition and government institutions need Non-Government Organisations.

This Criterion joins Connectivity and Rheotics as a trio that teases out the elements of Complex Dynamic System structure and change. While the Mathematics of CDS and SOS provide a potential cross-disciplinary language, principles allowing their practical application need to be less complex: planners and designers rarely appeal to Complex Mathematics, but it is comforting to know that the Principles have a basis in Science. A great deal of research and experiment is clearly required for more precise work, especially in the definition of instability zones and thresholds (to support Indicator development).

Unified Ecology and Hierarchy Theory have described the relative frequency constraints that keep information-sensitive systems relatively disconnected, and the perturbation and possibility of system collapse due to under- or over-connectedness, removal of constraints or ecological limiting factors. The development of technology (energy, materials, IT&T and transport) has

progressively dissolved the physical and temporal constraint systems presented to humans by Nature, and the controls have inevitable retreated to larger and larger scale, both in space and in time. But we know that predictability and stability in Complex Dynamic Systems are most available when a system is 'up against its constraints', and that pure positive feedback will result in a run-away (exponential) system that is likely to be very unstable. So it is ultimately important to have a clear understanding of both positive and negative feedbacks. But the metaphoric/cosmologic aspects of Constraint remain the most difficult and pressing for the implementation of EPP goals.

With EPP design work, most of the Constraint seems to come from institutional forces against implementing something different. Thus the attention is divided: getting the show on the road, and designing the supportive backcloth to ensure its survival and flourishing.

1.14.2 THE TNS 'FUNNEL'

The TNS tool 'The Funnel' was mentioned above (Ecocycles). It illustrates well the situation we find ourselves in with respect to Ecosystem Services, Carrying Capacity, Pollution and resource management. Over-harvesting of natural resources, mismanagement of land and sea and increasing concentration of toxic substances, all of which increase with technological advances, population, per capita consumption (lifestyle factors) and resource intensity per service, are impacting on global Ecological Services as a positive feedback driver. The 'Funnel' represents the developing Constraint (limits to growth in truth) of increasing net demand on resources. As increasing human need exerts more demands, Nature's productive services (forest, sea, soil), biodiversity (Nature's service bank) and Earth's Receptive Capacity are all squeezed, fresh water, food, living space, clean air, unspoilt materials and income become scarcer, potential for conflict increases and stress, anxiety, depression, suicide, aggression and addiction indicate communities in trouble. **Figure 53: BICM: The 'Funnel' (TNS).**

TNS predicts a feedback 'crunch' at about 2050, and proposes that application of the *Four System Conditions for Sustainability* in all decision making can create a window of opportunity that could provide a solution (also illustrated). There is nothing new intellectually in the TNS exposition, but it does have the advantage of a scientific foundation and a very clear, simple model that is easily taught to anyone, including those without scientific training. The System Conditions are a Compass, not a command, so do not put managers off side, and indeed support them in working out their own applications. **Link: Criterion Indicators.**

TNS is very popular with global Big Business, (for instance Shell, Toyota, DuPont, 3M, Compaq, Interface, Xerox, McDonalds Sweden and Detroit, Electrolux, IKEA) (for instance see Alexander *et al* 1987; Anderson 1998; Hawken 1993; Hawken *et al* 1999; Romm 1999; Von Weizsäcker *et al* 1997). It has international connections (*inter alia*) with the Rocky Mountain Institute through Paul Hawken and the ISEE through Robert Costanza. The combination of TNS, Natural Capitalism, and RMI Factor 4 goals with the Ehrlich Environmental Impact Equation, has given business and industry a framework that teaches them how and where to apply Constraint.

Ray Anderson of MNC Interface,²²⁶ a now well-known proponent of TNS and Natural Capitalism, uses Ehrlich's Environmental Impact formula, which is somewhat simpler than that presented under Criterion Population:

$I = P \times A \times T$ where **I** = Environmental Impact, **P** = Population, **A** = Affluence, **T** = Technology (Anderson 1998: 18).

But Anderson differentiates first industrial revolution technology (**T₁**) and **T₂** technologies from those of the next revolution:

But just what are the characteristics of **T₁**, the technologies of the first industrial revolution? For the most part, they are extractive (written right into the dictionary definition of technology), linear (take-make-waste), fossil fuel-driven, focused on labor productivity (more production per worker), abusive, and wasteful – the destructive, voracious, consuming ... And they are unsustainable ...

But what if the characteristics of **T** were changed? ... **T₂** ... renewable, rather than extractive; cyclical (cradle-to-cradle), rather than linear, solar- or hydrogen-driven, rather than fossil fuel-driven; focused on resource productivity, rather than labor productivity; and benign in their effects on the biosphere, rather than abusive. And what if they emulated nature, where there was no waste? (Anderson 1998: 19). [*Bold added*]

Anderson then proposes that the equation would look very different (Anderson 1998: 20-21):

$$I = \frac{P \times A}{T_2}$$

This would increase employment (working on resource productivity), conserve natural resources and industry and civilisation could be reinvented, with the more technology the better!

Table 100: BIESCM: Principles of Natural Capitalism spells out the basics of this type of approach, mentioned variously elsewhere, which appears to be a new key to entraining the business world into activities supporting sustainability. These strategies do nothing to reverse Consumerism itself, but do give tremendous potential resource efficiencies (and thus more potential time to act more radically), and do much to raise awareness, with a commercially attractive (somewhat 'male macho') tendency to world promotional tours with fast and impressive words about energy savings, the 'new' Capitalism and the RMI 'Hypercar'.⁵ Natural Capitalism is based on democracy towards all Capitalisms, but particularly brings biology into the

²²⁶ One of the world's largest interior furnishing companies.

fold as the future most predictably scarce resource over which to prescribe abstract value for trading (Hawken *et al* 1999: 1-21). **Links Confluence: Methodology: 'Sustainability'; Conclusion.** Anderson's book "*Mid-Course Correction: Toward a Sustainable Enterprise: The Interface Model*" (Anderson 1998) includes Anderson's systems model that links Biosphere, Lithosphere and Noösphere and puts financial aspects into what EPPs would probably regard as proper context as emergents and system loops, not as over-arching Constraints (Anderson 1998: 101-137).

Link: Criterion Population: Essence.

10.14.3 NATURAL AND INSTITUTIONAL CONSTRAINTS AND THE REPLACEMENT OF CONTEXT

The stability of Ecosystems and Landscapes emerge from function at lower scales (**Link: Criterion Organism**). Slight individual differences in physiology provide a functional redundancy that enables a Community to maintain stability at the higher level, as the multi-resource Constraint system switches about, favouring different species as environmental characteristics change (hence the importance of preserving Biodiversity in a changing environment) (Chapin, Bloom, Field & Waring 1987: 55). Chapin *et al*'s *Physiological Ecology* provides a beautiful description of the strategies and defensive responses taken by plants as they assume different functional balances and reassign energy, water and materials (nutrients) according to resource imbalance.

This links in with Ecological Field Theory (EFT), which was developed to quantify the interactions and constraining effects of co-located plants of varying genera, size, form and function. Plants influence each other at different levels of intensity, as they compete for those resources available, depending on individual vulnerability to constraint. Each has a pulsating geometric zone that impacts on other plants through an influence domain with a Field Intensity, a Field Surface and an 'Intensity of Interaction' (Walker, Sharpe, Penridge & Wu 1989: 81-95). EFT research has found that the artificial addition of multiple resources (such as sunlight, water, fertiliser) to a system conditioned to multiple constraints, causes a 'synergistic' response, that is out of proportion to the expected additive response (Chapin *et al* 1987: 55). This has application to Agriculture and to the accelerated growth of weed species such as arid-origin Australian natives in wet climates elsewhere (for instance the *Melaleuca quinquinervia* menace in the USA Everglades). **Link: Criterion Landscape: Imitating Nature by Design, Context Replacement; Table 55.**

There is a clear argument on Complex Dynamic System grounds for the deliberate and careful design of artificial constraints for human systems, rather than follow the rhetoric of dismantling of constraint used so much by market libertarians. What they are actually recommending is that all other constraints be dismantled, leaving the market to constrain the system by price structure alone. They fail to mention the transfer of substantial monopoly rights of government bodies to the private businesses given or sold the right to provide those services, the dominance 'rights' and superior networking abilities of those with control of resources, and the operation of the 'Theory of Virtue' in general.

Without artificial constraint, the system really does turn around individual and collective greed, and market signals, if any, are usually too little, too late. Market failure in the economically invisible environmental and social justice areas is already clear, obvious and predictable to those not besotted with this Ideology.

Institutions that operate so as to capitalize all gain in the interests of the few while socializing all loss to the detriment of the many, are ethically, socially and operationally unsound. Yet that is precisely what far too many corporations demand and far too many societies tolerate. It must change (Dee Hock, founder, President and CEO emeritus of Visa).

10.14.4 CATALYSTS

The types of Catalysts to be expected in a human settlement setting include enablers and triggers, as well as retardants. These are essential to the initiation, implementation and long-term function of human settlement projects, and may include:

- finance, funding
- other resources: personal time, energy, water, labour, expertise, infrastructure, capital assets: human or social capital, natural capital, information/ knowledge/ wisdom
- access to information, power, influential contacts
- triggering events (such as the sale of public assets by government or centenarian/millennarian engagement)
- licenses or legal protection, formal and informal approval, permissions, favourable/unfavourable legislation and other drivers or allowers
- available time, appropriate timing, resonance, synchronicity
- sense of mission, persistence, community 'glue', strong commitment, investment, ambition by individuals, moral support
- public endorsement of the shared vision
- public 'education' (including public participation, consultation, information sharing, charrettes, round tables, marketing and propaganda)
- ideas, knowledge, consciousness, awareness, belief, wisdom, 'street smartness', 'rat cunning', opportunism (sometimes enlightened, sadly, usually self-centred).

It would be helpful if decision-makers of the Dominant Paradigm could bring themselves to regard investment in ecological approaches not just as economic opportunity, but as an insurance policy attracting subsidy.²²⁷ This would then be taken as a positive feedback signal, in which developers could start to have confidence. Governments still have powerful potential for

²²⁷ Eco-socially responsible investment is presently bringing double the returns of orthodox investment.

creating Attractors through policy leverage and funding. This strategy worked well in Denmark for the introduction of windmill technology and recycling. Once windmills became commercially viable, the subsidies were withdrawn.^{5,228}

The Rocky Mountain Institute has proposed a set of Principles for '*Natural Capitalism*', derived from their experience in radical redesign of industrial and other processes. Such Principles are potential catalysts for a new form of Capitalism, which relies on relative scarcity of ecological goods. These were listed in Table 100: BIRRCM: Principles of Natural Capitalism (Hawken *et al* 1999: 9-10). Such Catalysts can be drivers for change. But the role of Constraints should not be forgotten in the rush to new forms of market-driven behaviour unless the full range of Capitals really is valued as recommended and reflected in economic function (which involves built-in higher level Constraints in any case). **Links: Confluence: Integrative Strategies, Pre-empting EIA Through Design.**

The recent claimed 'major' overhaul of Australia's taxation system has really been a disappointingly non-ethical, even unethical exercise in cost-shifting from rich to poor, exporters to local suppliers.^v The opportunity existed for Australia to take a real leap forward rather than reinforce the dangerous trends of the past: to support a sustainable future through defining a sustainable society then designing Policy to match, including environmental taxes, reassigning cross-subsidies, removing taxes on employment ...

It does not seem to me politically impossible that in Germany or the European Community as a whole, after a comprehensive campaign of informing the population, an appropriate levy on non-renewable sources of energy, in particular coal, petroleum, and natural gas, but also fissile nuclear material, might be introduced, increasing their market prices continuously over the next 15-20 years to about triple or quadruple their current prices. Crucial to such energy taxes is the proviso that the additional funds levied would be returned to the consumers in an appropriate fashion that would further promote sustainability. Such a measure might produce a decisive turning-point in our economic system (Dürr 1993: 147).

10.14.5 POLICY FEEDBACKS

As mentioned elsewhere, EPPs like to act as if appropriate policy were in place, and will often fight for changes to policy in their time off. Industrial Ecology and Ecological Economics provide a number of suggestions as to appropriate policy responses to materials and energy flows, that should be in place to support the same goals.

Powers identifies a number of causes of inappropriate regulation. These include cross-subsidy, piecemeal regulation (missing other pollutants and ecological rucksacks), linear waste management (missing resource opportunities), facility-centred approaches (ignoring customer

²²⁸ Associate Morten Elle, Technical University of Denmark, personal communication 1993.

polluters), short-term focus (missing long term, inter-generational issues), focus on one life cycle (missing multiple cycles).

Strategies to deal with these often involve scale-related, wholistic inclusiveness: long-term thinking across multiple lifecycles, across cultural barriers, resisting fragmented thinking; wider categories dealing with complex, ecological-economic interface, resource, energy, water and waste efficiency and demand management, tracking connectivity across scales: full costing, full life cycles, flow tracking and greening the whole system. Optimise all pipes before 'Front-of-pipe' before 'end-of-pipe'. Policy should support all this, be broader, more inclusive, flexible and stop being so prescriptive, as it stops adaptive and learning behaviour. Involve business in policy making and have an evolutionary regulatory system that encourages industry to experiment and test new practices in good faith without fear of redress ("policy maker, not policy taker")(Powers & Chertow 1997: 30, 19-31).

The Netherlands NEPP, (National Environment Protection Plan) referred to under Ecocycles, is an integrated materials policy based on an assumption of the need for Ecocycle closure for sustainability across a National scale. Its three goals of loop closure (whole life cycle approach to products, with recycling), energy saving (services, production and renewables) and improve quality (increasing product life) aim to reduce materials and energy flows. A preventive approach is followed where possible, through source-oriented measures (as distinct from effect-oriented). Feedback mechanisms are introduced into the economy, relating to legal and institutional limits on resource use, pollution, the above goals, maintenance of regenerative capacity of renewables and phased-in switching to renewables.²²⁹ Emissions Trading is seen as undesirable, but a short-term tool (Hare *et al* 1990: 58-9).

10.14.6 COST FEEDBACKS

There is a general assumption in Australia that anything 'green' will cost more. This acts as a tremendous conceptual Stopper. It is true that an experimental, prototype house can cost a great deal more than normal,²³⁰ but that situation does not stop prototype cars being made. It is also true that a single 'green' or 'energy' house may cost about 10-20% more, but that is partly because it loses economies of scale by being different, and partly because it will usually be architect designed and quality built.⁵ But the story is completely different if a whole community of houses can be built to the same principles at site scale.

²²⁹ Not forgetting that renewables can also be unsustainably used if drawn down faster than source recovery rates).

²³⁰ The *Advanced House* I saw in Vancouver cost double the usual price for quality, size and area.

For instance on Dewees Island, USA, land development and infrastructure cost 60% less (for 150 houses) because it avoided conventional landscaping, with low maintenance, indigenous native species instead, rejected impervious roads and cars, and planned for golf buggies and walking. Village Homes (Davis, CA) used swales and natural absorption management of stormwater instead of the usual drains and sewers, diverting \$182,000 (late 1970s) to common green space and other amenities. These ageing houses still command \$US10-20/ft² more than normal housing nearby (1997), and sell very fast.⁵ Other projects (Chicago, New Haven) have also made savings on infrastructure costs, particularly by indigenous native landscaping, enlightened stormwater management, reduction in paving materials and high-performance building envelopes (Rocky Mountain Institute 1998: 11-12).⁵ **Links: Plate 3: Collage: New Haven; Criteria Connectivity, Ecocycles: Urban Form & Greenhouse; Confluence: A New Approach to Development: Funding & Finance; Plate 8: Placemaking.**

Work associated with the Rocky Mountain Institute, including that of Amory and Hunter Lovins, Ernst Von Weizäcker and Paul Hawken (Hawken *et al* 1999; Rocky Mountain Institute 1998; Von Weizsäcker *et al* 1997), is helpful in locating specific implemented cases with substantial savings: not the 'normal cost +10-200%' widely believed by the building industry to be necessary. This attitude is a scale-sensitive problem. Lovins is fond of saying in interviews and presentations, that radical energy efficiency saves more and does more with less than tinkering around the orthodox edges.⁵ As mentioned elsewhere, MFP Australia had a database on implemented sustainability strategies. At Habitat II, a CD was released by UNCHS²³¹ and the Together Foundation: "The Best Practices Database", which was to be followed into new versions.²³²⁵ In Australia, one of the best sources is Urban Ecology Australia.⁵ The equivalent in the USA is Urban Ecology Inc., located in Berkeley, California.²³³⁵ None of these sources, to my knowledge, issues details comparatively costing (\$, energy, CO₂) across all relevant scales: a clear research opportunity, but they do have libraries.

In Australia there is an accumulating body of experience in ESD, but it still takes effort to seek out clues to relative dollar costs (Loder and Bayly Consulting Group and others 1993). To date, most advances have been quite heavily subsidised in the spirit of research. Reports in this dissertation barely scratch this surface, and EPPs believe there to be a crisis of prioritisation rather than funding.⁵ Certainly Ethical Investment and retirement funds are now coming into their own.

²³¹ United Nations Centre for Human Settlements, Nairobi, Kenya.

State governments often have energy offices or energy centres²³⁴ which issue lists of comparative figures on electrical appliances. **Link: Criterion Ecocycles: 'EcoCost' of Building Materials.**

10.14.7 SOCIAL CONSTRAINTS: INDIVIDUAL, GROUP, SOCIETAL, MORAL, COSMOLOGICAL

Michael in *"Barriers and Bridges to Learning in a Turbulent Human Ecology"*, explores the manner in which we, deluded into believing ourselves independent agents, are actually deeply and inevitably shaped in belief, behaviour, approach to evaluation and learning by our Myths and habits:

Our conventional mythology and its semantic baggage view constraints negatively. We want to do and expect to do our own thing! However for many cultures and for many activities in our society, constraints provide the discipline for focusing creativity, for reducing detours and dead ends, and for shaping reliable behaviour. The controlled experiment, so essential in experimental science, exemplifies this virtue. In most cultures the stabilizing constraints of family, religious and community obligation take priority. Even though we celebrate freedom from constraints ... they unavoidably shape learning for any purpose. Acknowledging constraints and working selectively with them will help learners learning be more realistic in their expectations and effective in their practice (Michael 1995: 468).

Links: Early Findings: Barriers to Implementation, Table 4: Barriers to Urban Ecology; Metaphor; Organising Principles.

Two areas of theory, one from Social Psychiatry and the other from Anthropology, have something to offer in thinking through Social Constraints: Transactional Analysis Script Theory, Stroke Economy and Structural Analysis (especially Parent Ego State) models it for application (Link: Organising Principles), and Mary Douglas' Social Bias Analysis exemplifies it (Link: Community Criterion: Clues to the Convivial Society: Helpful Models).

10.14.8 MINIMAL MODELS, MONOCULTURES AND MEDICAL MODELS

Allen & Hoekstra (:25), very much in the scientific mould, argue against cumbersome models and for minimal ones, counselling against using the complexity of the big picture as a justification for doing over-reductionist research, as generality is thereby lost. Appeals to a relationship to ultimate reality do not necessarily imply predictive capacity. However in ecological studies it is often possible to confine research to the study of a limited number of 'keystone' or 'indicator species'. The situation is not necessarily as straight forward where human systems are concerned, but similar patterns can be identified.

It could be argued that a misplaced principle of parsimony is implicated in the over-simplification of explanatory models such as in Agriculture, Economics and Medicine, where unhealthy

²³² *The Together Foundation*, Office of the President, 55 East Street, New York, New York 10021; (+212 628-1939; Fax +212) 628-4265; <http://www.together.org/>.

²³³ Email address: urbanecology@igc.apc.org/.

narrowing to a linear cause and effect model have in practice resulted in unpleasant, long-term, externality-driven Surprises. Here the parsimony problem is a misapplication of scale, so symptoms or concomitant conditions are seen and treated as causes. For example medical diagnoses are usually in fact syndromes, or collections of symptoms, and the 'label' is an emergent entity that immediately attracts a standardised and often stigmatising response once applied. Hence the reluctance of some practitioners to apply, and many patients to accept, a socially unattractive label.

A diagnosis of migraine commonly leads to a standard symptom treatment alone. It is uneconomic and physically impossible for busy doctors to take a wholistic approach to illness in the common six-minute GP consultation. Without going up to context level and down to mechanism, the diagnosis is often seen as cause, and the cause persists throughout treatment, often disappearing with time or fortuitously. It may involve a variety of social and physical entities, including secondary reinforcement, and all or a combination of, chemical or food chemical intolerance (which foods/chemicals?), dys-stress, cervical or tempero-mandibular disorders (causes? stress?), or even the migraine treatment itself. It turns out that there are often multiple contributory 'causes' that are really associations, and alleviating two or three is often sufficient to restore the body's ability to self-regulate.²³⁵ However experience⁵ shows that there is often a 'keystone' dynamic, often related to diet, lifestyle, relationship or emotional levels, whose persistence or aggravation can bring down the whole personal Ecology, and which will do so again if allowed to persist, often leaving the patient with unpleasant symptoms or side effects to 'put up with'.⁵

Bateson, describing an Ecology of Mind, has a nice explanation for this phenomenon which is derived from Ecology itself. He assumes ("following Ross Ashby") that all biological systems, including ecological and social systems, can be approached through their description as interconnected variables. Each variable has a characteristic optimal range with tolerance thresholds. Any variable in the system that runs near its tolerance limits, becomes a limiting

²³⁴ For instance *Energy Information Centre*, Department of Primary Industries & Resources, SA.

²³⁵ Flippantly called by me in medical practice (1981-91), the '*Rounsefell Weak Link Theory*' of disease causation: the patient has a given genetic makeup which predisposes to a particular pattern of psycho-somatic breakdown in the event of systemic (dys)stress. Stressor types to which a person may be subject include physical, mental, emotional, spiritual, nutritional, chemical, radiation, institutional (some mechanistic, some linguistic). Under chronic (dys)stress the body will take a downward path along the wellness continuum (**Link: Criterion Organism: Figure 44: Wellness Continuum**), but the nature of the illness will depend on the predisposition pattern: the personal *weak link(s) and the environment*. Thus except in so far as it becomes an entity itself, the diagnosis does not matter, since the same stressors may produce in one patient a heart attack, cancer in another, in another arthritis, yet another chronic diarrhoea, and another, no change (Rounsefell 1991c: 82-98). Complementary cancer treatment involves a searching of all these areas of potential dysfunction/dys-stimulus for such correctable dynamics as an attempt to rebuild the psycho-somatic identity of the patient. In effect, changing the Backcloth to one that will not support a cancer process, is hoped to be sufficient for physical survival. That expected survival time is approximately doubled and remarkable recovery achieved in about 1:40 cases (approx. figures Australian Cancer Patients' Foundation 1984)⁵ suggests that there is more to learn but we seem to have some things right. Active research is now proceeding in the area of Psycho-Neuro-Immunology.

factor and confers a loss of flexibility on the whole system, with discomfort-pathology-death as a potential sequence (Bateson 1972a: 496-7).

This pattern is clearly recognisable in many ecological and social situations, where resilience is so threatened as to render the system vulnerable to even small perturbations (for example poverty, unemployment, environmental illness, climate change, loss of biodiversity, excessively long supply lines (trade, ecological 'footprint'), fossil fuel dependence, 'path dependence' in urban systems, and IT&T dependence, which leaves users open to perturbation from 'externalities' such as Y2K bugs, trade embargoes and sunspots). This suggests an ecological 'medical' approach to human settlement problems, which is to identify the variables which are apparently running at or near their tolerance limits and seek to bring them back to mid range. Very often the fragility can be traced to a loss of diversity (such as loss of biodiversity or under- or inappropriate education), loss of functional redundancy or underconnectedness of available diversity, and overconnectedness to a single resource (for instance monoculture crops and limited diets).

Although 'symptom treatment' or alleviation at the scale of the problem may help in the short term, in the long term, the correction of one or two identified variables,²³⁶ which characterises orthodox Medicine (for instance artery graft without diet change or stop smoking) and orthodox Planning (for example road widening without demand management or provision of alternatives), is not usually an adequate stratagem. At the very least the entire system must be approached, and as Allen *et al* and Holling point out, the nature of the connectedness and the dynamics of relative disconnection, are also crucial to the stability and resilience of biological systems. An assessment should thus be made at the level of the Backcloth, of the nature of the relevant constraint system from higher levels, and the pattern of connectedness and diversity of responses, functional reserve and contracts inherent in the interpersonal and social relationships, and the underlying mechanisms.

While most medical (and other eco-social) assessments are mechanistic and rate-dependent in nature, linguistic or rate-independent (purposive) explanations are never far from the symptom surface in both human personal and social systems, and should be looked for in research and allowed for in design. In Medicine this is referred to pejoratively as 'secondary gain', 'placebo effect' or 'illness behaviour', and rarely considered by other than psychiatrists and pain clinicians (sociologists/criminologists). If the neediness or Satisfier attachment expressed in this way is not dealt with by other means, then the symptoms will persist or augment, or other, potentially

²³⁶ Much as in pathogenic family systems where the 'identified patient' was often blamed for mental illness, when the problem was really the family system.

worse ones will emerge (**Link: Criterion Organism: sections on Needs**). The 're-revolution' required for change is thus well-named: it implies a shift to another Attractor. EPPs believe that their Cosmology is the Attractor to which the orthodox system in crisis should change. That is, a shift from 'Ego' to 'Ego-Thou-Eco'.

10.14.9 FUZZY SUSTAINABILITY SPACE

Links: BP 5.3: Working with Vague Information: Fuzzy Logic; Criterion Indicators; HST: Far-From-Equilibrium Systems.

Very basic concepts of Fuzzy Logic and Systems Theory are prerequisite knowledge for appreciating the concept of a 'Fuzzy Sustainability Space', which is proposed here for use in conjunction with the Unified Human Settlement Ecology Matrix, for application at Bioregional scale. Its use would presently be intuitive, awaiting more concrete knowledge of thresholds and instability zones/optimal ranges in ordering parameters (after Synergetics).

In Fuzzy Control System Design, the task is to define a set of control parameters, with appropriate sensing apparatus, so that adjustments to internal and external conditions can be made in a dynamic way according to the readings. A Fuzzy Control System is a rule-driven process with Fuzzy Rules constructed by tracking the output of an expert or group of experts (non inherently excluding Community), using a Fuzzy Computer Chip and a Neural Network in tandem (a Fuzzy Adaptive Network - FAN) (Chuen-Tsai 1994; Kosko 1991). There appears to be an analogous relationship between Fuzzy Control Systems, Eco-Logical Systems and human settlement Design Principles. BP5.3 section on Fuzzy Logic includes a diagram of a fuzzy air conditioner control system which shows how fuzzy rules are constructed to cover an 'uncertainty space'.

The delimitation of a Sustainability Space is similar in conceptualisation to the complex Health Space described above, that I used with subjective success over ten years in Wholistic Medicine, and to Bateson's concept of Optimal Operating Range also above.⁵ It has conceptual cousinship to the 'Compass' tool defined by the *Four System Conditions for Sustainability* and the *Funnel* promoted by *The Natural Step* organisation.²³⁷

Thus without necessarily understanding the Mathematics, the notion of a Fuzzy Control System can be adopted analogically as a guiding Metaphor or an audit or design tool for sustainability projects.

²³⁷ Although this is not recognised by TNS trainers in Australia, being external to the pedagogy.

A rule-delimited Sustainability Space would be defined according to a multiplex definition of Sustainability at a particular Scale range, representing the supportive Backcloth or Attractor for a particular Traffic: a system in dynamic equilibrium, enclosed by that space. The rules would initially be arbitrary in the sense that they were defined intuitively or dynamically and by functional Constraints or goal-defined social or artificial Constraints (discovered through relations of Hierarchy as above). As humans we would presumably want to define 'Sustainability' to ensure that our own reasonable needs were met within this space, and that within a healthy Biosphere as we now understand it.

In formal modelling the system would rely on feedbacks derived from sensors or specially designed audit processes that could reveal the presence of instability conditions likely to trigger catastrophic responses within the system at certain threshold values. Such a system may be formally represented as a lattice of nodes and connections with different threshold values for individual nodes (an FCM), or as a 'Sustainability Space' bounded by Fuzzy System Rules. **Tool 3.7: Fuzzy Sustainability Space: Structure and Figure 54: CM: Fuzzy Sustainability Space: Impacts** suggest how this may be diagrammed. The system elements would be impacted and ultimately respond to, the control parameters (which represent higher scale external conditions), and the system itself is held in place by an Attractor system represented by the band at zero.

The FSS would be bounded by an identified threshold or instability zone (Deterministic Chaos), and within that, an FSS zone (defined by the 'Stretch Goals' concept: Link: Criterion Indicators) expressing an 'ideal' state for sustainability, at first set by expert conjecture and intuition,²³⁸ next checked experimentally and 'tuned' for function at appropriate intervals through audit and Indicators: an Environmental Management System. This discussion is resumed under Criterion: Indicators. Figure 54 offers an understanding of the seriousness of perturbation and the types of adjustments such a system must make, to the impacts of urban development (ecological surface appropriation) and road building (habitat fragmentation).

10.14.10 DESIGN & IMPLEMENTATION ISSUES

In the end, living things thrive if their needs are met and they find a way to accommodate each other. Designers need to have a repertoire of strategies for helping them do so, and answers will often come from the trial and error of old ways. But when the environment is changing too, we all need to be observant and creative.

²³⁸ Using a 'modified Delphi' method as does Koslowski in establishing his Ultimate Environmental Threshold (as above) (Kozlowski 1986).

It will be remembered that different types of Hierarchy result in characteristic types of Constraint system. Consideration Project purpose against Hierarchies of Time (scale, process, synchronicity, communication, relative disconnection, Ecology), Space (physical access, disconnection), Concept (Ideology) and Dominance (especially Planning and legal context, and the cooperation : competition balance of the social milieu) will give a broad picture of the Constraint landscape.

Tool 3.8: Boundaries & System Constraints for Hierarchy Types & Criteria explores the more obvious Constraints associated with Criteria. **Link: Criterion Organism; Hierarchy Theory: Constraints.**

To gain an idea of what positive and negative Constraints may affect a project, a matrix can be run for each, across all the other Criteria. While time-consuming, not a lot will be missed. All these considerations are part of the same Backcloth. This can be done diagrammatically, or using Constraint Analysis Tables (similar to Tool 3.10: Scale Analysis Table), separate for positive and negative feedbacks, or SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis by Criteria, which may want to group the S with O, and the W with T to align with positive and negative feedbacks.

The Backcloth to any ecological project has a significant element of social/ economic /ideological Constraint, which acts eventually as midwife or executioner, even though all but its impact is ecologically invisible. Barriers to sustainability were mentioned in the Introduction and listed in an associated table. The Danish 'barrier thinking' approach seeks to dissolve Conceptual Constraints (converting a constrained understanding to a broader one through education, problem-solving, public participation and group communication). Where we may say 'no' or it's too expensive', they may say 'why not?' or 'how might we anyway?' (a 'double loop' question).⁵ That is, many Conceptual Constraints are ecologically pathological. Among the most potent barriers to the implementation of sustainable practices are ignorance²³⁹ and short-term self-service. Conversely, among the most potent Catalysts of social change (necessary, but not sufficient in itself) is Education. (**Link: Criterion: Community**). Thus Conceptual Hierarchies may need Constraints dismantled, while Dominance Hierarchies may need redesigning, and Spacetime Hierarchies may need rebuilding.

The context for the Quark Cooperative Programmes (Tables 2, 3) and Elle's *Scenario Workshops* (Table 4) was the recognition that the most difficult problem in sustainability was overcoming

²³⁹ In the French sense: lack of information, rather than uncouthness or deliberate disregard, although I would contend that disinformation and selective reporting are common, and can often be traced back to the behaviour of media or marketing (for instance allowing 'info-mercials' and 'info-tainment' to pass as news), and a tired, gullible, non-reading public is inclined to accept what is commercially offered.

institutional, educational and ideological barriers. Quark examined community building through education, with a particular long-term aim of capacity building for a reclamation of former community functional roles lost to governments (which have let the Biosphere down to a serious degree). Elle listed many necessary strategies for achieving community behavioural change around rubbish²⁴⁰: policy, fines, special taxes, subsidy, information, education, provision of alternatives, taking small steps, establishing dialogue between those involved and those about to be, getting senior people to change and charging for garbage by weight.⁵

So much for getting others to change behaviour. But having decided to change your own behaviour, systemic and institutional Constraints are considerable. As noted by Downton (Plate 4), persistence is a key virtue.²⁴¹ Garry and Stina Kerans of *Integrated EcoVillages* (Sun Village and other developments NSW) agree. They have used a compatible business (natural water treatment systems and composting toilets) to fund their EcoCohousing plans, but their best breakthrough has come from gaining credibility with Environment Australia, which is now anxious to throw money at the big environmental issues: water and energy especially. They are no longer viewed as irrelevant young hippies, and the barriers to implementing their projects have suddenly melted magically away. Urban Ecology Australia is also embarking on a similar course, welcoming effusive praise for its embryonic demonstration site from the Australian Greenhouse Office (AGO), spurred on by a sellout tour by Robert and Brenda Vale, of 'house with no bills' fame (Vale & Vale 1997). AGO is suddenly aware that the building scene is responsible for 50% of Australian Greenhouse Emissions.²⁴² Grants for demonstration work are more likely to flow freely in an election year.

Having dealt with institutional and social Constraint issues, we need to come back to the ecological, which applies everywhere, not just 'in the country' or 'outside the built-up area'. Social Traps have been mentioned elsewhere in the context of discounting and subsequent impact of slow variables that are set up at the same time as seductive, short-term, often 'engineering' solutions to problems. The concept is used at least in Ecology, personal growth and Organisational Development (the 'Learning Organisation')(Allen & Hoekstra 1992: 115-121;Argyris & Schön 1975: 19-20;Costanza 1987;Cross & Guyer 1980;Platt 1973;Senge 1990;Senge

²⁴⁰ Elle mentioned a Danish term for 'the same 12 people who do all the jobs all the time': 'Torten's soldiers'. Torten was a famous military leader who deceived the opposing Swedish army into overestimating the number of his troops by having a few run about and change their clothing many times.

²⁴¹ This is one of the core rules for Assertiveness Training: persistence without aggression will nearly always win in the end.⁵

²⁴² They are to release (4/2001) a new publication 'Your Home - Your Future - Your Lifestyle' as a resource on sustainability and energy efficiency for home owners, incorporating 55 fact sheets and advice for all climate zones, to be used in conjunction with the 'BPD Environmental Design Guide' used by the building professions, mentioned elsewhere. Reports on energy research for the Building Code of Australia and CD-ROMs are also now available.

et al 1994;Teger 1980). It is based on an understanding of the frequency-based hierarchy of return times, which recognises that system constraints take different times to 'roll out'. **Table 101: BIRRCM: Constraining Variables** shows examples of typical Constraints and periodicities from different fields of knowledge, organised into fast, medium and slow categories. It extends the material already presented in Key Variables & Speeds in Managed Ecosystems (**Link: HST: Holling's Infinity Loop**).

Forest ecologists are using Fractal Theory and the relationships between fast and slow variables to relate patchiness, age distributions, extinction rates and regeneration opportunities (Holling, 1986:308). These constraining variables should be key concepts in the design of Ecosystem-supporting Backcloths, and the development of ecological Indicators. (**Link: Synergetics: Phase Transitions: Table 42 (Ordering Parameters)**). Research to identify relevant Constraining parameters for Australian conditions needs to be available to the Planning community in a form they can use. Until then, usage must be intuitive, as used to construct the lower part of the Table. One should ask "What could be limiting factors at this scale?" By far the most important are the basic health needs for the local living beings (all species). The fact of an ongoing behaviour can in itself Constrain the emergence of other behaviours by occupying niches and action slots. This is an important trans-disciplinary research gap.

The higher (larger scale, slower) the next uppermost level of Constraint, the less control any local area has over its bioregional metabolism, the more likely the accumulation of biological perturbatory elements and the more likely will be an eventual, global scale, geobiological response, the penetration of which will be related to the level of connectedness to the global system. With relative disconnection, the spread of perturbation is inhibited. For this reason the retention, preservation or reinvention of local structure is crucial for supporting ecological health in a globalising world, especially where there is no higher-scale champion of local rights.

10.15 CRITERION: RHEOTICS (UNFOLDING)

10.15.1 CRITERIAL ESSENCE

The time issue was dealt with at some length under Complex Dynamic Systems (HST). As noted under HT, and also under CDS, a Frequency Hierarchy underlies the Unified Ecology framework, and is subject to the dynamic Ordering Principles that appear to explain Complexity Theory. As the fourth dimension perceived by ordinary humans, Time can be seen to relate to the other hierarchical structures: space, concept and dominance, since all events as we understand them, occur somewhere at a certain point in time, or have a particular relative rate of change.

One may question why a Criterion about Time and Change is necessary when Allen & Hoekstra's entire system is based on frequency. There are four main reasons. One is educational: we are having trouble converting from a static system that focuses mainly on Space to one coming to terms with Time and Change. This Criterion invites us to reflect on that. The second is contextual. For complex systems the initial conditions have a place in their own right. But we are also told that if we ignore History, we are doomed to repeat it. It is one thing to disconnect ourselves from our histories in order to move on. The ability of old timers to remember far into the past is becoming a source of wonder to the young, who are rushing through life grabbing sound bites and spending little time in reflection. Life becomes shallow and meaningless in the absence of history and when continuity is lost. The third is that being human, we have other Hierarchies to distract us as well as Time, which have their own Criteria (such as Landscape, Elements and Community). The last is practical: we have to stage a development into the future in order to implement it at all. So we have a Criterion for Change, which should now be an essential framework to which the design of any research refers.

The essence of this Criterion is dynamic: change over time: the regularity, frequency, rate, direction and character of change. Thus it is an expression of process. **Table 102: CECM: Criteria: Change of Emphasis with Project Phase (1)** indicates substantial differences within Criteria for focus at different stages of a project. A second-order matrix viewed across all the other Criteria is a useful orientating tool (**Links: Tables 115, 116: Opposing City West Project**).

The outcome of the dynamics will depend on the Constraint system (the nature of the Backcloth). Criterion Feedbacks described the structure supporting the phenomena being measured or attended to, such as the project on hand. This is best assisted by an ecologist from the earliest stages of Concept Planning for very large or strategically sensitive projects. For this

to be prioritised, ecosystems must be respected in the first place, which is automatically addressed if this UHSE system is used.²⁴³

10.15.2 PULSES & CYCLES

Pulses and cycles are ubiquitous in complex systems, and a number of concepts have been discussed above which describe many of the mechanisms, such as periodic Attractors, critical frequency ranges, chaotic behaviours, punctuated equilibria. The wave-like characteristics of subatomic particles describe a fundamental reality that constantly pulsates. Time Series may often be seen to be composed of periodic fluctuations, with background noise that actually represents chaotic Attractors operating at a different frequencies.

Underlying these concepts is the notion of structure as a pattern that persists through time. This parallels Bohm's explanation of Laws of Nature as patterns of relatedness that are relatively invariant, on a Backcloth of variance, and has links to the basis of Ecological Hierarchy Theory as a hierarchy of frequencies. In any case, if a system presents an invariant pattern available for perception, then in order to understand it fully, the characteristics of its unique trajectory through time and the frequency of its pulsations or cycling must be studied, even if it appears to exhibit only one cycle, or its frequency is so low that it appears static (and thereby part of context).

Life cycle studies became popular in Technology, Sociology and Planning some years ago, yet little evidence of wholistic life cycle integration appears in suburban tract design at present, except in the requirement to take account of the '100-year flood', or more recently, the possibility of 1 metre sea level rise in coastal locations. Time Geography, journey-to-work and time-space prisms have been fashionable and discarded, but are being resurrected in different formats now that computers are more able, especially for Transport Planning. In Eco-Business, Industrial Ecology, Building and Energy Policy, we have 'cradle-to-grave' studies: the analysis of embodied energy in manufactures and materials, especially for motor vehicle manufacture (for instance Volkswagen) and building: production, maintenance and destruction energy over the life cycle of the entity in question (OECD & IEA c1993), although Australian industry has little incentive to respond radically to this information at present, not yet having faith in the massive Eco-financial opportunity already being discovered by other nations in 1992 (EcoTech, São

²⁴³ This issue in Human Settlement Planning is parallel to the historically position of Ministers for the Environment in State and Federal parliamentary cabinets. While usually now 'required to take environmental issues into account', present economically driven decision making systems appear to do that and no more. The Environment Ministry has finally become 'senior' in Australia (been assigned a place in Cabinet).

²⁴⁴ Boolean Either/Or.

Paulo).⁵ Perhaps, as Sainsbury expresses it, we should be saying 'cradle-to-cradle' studies, as on reflection, 'cradle-to-grave' is still a linear concept.

10.15.3 HOLLING'S CYCLIC MODEL

Holling's general evolutionary model of four system functions ('Infinity Loop') applicable to all complex systems but particularly the ecological and the economic, was introduced under SOS (Costanza *et al* 1993: 552;Holling 1986: 307). Figure: Holling's 'Infinity Loop' Model was presented under HST as four boxes through which a system will cycle (actually spiral), and relates such concepts as evolution, survival strategies, catastrophe/surprise, creativity, healing, diversity, stability, resilience and management. The cycle of Exploitation, Conservation, Release (creative destruction) and Reorganisation is paralleled by relative changes in stored capital and by connectedness and internal organisation (which predictably behave similarly) as illustrated. Costanza points out the folly of building elaborate structures while suppressing the critical release of creative destruction, thus risking widespread destruction at a later time. Allowing modest, more frequent releases would be more appropriate (Costanza *et al* 1993: 552). He gives the example of interruption of fire régimes in the USSR, but Australia has many examples of the same phenomenon, most recently the disastrous fires in Sydney bushland suburbia in 1996, and Victoria and South Australia in 1989.

The control variables in complex systems may be fast, intermediate or slow (**Link: HST: Table 50: Holling Infinity Loop Model Elements**), and the speed of cycling through Holling's boxes and the amplitude of change are determined by which variables dominate. Tropical systems cycle rapidly and are patchy. Slower systems (for example US budworm waves - 10 year cycles) have higher amplitude and more dramatic discontinuity (Holling 1986: 307-8). In Australia we may want to think of locusts in these terms.

A development, then, would enter the cycle in the Release/Creative Destruction phase (clearing the site or conserving its integrity but remodelling), and move swiftly into Exploitation ('retrofitting': building internal and external materials into new structures), then settle down to Conservation (maintenance) for a longer period before (review) minor remodelling or replacement became due. The initial conditions will constrain future possibilities and probabilities.

10.15.4 CHANGE AND SELF-ORGANISATION

Since self-organisation does not necessarily result in outputs favourable to humans or environment (Krugman 1996: 5-6), and since Strategic Planning has often been pseudo-consultative and eco-illiterate (Sarkissian 1992; Sarkissian & Walsh 1994: 1), engineering-driven, insensitively superimposed and ecologically destructive,⁵ it would seem that a new approach could be beneficial, which takes dispassionate account of the fact of self-organisation rather than embracing it as a good, and which simultaneously attempts to influence the system's ordering parameters by Backcloth design to meet eco-social needs. Self-organisation (by 'invisible hands' or other forces) is manifestly inadequate for supporting non-economic and intangible goods such as Social Justice, Social Capital and eco-centric values, and can not be regarded as justification for pursuing laissez faire, purely market-driven policies or designs. This would only be appropriate in a system running on a Maturanian love Attractor! The current Attractor appears to be based on fear (Scarcity Myth).

In the Western world a new pattern of Economic Rationalist intervention has emerged which tends to cut indiscriminate swathes across large regions of economic activity: the 'take as axe to it' approach of (say 15%) cuts 'across the board'. This powerful new set of Changes and Constraints has tended to result in major instability together with highly creative self-organisational regrouping (as predicted by the Holling model), with underconnected (from funding) collapse of some system elements and the emergence of completely new, stronger combinations of elements. Such regrouping has catalysed both Creative Planning and undesirable (inhumane) responses to non-negotiable system constraints, along with inevitable crashes in many organisations that were operating on Attractors of Service or commitment to Community.

For example the University of Columbia, under threat of de-funding, after considering its overarching organisational goals, did away with several weak departments such as Geography and Geology. But a new collaborative Faculty of Earth Science has emerged, which has a goal of confronting Gaian issues from an interdisciplinary perspective, and new staff will be selected for their integrative, multi-disciplinary approaches rather than specialism in single, circumscribed fields. This process has been achieved slowly (for example over 17 years in some departments) and with widespread consultation, enabling all Faculty members to feel informed and involved, even when in basic disagreement.⁵

But similar processes have seen the loss or serious reduction of History, Geography, Anthropology and core, small, delicate departments, either axed because they did not contribute

enough to university image, niche definition (branding), the university budget or the market economy. In a society that denigrates intellectuals and believes that advanced Technology and Neo-Economics have released us from history altogether, we should not be Surprised eventually to find ourselves in the 'condemned to repeat it' situation around History.

Krugman presents a self-organisational approach to urban form wherein he distinguishes between spatial and temporal self-organisation and ascribes the emergence of order to either instability or random growth (Krugman 1996: 44-47). He represents temporal Self Organisation by Business Cycle Theory, Percolation Economics and phase locking in global business cycles. Spatial SO is presented as computer models of the 'Edge City' (Garreau 1992), 'Central Place' (Ullman 1959) and Simon's 'Urban Growth Model'. Schelling's 'Segregation Model' demonstrates that local short-range interactions produce macro structure (quoting Schelling's "*Micromotives and Macrobehaviour*" 1978). Krugman also gives the example of an integrated neighbourhood that becomes completely segregated over time operating under a very mild level of local preference to live near similar people: an example of order through instability (Krugman 1996: 17-20). **Table 103: BICM: Spatial & Temporal Self-Organisation** summarises Krugman's approach. Invoking Kauffman's rugged fitness landscapes (**Link: HST: Coevolution**), Krugman summarises the conditions for applicability of this model:

- Ensemble of many components.
- OR²⁴⁴ structures define each component's functional state (discrete on/off responses)[*the future will probably provide fuzzy alternatives to this probabilistic approach*]. **Link: HST: Stability, System Structure & Evolution.**
- Linkage of future state change of components.
- Both positive & negative feedbacks between components (Krugman 1996: 32-3).

While in reality component states operate along continua, even fuzzy systems (FCMs.²⁴⁵in their present state of development) operate by nominating individual thresholds and await increased computer power or wider availability of FAN (Fuzzy Adaptive Network) processing. In practice, the situation is more complex, with agglomerate forces (centripetal or centrifugal), [*an emergent property*], containing (for example) worker mobility (mobile urban labour, immobile agriculture workers), access to markets (good/poor), returns on investment (rising/falling), and transport costs (locational advantages, dispersal of agricultural producers), real wages (high/low), which can be seen to constitute a complex landscape. One could add other factors such as recreation or scenic amenity.

This can be understood as a field of small Attractors which operate together through an Interference Field to form the emergent centripetal/centrifugal balance (market potential

function) at a higher level, with an emergence higher still of an urban structure at a particular location. Krugman refers to Garreau's "Edge City", which defines cutoffs for Attractor functions or 'urban multiplier effects': for example known basic minimum office space (allows for growth of business services at local level), and Repellers such as Traffic congestion and land costs (Garreau 1992;Krugman 1996: 78).

Spatial decay effects are well known in a number of Sciences ($1/d^2$) where d = distance, for example electro-magnetic field strength, Urban Economic Geography, Transport Modelling and Diffusion Theory. Krugman (see above Table) explains such counter-intuitive regularities and fluctuations as the Zipf Law, and self-organisation through the theoretical concept of a Fourier Series,²⁴⁶ which decomposes fluctuations into multiple frequencies with different inherent rates of growth or decay. High frequencies tend to dissipate, low to fade out, and medium to grow with frequencies favoured by other parameters growing fastest and in effect dominating (slaving) the others (Krugman 1996: 78-80).

P.M.Allen presents a dynamic ('dissipative, evolutionary') model of urban structure based on market factors that bears strong resemblance to much of Krugman's work above and is similarly related to Christaller's Central Place Theory²⁴⁷ (Allen 1982: 101-109). He points to the intrinsic relatedness between human and 'natural' systems; to the "extraordinary richness of structure, rhythm, and pattern" in far from equilibrium dissipative systems; that humans are not outside Nature; that bifurcations or choice points with random factors and particular events all influence system evolution; that the past has relevance as a constraint on potential for change; that there are limits to control by design (Allen 1982: 110).

This gives rise to new types of questions appropriate to the exploration and understanding of (learning within) complex systems:

- What is the inner structure of the system?
- How will the system react?
- At what scale must the system be approached ('disaggregated') to understand the above?
- What is reproducible and what is not? (Allen 1982: 100).

The change process involved in continuous learning in organisations and projects, is discussed under Criterion Indicators.

²⁴⁵ Fuzzy Cognitive Maps.

²⁴⁶ For example (x) over length L decomposes into sine waves at frequencies 0 (horizontal line), $2\pi/L$, $4\pi/L$, $6\pi/L$ and so on. (Krugman 1996: 80).

²⁴⁷ This theory is also central to Doxiadis' Ekistics Theory as mentioned elsewhere.

10.15.5 INCREMENTALISM

Incrementalism, or the 'tyranny of small decisions' (after Kahn 1966 referring to Economics)²⁴⁸ recognises the emergent impact at a higher scale of a multitude of small decisions, but policy rarely responds appropriately (Edwards 1997).²⁴⁹ The conscientious attempt to respect this is one of the key differences between an environmental and an ecological approach.

Murphy's Law is actually a manifestation of the Theory of Incremental Progression. For an undertaking to proceed, every element in it must succeed. However for it to fail, only one step need fail. Incremental Progression provides a rational explanation for not only Murphy's Law but numerous other empirical observations about how land is developed and, for that matter, about society generally. The Theory states:

Matters progress by a series of incremental steps, each of which is logical considering the circumstances and the motives of the key players at the time (Edwards 1997: 1).

This is a classical CDS description, unstably constrained by the Social Trap expediency and encouraged by the Theory of Virtue (**Link: Ordering Principles**). Edwards, like Theobald, points out not just the threat of the 'tyranny', but its harnessing potential in the service of worthwhile change: the 'triumph of small decisions' in a persistently appropriate direction. **Table 104: CM: Elements of Incremental Progression** presents a range of general causes and characteristics of Incrementalism from the local government-developer interface. **Table 105: RRES: Identified Causes of Coastal Incrementalism** looks more closely at the specifics of a Queensland coastal area, making recommendations for planners.

Edwards attributes the tyranny to taking 'each case on its merits', which means that plans usually do not work. The Natural Step recognises this by instituting a Benchmarked process ('The Compass') with small, manageable steps, tuned to the organisation's change capacity and resources, but inexorably tuned to the long-term sustainable objectives (The Natural Step 1999b: 4.7). The Ecological View recognises limits beyond which we must not go. With complex systems it is actually best when uncertain, to nudge and watch, nudge and watch: to allow for creativity, to not demand a particular visual outcome, but a functional outcome, and yet to forbid actions by anyone (regardless of income) known to be damaging: to keep aiming the compass towards, never away from long-term resilience and liveliness.

High staff turnover and modern discontinuity imply the need for a system (such as an EMS²⁵⁰) that persists longer than the staff, giving continuity and expression to the local higher vision (if only that Vision would celebrate life rather than money). If not, then perhaps the longer the system remains ineffective, the better!

²⁴⁸ (Edwards 1997: 6-7; referring to Kahn 1966).

²⁴⁹ Policy Planning, Department of Lands, Queensland.

Links: Criterion Ecocycles: Dematerialisation; Confluence: A New Style of Development; Early Findings: Barriers to Implementation; Table 4.

10.15.6 CUMULATIVE EFFECTS ASSESSMENT

The evolutionary approach to environmental management has in the USA and Canada spawned an extension of EIA (Environmental Impact Assessment) which takes incremental change over time into account, the so called CEA (Cumulative Effects Assessment), which has now become commonplace. A literature search and field survey by Spaling and Smit has recommended a plurality of approaches (actually a Complementary approach including the empirical/scientific and the Planning/local knowledge of eco-econo-social processes) (Spaling & Smit 1993: 597). Spaling *et al* list the attributes of Cumulative Environmental Change as temporal (periodic, continuous or irregular and short or long time frame); spatial (local, regional or global scalar; clustered or dispersed density; point, linear or arcal configuration); and human induced effects on accumulation, with varying characteristics. Theories of causality mentioned specified: source (who? natural, human), structure and process (how? social, economic, ecological, affected by perturbations; spacetime responses) and effects of change (what? in structure & function/spacetime) (Spaling & Smit 1993: 591).

Eight types of cumulative change were assembled which emphasise the underlying spatio-temporal (scalar) issues: **Table 106: CM: Cumulative Environmental Change: Typology.**

It is clear from this type of classification that application of EIA only to site of interest is inadequate, as distant effects in space, time and process must be taken account of. Not only this, but incremental effects of small, unrelated decisions are manifestly problematic. This type of understanding lies behind the human settlement ecologist's insistence that both a global and a bioregional approach be taken to all developments, not just large ones. If projects take responsibility for their own resource inputs and outputs within the bioregion, then there will be no impact at a larger scale. (**Link: Criteria: Genius Loci, Biotics: Bioregionalism**).

In the context of environmental management a number of papers have appeared which approach the subject through ecosystem, SOS, dissipation, evolution and stochastic-resilience concepts (Allen 1982; Allen 1989; Grzybowski & Slocombe 1988; Hollick 1993; Slocombe 1993a; 1993b). P.M. Allen, taking an evolutionary position, speaks of four basic types of evolutionary processes in urban or regional settings:

- Spatial diffusion of population (following perceived opportunity Attractors)
- Input/output and cost changes secondary to technological change
- Completely new activities from new technological entities
- Lifestyle and expectations changes [*including fashion*] (Allen 1989: 89).

Peter Allen here describes a model that deals quite well with the first two processes but not at all with the last. Earlier in his paper he discusses the relative speed of cultural evolution, which by perception-judgment-imitation, selects out the conceptually unfit by an individually decided affirmation of advantageousness. In modern complex cultures, he sees information creation, channelling, diffusion and concealment as the new currency, equivalent to genes in biological evolution, and allowing the interfacing of a diversity of views and values, thus steering a course between "a rigid 'mono-culture' of clear values and duties, and the chaos of totally disparate individuals with no consensus at all, unable to act together." (Allen 1989: 86). This in effect describes an *Edge of Chaos* situation and demonstrates its Complementarity: the chaotic fluxes into the measurable. His main point is that the current system must be transcended, and this can best be done by a proper balance of 'stochasts' who embody the adaptive capacity of the human response system and whose research should be fairly funded, and the 'Cartesians', the system backbone which represents normality, stability and excellence (Allen 1989: 89).

In another paper on urban modelling, Allen presents the charming simile of origami to illustrate his description of Bifurcation Theory. He presents eight different forms which may be made to emerge from the folded paper, noting the number of folds necessary and the bifurcation points at which different outcomes were committed to. While one could take a Cartesian view and say that the paper was white, had complexity level X according to a formula related to the number of folds, and had certain physical characteristics, to complete the description one needs to affirm the essence of a horse or a bird not just by the characteristic number of folds, but the position and order in which they are made. That is, the history is a vital component of the object's essence (Allen 1982: 100-101). This is a direct if unconscious appeal to the Complementarity Principle, and seeks to demonstrate the qualitative change aspect of complex systems, which is also emphasised by Holling.

Hollick looks at the common themes for Sustainable Environmental Management presented by the World Watch Institute in 1987, and notes that downscaling, growth-limiting, population controlling, conservationist types of parameters lack any concept of evolution or self-organisation. He counsels the acceptance that outcomes are unpredictable, and goes on to suggest a new strategy for Environmental Management based on evolutionary principles: **Table 107: ES: Hollick's Evolutionary Management**. From a psychotherapist's perspective, these

same principles would provide an excellent outline for running healthy human relationships and parenting as well. **Link: Criterion Indicators: double loop learning.**

10.15.7 THEMES OF CHANGE IN HUMAN SETTLEMENTS

These include:

- a). Site history
- b). Return times/phase cycles, pulsations, rhythms, synchronicity, oscillations (scale related); events of characteristic frequency (for instance the '100-year flood')
- c). Change, evolution (unfolding), devolution, revolution ('volution'); allowing for future change in Planning and development
- d). Development (complexification, enrichment, revelation), envelopment, (voluper to unwrap), 'velopment', 'revelopment', 're-de-velopment'
- e). Project staging
- f). Time's arrow: directional passage of time (past-present-future); circular perceptions of time, Dreamtime issues
- g). Relationships with future generations
- h). Life cycles (people, buildings, products, trees, forests, all biota, geological)
- i). Issues of timing, synchrony, resonance, compatibility (ideas, timetables)
- j). Incrementalism.

It is not realistic to expect that any role player currently involved in Urban Development should understand the Mathematics of Complex Dynamic Systems, but the ubiquitous ignorance underlying development decisions could be approached by teaching a generic version at tertiary level, relating a general understanding to the types of strategy likely to allow Natural Wisdom (as defined by Maturana *et al*) to emerge.

This is not a simple system. It reacts over long timescales in surprising ways, and gross impacts such as currently allowed to developers can not continue if biodiversity and Ecosystem Services are to be valued and supported. At the very least, ecologists should become normal members of development teams, employed by developers, local and state governments; local government staff, especially those who may impact vegetation through maintenance, clearing or planting decisions, tender authoring, Policy development, refuse disposal, engineering, and many other roles, need generic training such as TNS. Necessary first strategies include biotic inventories and long-term Regional Landscape Plans. Staff also need access to databases, learning systems, library resources, contact lists, peer and bioregional networking.⁵

10.16 CRITERION: INDICATORS

10.16.1 ESSENCE

The core issue for indication is the healing, well-being and long-term maintenance of all life forms on this planet; to guide our human participation in the ecological systems and services of the Biosphere, through which all life forms, one way or another, express mutual dependency. A number of different types of Indicators are described below. Such a Criterion is included because it is now accepted as essential to the Learning Systems we now know we need to create.

10.16.2 THE WIDER CONTEXT

Work from the United Nations Statistical Office (UNSO) first provided a frame of reference (FDES: Framework for the Development of Environmental Statistics, first mooted in Warsaw in 1973), with the first draft presented to the UN in 1981. Since the findings of the Brundtland Commission were released, and especially through the 1990s after UNCED, the level of interest in monitoring matters has increased globally, with leadership being most apparent from the United Nations, Germany and The Netherlands,²⁵¹ which are now investing in the development of 'Second Generation' Indicators.

Australia's progress has been very slow and reluctant relative to other OECD countries. There is a realisation elsewhere that P-S-R (Pressure-State-Response) Indicators (now being adopted widely in Australia) are "not ecologically well founded" (Rennings & Wiggering 1996: 30). They were developed as a tool for international comparison of environmental indicators, not for local monitoring. Having released different types of State of Environment (SoE) reports earlier (1986, 1992), Australia has been working on a national reporting system (SoE, SoER) since 1992, consistent with Objective 14.2 of the National Strategy for Ecologically Sustainable Development (Commonwealth of Australia 1992b: 63). The definitive work appeared as "State of the Environment Australia 1996", and in 1998 Environment Australia outsourced the development of a massive set of Environmental Indicators for human settlements, biodiversity, the atmosphere, the land, inland waters, estuaries and the sea, and natural and cultural heritage.

The human settlement set has been based on the 'Extended Metabolism' model, which is resource (resources in, wastes out, but no connecting concepts as described above) and quality of life based, and which mentions biodiversity not at all (Newton *et al* 1998: 11). **Link: Criterion Ecocycles: Urban Metabolism.**

All Australian States and the ACT (excluding the NT which is waiting to emulate the Commonwealth findings), are²⁵² now working on SoERs and developing Indicators, all using the P-S-R model, or the variant C-P-R (Condition-Pressure-Response - WA, ACT), except Victoria, which simply produces thematic reports using a Stress-Impact model (no Indicators, no legislation). Five have enacted supportive legislation²⁵³ (NSW, Qld, SA, Tas, ACT) (Department of Environment & Natural Resources 1997: 15). The Commonwealth human settlement Indicator set has been presented as a C-P-R (C-S-R) model (noting the differences between Pressure and State, and between the P-S-R and D-S-R (Driving forces-State-Response) approaches. This has been adopted notwithstanding a number of "acknowledged shortcomings" which include simplification, exclusion of ecological responses, P, S, R distinctions being purpose-driven (and thus confusing), and omission of inter-generational and exogenous processes. The latter is addressed not by Indicators, but by reference to macro forces, including international migration, economic growth, globalisation of trade and economic dependency, and technological change affecting options in energy and information processing (Newton *et al* 1998: 19, 20).

The development of Indicators and other forms of auditing is still often unsophisticated, selected on convenience, intuition and parsimony, sector- or theme-driven, historically under-funded and largely uncoordinated. For this reason, an expanding number of non-coordinated approaches has emerged, through several Criteria and Scales (local, city, regional, state, national, international, sectoral [*for example Forests, Agriculture*], thematic), as appropriate models and surrogates are sought, and each jurisdiction selects Indicators suited to its own needs, availability of data and ability to fund. In the short run this creative process will provide experience with many types of Indicators and information about their practicability at different scales, as long as this experience finds a way to be shared and integrated. The trend to firm up Indicator systems at all scales along P-S-R lines, however, will create path dependencies which may be difficult from which to withdraw. Also, as in parenting, 'you get more of what you notice': things not indicated remain invisible and potentially Surprising.

The FDES process considered four approaches which are still popular today: the 'media' or SoE approach, the 'Stress-Response' model from Canada, the 'Resource Accounting' approach (resource flows, largely European), and the 'Ecological' which identifies relationship issues

²⁵¹ Sink-oriented pollution control policy was initiated in the mid 1960s in the Netherlands as in a number of other countries at that time (Adriaanse 1996: 3).

²⁵² 1998.

²⁵³ Supportive legislation is regarded as an essential reinforcement for national statistics collection. Communal arrangements are much less formal, and their lack of standardisation and the difficulty in making comparisons, have resulted in the formation of a Communal (municipal) Statistics Information System known as KOSIS-Verbund to enable joint development of Indicators (Federal Ministry for Regional Planning 1996: 111).

between plants, animals and their environments (but does not include humans as animals apparently) (Commonwealth of Australia 1992a: 3-11). Each approach tends to emphasise a focus of interest, and implies a set of values and a definition of sustainability. An ideal state is often explicit, as where goals or Benchmarks are stated, but these may be quite arbitrary (such as qualitative, socially-driven values – **Link: Core Set Model below**), and/or interim (such as Greenhouse Gas emission reduction to 1988 levels less 5% by 2005 - some 80% reduction being actually required to return CO₂ levels to 'sustainable' range by 2040²⁵⁴), economically driven, (such as the Benchmarks Set for preservation of forest types, which have little to do with the requirements for biodiversity protection), and are usually anthropocentrically chauvinistic. This is hard to avoid, since that is our species, but inter-specific justice issues are very much slippery variables, and as ever, Ecology will not be mocked.

The Australian Commonwealth Environment Protection Agency (CEPA) in 1992 considered four general approaches to finding suitable Indicators for assessing, monitoring and 'managing environmental quality': **Table 108: BI: Approaches to Finding Suitable Indicators.**

The P-S-R/C-P-R model, being adopted so widely in Australia, and with so little integration across political boundaries, can be predicted to cause problems of comparison in the longer term. In addition, while it claims to relate Causes (Pressures) to Responses, it does not inherently evaluate the effectiveness of those responses, nor actually relate to causes in any systematic way. For instance there is a habit of identifying 'core' Indicators out of a large list, and even though the whole set is presented as P-S-R, only one of these is commonly selected as core. That is, the core Indicators are not selected as a set relating P+S+R, and finance and convenience play significant roles in the choice.⁵ The Indicators settled on still have the quality of a collection rather than a colloquy. Even then, Spangenberg *et al* of the German Wuppertal Institute are quoted by Hendriks & Harding (1995: 5, no ref. details given) as saying:

Deriving responses from the selected states necessarily results in the development of (short term) curative politics, preventing the development of cause-orientated approaches. In this respect, the P-S-R system reflects a kind of political 'end-of-pipe thinking' and thus cannot fulfil the requirements of proactive environmental policies.

Not only end-of-pipe, but similar to Illness (symptomatic) Medicine, as distinct from Wellness (preventive) Medicine. This could be acceptable if we were already in a Sustainability Space and had only to 'nudge' the system to keep it there, however much longer timescales and far more radical action are required just to 'turn the ship around', let *a*/one approach sustainability.

²⁵⁴ (Rennings & Wiggering 1996: 29 quoting Weterings & Opschoor, 1992).

Most groups who have used the P-S-R model appear to have had to adapt it in some way, and the ways do not match across States. In the Australian (national) case, the approach has tried to take into account environment-culture linkages, Australian local variability and lack of environmental knowledge (biome, region, continent), and complex rather than linear conceptualisation (Commonwealth of Australia 1996b: 10; Hendriks & Harding 1996: 8).

Europe has tended to emphasise Pressure aspects, while Australia at all scales has focused more on SoE (State), at least as a first approach. Canada (Toronto in particular) has been strong in Quality of Life and community-participatory attempts to integrate Quality of Life and WHO²⁵⁵ Healthy City Principles with sustainability, and to construct Indices (Canada Mortgage & Housing Corporation 1993; Houston & Ferguson 1991; The Municipality of Metropolitan Toronto 1992). At worst, Indices, the epitome of surrogacy, are arbitrary, problematic, replete with assumptions, prone to inappropriate reification, often uninterpretable and a nightmare for comparisons.

Indicators are required at several scales, and as with Planning and Development, two approaches have emerged: top-down (for example P-S-R, SoER) and bottom-up (for example AMOEBA, Toronto WHO Healthy Cities, Metro and COMLE). As Brown notes (Brown 1996: 1), Australian Local Government has been leading the Commonwealth in the process of developing Indicators, producing annual SoERs and responding to the demands of Agenda 21.²⁵⁶ The bottom-up approach is wonderfully appropriate socially, but even if guided carefully and accompanied by relevant information, does not guarantee that ecological issues will be adequately considered.

The importance of community involvement and empowerment (and providing Indicators for that too), with a concomitant attention to Community Education, were strongly iterated by the Toronto Healthy City focus groups, while local perception of Quality of Life was notably not necessarily correlated with Sustainability (Houston & Ferguson 1991: 30, 3). To save time, communities will often start with somebody else's list and modify that intuitively, but in the long run, Indicator selection must be relevant to local conditions. For instance Indicators relating to industrial pollution and acid rain are stated by national experts not to be relevant to Australia, however there are some areas of Australia where acid deposition is an issue. For example the Blue Mountains and Newcastle receive (albeit) minor aeolian acid from Sydney due to combined local geomorphology and wind action, and naturally occurring tropical acid rain occurs in the

²⁵⁵ World Health Organisation.

²⁵⁶ Having attended the Global Forum in Rio de Janeiro in 1992, and knowing the commitments undertaken to do Local and other scale *Agendas 21* and *SoERs*, and knowing how slow the process was to start in this country, I was surprised on attending the "*Pathways to Sustainability*" International (Local Government) Conference in June 1997, to find that the concept has now caught the imagination of many Local Governments Australia-wide, with a complete turn-around in attitudes beginning to spread under its own momentum.

Northern Territory as a result of emissions from rotting vegetation (Anderson & Lumbers 1986: 84-5; Bell 1986: 22; 1989: 17-20). Since most of Australia's brown coal and other fossil fuels are low in sulphur, the severe destruction of building surfaces and disastrous acidification of rivers, lakes, forests and soils have not been seen here, but this may change if instead of seeking renewable alternatives, we import more Middle-Eastern oil, or if we use more high-sulphur SA coal (Bell, 1988a: 28).

The struggle to formally balance the Gross Domestic Product with a Genuine Progress Indicator is spearheaded in Australia by the Australia Institute (Dr Clive Hamilton). It has some limitations but appears to correlate with an intuitive feeling that things are not going as well as the GDP (measuring only economic activity) would suggest (Hamilton 1998; Hamilton & Denniss 2000).

10.16.3 INDICATORS & SUSTAINABILITY

The Executive Summary of the 1996 SoER for Australia mentions in numerous places, the need for a system-based approach to sustainability Indicators. This is reiterated in the Environment Australia Human Settlement Indicators document (Newton *et al* 1998: 25), but even though Indicators for the separate domains (exogenous, energy, water, urban design, transport & accessibility, population, housing, indoor air quality, environmental health, noise, waste) claim to be based on a thorough understanding of the systems underlying those chosen, the selection is heavily influenced by the authors' brief to be convenient and relevant to practitioners and policy makers in these domains (Newton *et al* 1998: 21), and the fact that the Extended Metabolism Model is linear. **Link: Criterion Ecocycles: Urban Metabolism.** The linkages disappear from view. Many Indicators would still be used if a complex systems framework were to be more explicit, but transparency of framework would have an educational role in addition to informing Indicator development. **Link: Criterion Ecocycles: Molecular Pollution: EcoCost.**

The development of Environmental Indicators assumes a model of sustainability, which may be modified by relative concern weightings on an economy-environment polarity, and may carry misinformation in implying environmental sustainability by using the word 'sustainable' alone, or even attached to the words 'environmental' or 'ecological', while actually meaning economic sustainability.²⁵⁷ Professor Martin Williams (ANZAAS '97 Conference, Adelaide 1997) presented a diagrammatic continuum in explaining the range of sustainability priorities in approaching development. Sustainability is in the eye of the beholder: **Table 109: CM: Sustainability: Priorities in Development.**

The Natural Step definition of Sustainable Development is anthropocentric but eco-responsive: "a dynamic process which enables all people to realise their potential and to improve their quality of life in ways which simultaneously protect and enhance our Earth's life support systems". The key criteria for a model of sustainability espoused by TNS include a systems approach, a scientific basis, clear definition of sustainability, trans-scalar application, economy-ecology linkage, simplicity ('intellectual clarity'), consensus-building,²⁵⁸ economic feasibility and ready implementability.²⁵⁹

It is reiterated that ecosystems are completely indifferent to human 'reasoning', 'rationality' and to excuses based on self interest, or the need to formulate neat and manageable policy. Yet the prime objective of the Australian Governments in the National Greenhouse Response Strategy of 1992 was:

[To] stabilise greenhouse gas emissions (not controlled by the Montreal Protocol) based on 1988 levels by the year 2000 and to reduce these emissions by 20 per cent by the year 2005

... subject to Australia [sic] not implementing response measures that would have net adverse impacts nationally or on Australia's trade competitiveness, in the absence of similar action by major greenhouse gas producing countries (Commonwealth of Australia 1994a: 3). [Emphasis added]

Politically, Australia's present position on the far left of Williams' continuum, and the lack of understanding of and commitment to the necessary radical sustainability (even as the magic words 'Sustainable Development' are mouthed and claimed in reports), is also evidenced by the propensity of both major Australian political parties for over-ruling environmental considerations on 'either/or' economic grounds (for instance the ready acceptance of clearly flawed and biased Environment Impact Statements or the waiver of requirement for EIA, allowing desecration of National and World Heritage Areas, or threat to sensitive habitats (for instance Port Hinchinbrook), the encouragement of cotton production in the North despite devastating consequences downstream, conducting a major taxation review without considering environmental taxes²⁶⁰), and Australian political leaders' recent reluctance to countenance taking binding action on GHGs,²⁶¹ even when other producers, Australia's competitors, are proposing such action themselves and invest up to ten times more on remedial strategies.²⁶²

²⁵⁷ For instance see Liberal Party election promises 1996 under heading 'Environment'.

²⁵⁸ Actually means presentation of a scientifically legitimated model with which it is difficult to argue.⁵

²⁵⁹ Official training material, 1999.

²⁶⁰ A major Australia Institute Report on Ecological Tax Reform has demonstrated that 250,000 jobs could be created (including removal of payroll tax), greenhouse gases reduced by 40% by 2020, \$6.3 billion raised just through a small carbon tax and a range of other measures (Hamilton *et al* 1997; The Australia Institute 1997).

²⁶¹ Based on a manifestly biased and flawed report funded by the fossil fuel industry which considers only the negative side of taking action.

²⁶² Australian Conservation Foundation international comparison of countries' efforts on Climate Change announced 20/11/97. See also <http://www.acfonline.org.au/blueprint/>; (Krockenberger, Kinrade & Thorman 2000).

Department of the Environment personnel, on the other hand, are well aware of the ecological realities, but are often forced into pragmatism or compromise as a result of politico-economic externalities, notably funding restrictions.⁵

The term 'Sustainability' as commonly expressed, appears to imply a fixed, recognisable but impossible state, to which one should aspire in one's dealings. Or worse, it is often used to indicate that maximum licence may be taken short of (apparently) actually causing collapse of the system involved: an attitude universal in Economic Fundamentalist and Resource Economics circles, which expects substitutability and reversibility, and has apparently never heard of the hysteresis phenomenon. In fact a system may well be in a state of collapse, undiagnosed, when its return time is slower than human scale (note the 80-100 year lag in manifestation of salt problems from rural clearing). **Link: HST: Surprise.** It is thus important that assumptions about Sustainability be stated before attempting to set goals, Benchmarks and Indicators, and in practice, at least a transparent working definition is necessary in order to provide a qualitative Principle or quantitative Benchmark for the interpretation of the Indicators developed. For the purposes of this dissertation, sustainability should be expressed under UHSE headings, including Scale intended, because of variation of scale and extent amongst issues: Table: Sustainability x UHSE Criteria. I would argue that (Biocentric) 'Sustainability' is absolutely meaningful to biota only if it refers to the indefinite maintenance of the processes that support their life and well-being at the Scales occupied by those biota: the supportive Backcloth from which they have emerged, including the initial conditions, all the other scales and all the necessary co-evolves: living beings, resources, linkages, dynamics and mechanisms. What we usually argue about is 'Relative Sustainability', a fuzzy concept that we determine by commission and omission, hubristically making tradeoffs, and playing God in our trance.

In the forest fire example: a fire is devastating to a single tree, but a key Organising Principle for the whole forest. Do I demand sustainability for all lifeforms over the whole Biosphere, or do I maybe mean just for people like me?

10.16.4 INDICATORS & BENCHMARKS IN PRACTICE

Indicator development has received substantial funding from Environment Australia in 1998, for a full range of environmental sectors including urban (for instance see Commonwealth of Australia 1996b; Newton *et al* 1998). Many local governments are apparently using Indicators, but one Catchment Board officer confided in me: "nobody has any idea what Indicators are

about, so they stick a few on the end of reports to make them look good, but they don't actually use them."⁵

If it is accepted that there is a serious ecological problem, and that action should be taken to alleviate it, then a serious approach to evaluation and monitoring is implied, in imitation of Nature itself, and to enable a policy of continuous learning and improvement. Nature brings to bear the full range of sensory capacity of its elements, responding sensitively to information.

Continuous learning models are now regularly prescribed for organisations as they strive to improve performance, first economically, and more recently, environmentally in human relations and in management (BHP Safety 1998; Normandy Mining Limited 1998; WMC Limited 1998a; 1998b). They can not do this without appropriate Indicators. Senge's books on the Learning Organisation and Argyris' on single and double loop learning²⁶³ are now well known in Business Theory (Argyris 1996; Argyris & Schön 1975: 19-20; Senge 1990; Senge et al/ 1994). In short, single loop approaches deal with immediate causes and short time scales. Double loop approaches address the system itself. **Link: HST: Social Traps.** Environment Australia in 1999 commissioned a nation-wide, participatory process for the development of a manual on Environmental Reporting for Australian organisations (in press).

If one reason for inadequate progress towards sustainability is ignorance, and another path dependence, a third is the fear of legal redress if experimental activities fail to deliver their promise. What is now regarded as tried and true in Planning and Urban Development, has not in reality existed for very long, but it appears to be cycling on a tremendously strong Attractor. The new Corporatist agenda is emphasising the necessity for accountability to shareholders²⁶⁴ and some are measuring, valuing, benchmarking and seeking feedback on ecological and social performance. This has not so far been attractive to 'average' developers, and it may take a large government joint venture like LMC²⁶⁵-Delfin Lend Lease (formerly an MFP project) to model Benchmarking, but it is a slow and resisted business.

The importance of experimental housing and an attitude of continuous learning and improvement was emphasised to me by Danish, Swedish and Dutch academic researchers,

²⁶³ 'Double-loop learning' described by Argyris, refers to changes in direction (say of a company) in response to predicted negative delayed effects from present practice. For instance, *The Natural Step* describes the switch by Shell, which 'hit the wall' over confrontation of its appalling behaviour in Nigeria. Having defined its core business as 'selling oil', it could not meet the TNS *System Conditions for Sustainability*. Redefining this to 'selling energy' opens up a whole new area of potential business, and the gradual phase-out of oil exploration could then be contemplated (unpublished fact sheet, TNS 1999).

²⁶⁴ If this is true then shareholders could potentially 'save the planet' through their demands, IFF they understood why they should. This is apparently emerging now, through the sudden recognition that 'Socially Responsible Investment' commands consistently higher returns than other investment. Such companies now have a special category on the New York Stock Exchange..

planners, eco-village developers, housing association personnel and co-housing community residents. Proactive benchmarked goals especially in the energy area were a feature of the MFP and its step-up project at New Haven, Adelaide.²⁶⁶

In 1992-3, MultiFunction Polis Australia's Urban Development was supposed to implement "a paradigm shift" in ecologically sustainable Urban Planning: stringent energy policy (a modest 50% saving vs typical Australian average – compared with say, Rocky Mountain Institute, 70% fossil fuel reduction), solar access site design, energy efficient housing and many other features⁵ (**Links: BR 5.1: Helsinki Paper; Early Findings: Barriers to Implementation, Table 4; Project Failure: MFP Australia; Confluence: New Approach to Development**). The privatised successor, the Delfin-Lend Lease 'Mawson Lakes' development was to be Benchmarked to a higher level of energy efficiency than New Haven; New Haven was to have been 30% more energy efficient than the suburban average, which was approximately achieved at site scale only.

New Haven was built (circa 1996-7) in a low income location where the population was unlikely to appreciate its benefits without education, and it was passed on to commercial agents and marketed unsuccessfully. The full complement of houses had not been built (1997), and no 'Green Mortgages' taken up. The development had by early 2000 finally started to fill up, but not embracing many original concepts.⁵ As they expected, the SA Housing Trust and MFP had tremendous difficulty encouraging builders and real estate vendors to deviate from the normal path^{267,5}

Mawson Lakes (1999) has been disappointing in terms of its promoted image of 'conspicuous consumption', the developer's decision not to promote the projects sustainable aspects (for fear it would not sell), and decision to exclude sustainable strategies prejudged to be non-commercial(eg solar hot water); of its marginalised energy scoring system, which caters to the tastes of reverse cycle air conditioning in a climate better suited to evaporative cooling, and of its 'voluntary' solar design. Compared to 'Australian average', the targets and current (05/2000) status respectively are officially (report from LMC Mawson Lakes Project co-management):

1. Potable water use reduced 50%: dual piping to every house but grey water system complex: not designed yet, will cost "millions", awaiting larger population (presently ≈ 100 - ≈ 40 households).
2. Household energy use reduced 50%: not yet audited and generally considered unlikely to achieve any reduction (see comment below).
3. Mixed commercial energy use reduced 40%: no town centre designed as yet (designs were due by end 2000).
4. Solid waste to landfill reduced 50%: initial focus on building waste strategies abandoned for fear of increasing builder costs(currently approximately 8 tonnes/house).
5. Embodied energy residential + commercial reduced 50%: no strict encumbrances on buildings

²⁶⁵ Land Management Corporation, Adelaide. Manages all SA Government-owned properties.

²⁶⁶ Leon Byass, unpublished paper delivered at Catalyst '95 Conference, Canberra, ACT, 1995.

²⁶⁷ Project Management staff from both, personal communication.⁵

A triennial review is due. Audit reports to support these claims are not available. Builders are signing compliance forms and subsequently installing equipment other than specified.⁵ These activities are apparently not being checked on site in any case and the local Council is powerless to insist, having assigned its planning role to the developers under a Plan Amendment Report (PAR), with associated encumbrances and indenture agreements. Sadly, all this is being promoted as Best Practice, Australian, perhaps world, and the media and politicians generally are keen to deliver positive articles about its achievements. Whilst no doubt valuable as a public relations exercise for the developers, this is likely to mislead the public generally as to the extent of change necessary to be able to claim sustainability.

The original MFP Board (1992) had intended to retain control of sustainability features by developing the urban villages itself, not appointing a commercial developer.⁵ The instant implementation demanded of the MFP from the outset was clearly unfair and politically motivated, as it was always a 30-year project. The residential component – now to be delivered by developer Delfin Lend Lease Consortium has received substantial government assistance, including an underwriting agreement to guarantee a minimum 26% internal rate of return. When the project was privatised, government owned land was handed over without charge on condition that the developers deliver on a series of sustainability commitments (these included a 50% reduction in energy use, water use and waste to landfill for example). There is evidence from other sources that the developer has been inhibiting innovative strategies in the sustainability area to maintain the appearance of a 'me-too' development. They have clearly succeeded. Insufficient funding or commercial non-viability have been claimed for many sustainability commitments and the grey water recycling scheme has not been implemented, nor even designed, despite houses being plumbed in anticipation. ISDN connections 'to every house' are now 'available for connection'. Promised solar hot water systems were never installed, despite 20 of 40 energy points availability, and despite their presence on a list of mandatory requirements when the project was first mooted. This requirement was also incorporated into the Stage 1 Economic Development Business Plan – signed by Delfin-Lend Lease prior to the renaming of the project.

A fund was established by the Land Management Corporation to provide financial 'oxygen' for innovations and emerging economic opportunities at Mawson Lakes. Funded by a 2.5% levy on land sales, the fund had the potential to, for example, subsidise the cost difference between

solar hot water collectors linked to ground-level tanks, and the more usual gas or electric. This fund also offered the potential to attract \$1 for \$1 funding from Australian Greenhouse Initiatives such as the *Renewable Energy Commercialisation Program* (RECP) now in its sixth round of grants.⁵

Perhaps the most important learning from this disappointing behaviour, is that we should question naïve governments and elected Ministers extremely closely about their deals with 'name company's' in the private sector, who are apparently only too happy to sign up for generous concessions, only to renege on their part of the bargain; they do not appear to be subject to accountability, and are clearly doing ESD work under protest, if at all. **Link: Project Failure: Halifax Project.**

Just as regulatory intervention (a supportive regulatory Backcloth) in the environmental sphere has catalysed US, Middle Eastern and European businesses into the global niches for sales of environmental technologies and equipment (a process already evident at EcoTech, Sao Paulo in 1992), so too we must not let the dinosaurs of the development and construction community, hold back Australian participation in this rapidly developing conversation - and market - by failing to appreciate the key components of building sustainable communities. Above all, we should insist on following up any Benchmarks set, and send missionaries to Developerland.

A number of energy performance standards are certainly available 'off the shelf' for housing and industry. For instance in UK see BREEAM²⁶⁸ (Baldwin 1993), in Australia, NatHERS²⁶⁹ (Ballinger 1997; Lee & Stringer 1997), and Sainsbury's EcoCost System. Guideline systems for insulation such as Canada's R-2000 have emerged and are being applied in other countries (for instance Japan). The Royal Australian Institute of Architects put its weight behind passive solar design by publishing a technical book on thermal design in 1995 (Szokolay 1995). Many cities I visited in 1993 were well established with quite large tracts of experimental energy housing (Vancouver Canada, Almere The Netherlands, Milton Keynes United Kingdom, Davis California, Portland Oregon and Odense Denmark, to name a few.⁵ (For recent information see Commonwealth of Australia 1995a; 2000a; Energy Efficiency Team 2001).

This aspect of sustainability was the best understood and most comprehensively addressed topic in the Jerrabomberra Valley National Ideas Competition.⁵ As mentioned above (Criterion Ecocycles: EcoCost of Building Materials), Entry 101 presented a summary of its author's PhD

²⁶⁸ Building Research Establishment Environmental Assessment Method.

²⁶⁹ Nationwide House Energy Rating Scheme, especially in ACT where energy rating of new housing became compulsory in 1995.

output, the 'EcoCost' software for the building industry assessing extramural energy investment in different building materials.²⁷⁰

Industrial and domestic versions of Energy Auditing for resource conservation have become sub-specialties of Engineering or Architecture, although Engineering firms have tended to enter the field on the basis of their past contacts and reputations, and many extremely poor, untrained appraisals are tending to cost companies a great deal for a very superficial audit (Haines 1997: 740-44). This results in only small proportions of the possible savings being achieved.²⁷¹ Domestic auditing does not pay on a private basis, but provider audits pay dividends to buyer and seller through demand management. For all the fuss Australia has made about the Kyoto Protocol, it has made no attempt to entrain domestic energy and fossil fuel users through demand management, which is extraordinary in a country where domestic use is near half the total.

The Rocky Mountains Institute's "*Factor 4*" describes dozens of implemented examples far more radical than those presently in vogue in Australia (Von Weizsäcker *et al* 1997), both new designs and retrofit. Actual practice of alternative energy installation is still limited, and more common in remote and intentional community settings, but this is changing as prices start to come down. Research clearly separating cross-subsidies for all manner of unsustainable practices could form the basis for a Benchmark programme that looks to steadily reducing such subsidies.

The Scandinavian Government-supported experimental attitude to eco-housing development, and the need to transcend the fear of uniqueness in this country, were mentioned elsewhere.⁵ Most development projects in Australia are not set up as learning opportunities, nor is their design intended to be educational. The Halifax and Bourne Court projects undertaken by Urban Ecology Australia and Ecopolis Pty Ltd, and the Aldinga Arts Eco Village, all in Adelaide, exemplify the EPP interest in (user) Participatory Design and Planning, and great richness of sustainable features, but even here there are no actual Benchmarks or Indicators evident.²⁷² If we are to move quickly towards sustainable human settlements, then we need targeted subsidies for experimental building and rapid feedback about the performance of our ideas, with a central clearing house entity, probably best set up by government. This again, was one of the intentions of the original MultiFunction Polis. Recent Greenhouse Gas reduction commitments are starting to see significant catalysis from the AGO, belatedly in the right direction, but still in the face of direct and indirect fossil fuel subsidy.

²⁷⁰ Findings: all else being equal, transport energy is a major and significant sustainability issue with building materials.⁵

²⁷¹ Personal communication, Christopher Haines, practising energy auditor, 1998.

²⁷² Aldinga has been offered the services of a top level scientist but has not had the human resources to initiate anything to date.

10.16.5 CRITERIA, STRETCH GOALS, BENCHMARKS AND COMPASSES

Indicators and State of Environment Reporting are essential to the journey towards sustainability, but they are presently ad hoc, fragmented, de-stratified and give an incoherent, piecemeal picture of the actual state of function of the integrity of the ecocycles upon which we depend for our ultimate survival. In most 'core sets' of Indicators, the definition of Indicators does nothing to establish a common language of purpose, nor does it provide guidelines for improvement.

It would seem advisable to start again, and to select user-friendly, inclusive language that will help recruit the non-scientific to the cause of sustainability and responsive management. If, as recommended, we used the Bioregion (Landscape scale Indicators) as the main unit of focus, we could then look to our definitions of Sustainability, and work out what that may mean at bioregional scales in accordance with the UHSE Criteria of Observation. With that in mind we could then set idealistic functional 'Stretch Goals' (**Links: Tables 110, 111, 112 below**).

Then we would need a set of Integrated Action Principles based on that definition of Sustainability, and a fully integrated, stepwise Plan to reach that goal, which would aim to ensure that our major concerns were addressed through every law, policy, strategic plan, decision, action and project devised.

A continuous improvement programme would inform realistic Benchmarks as intermediate goals, report Snapshot (State or Condition) Indicators to monitor progress, be used with SoER, and would include Indicators for health and resilience as well as disorder alert (Trigger Indicators) for ecosystems (a similar need exists in Medicine and is partly fulfilled). Only a government or task force at a scale above the action could have the necessary overview to entrain such a process. Actors (Community) at the scale of implementation must work with the Complementary interpretations and actually drive the processes.

In the meantime, we could ask the universities to invite postgraduate students to research the nature of the Critical Thresholds (catastrophe zones and points) at which different parameters become unstable, separately and in groups. Dutch and German 'second generation' Indicators look at tolerance thresholds and carrying capacities (Adriaanse 1996).

Indicators are meaningless unless they are part of a responsive process. A paradoxical situation exists where a National Government that devalued Planning and dismantled the Department of Housing and Planning as one of its first acts, and State Governments that refuse to support planners' work through potent development control legislation, nevertheless fund and preside

over considerable expenditure on SoER and metabolism Indicators for every sector, and fund a nation full of people all rushing about doing PLANS for Local Agenda 21, Local Action Plans and Catchment Water Management, *inter alia*, with much duplication.⁵

Indicators are expensive items to be concerned about, and more so not to be. We can achieve continuous improvement a lot more efficiently by targeting them carefully, and designing them to integrate with a flexible Plan that is being implemented, and to which everyone can refer.

Directional Indicators actually indicate the function at the destination of a process seeking sustainability. These are 'encompassed' by the concept of 'System Conditions for Sustainability' of The Natural Step (TNS). Indeed they form part of the tool TNS refers to as 'The Compass', used with this so-called 'Backcasting' process (The Natural Step 1999b). I have labelled this type of Indicator a 'Compass' or 'Directional Indicator', because it can be used to indicate whether an action is towards or away from a specified condition. The value of qualitative Compass Indicators lies in providing an intuitively accessible tool which can be applied 'on the run' as a rule of thumb for discriminating between options, avoiding expensive measurements. **Link: Figure 53 (The 'Funnel')**. This user-friendly approach appeals to the 'triumph of small decisions' principle, doubles as an organisational lingua franca, and befriends non-scientific staff.

The Natural Step's Four System Conditions for Sustainability were developed through the collaboration of many well-known, international level scientists, and endorsed by a conference group of similar calibre in Australia in 1998. They prioritise resource issues, and so are popular with large organisations up to international scale, as well as being accessible to small business and local government.⁵ They have already been described in their original form under Ecocycles. The latest version²⁷³ of the '4SCs' is as follows:

²⁷³ An evolving definition.

In order for a society to be sustainable, nature's functions and diversity are not systematically:

1. subject to increasing concentrations of substances extracted from the earth's crust;
 2. subject to increasing concentrations of substances produced by society;
 3. impoverished by over-harvesting or other forms of ecosystem manipulation;
and
 4. resources are used fairly and efficiently in order to meet basic human needs worldwide
- (The Natural Step Environmental Institute of Australia, training material, ©1999).

The 'Funnel' concept (Figure 53) combines with the 4 System Conditions with a Scenario exercise ('Backcasting') that redefines a project's goals through the 4SCs, redescibes goals in these terms, then defines feasible steps to achieve the goals. This combined approach is called 'the Compass', which is illustrated in **Figure 55: BIES: The Natural Step 'Compass'**.

The 'Stretch Goals' used for the City of Manningham are narrower, but are also Direction Indicators. Manningham found the TNS System Conditions 'too complex' for their lower-educated staff and residents.²⁷⁴ Note that these have no human/social component as such.

Once sustainability or Stretch Goals have been defined for a system, any action either is or is not in that direction. This also provides a basis for more refined local Goal, Indicator and Strategy Development, as spelt out for Manningham in: **Table 100: BI: City of Manningham: Sustainability Plan** and **Table 111: BIES: City of Manningham: Stretch Goals & Strategies**.

Pressure (problem/cause Indicators) and Response (action Indicators) are well known international comparison Indicators, but as seen above, have ecological shortcomings. They could be used for any problem or action, but are not inherently 'ecological', promote a linear view of Cause, and are not functionally in the same category as Condition/State/Snapshot Indicators. They are more relevant to compliance and inter-organisational competitiveness than to appropriate function at the human scale, and often look to the old Statutory Planning dicta than to more flexible performance-based approaches. Focus on problems rather than solutions tends to produce more of the same.²⁷⁶ **Link: Background Paper: The Problem of Cause.**

Thus for each Criterion, an Indicator set might consist in subsets consisting of Snapshot, Threshold alert (based on boundaries of OOR for Sustainability Space), Compass or Directional Indicators and interim Benchmarks for a staged approach to achieving Sustainability, as defined

²⁷⁴ Roger Collins, Manager, Economic & Environmental Development, City of Manningham, Victoria, personal communication 2000.⁹

²⁷⁵ His complaint was that TNS wanted everyone to do a course on the Conditions and their application, whereas he just wanted to use the terms to entrain the staff with simple language.

²⁷⁶ For example 'scarcity thinking' vs 'abundance thinking' in business, half full vs half empty optimism/pessimism distinctions, "You get what you notice" (Ken Mellor, psychotherapist & parenting training) and "The Fuzzy Tale" Stroke Economy vs abundance in Psychology in Transactional Analysis (after Steiner 1977).

by the scientifically agreed and functionally defined Interim²⁷⁷ Sustainability Definition, and finally, High Level Wellness indicators.

Continuous Learning requires a sensing system (reporting internal and environmental conditions), and an actual Learning System (EMS). There needs to be a series of Snapshots (SoERs, audits, inventories) to establish a baseline and then track progress and enable learning and informed modification (Plan-Do-Monitor-Review cycles) (Institute of Environmental Studies 1997: 13).

Some major Indicators are emerging which have proved very helpful. One is the Ecological Footprint (see below). **Table 112: ESFRRR: Indicators for a Learning BioRegion** suggests a general UHSE Criterion-sorted Indicator set, with some linkages to City of Manningham Stretch Goals, TNS System Conditions for Sustainability, and examples of existing Indicator systems.

10.16.6 ECOLOGICAL FOOTPRINT

This concept, of catchy title and proven popularity, annoys some: a response common for powerful approaches that state important truths in simple words. TNS, POP and Transactional Analysis have similar problems. The definition is:

The ecological footprint of a designated population is the area of productive land and water ecosystems required to produce the resources that the population consumes and assimilate the wastes that the population produces, wherever on the Earth the land and water is located (Wackernagel & Rees 1996).

That is, it converts environmental problems to land area for comparison. The purpose:

... is to determine whether and by what order of magnitude human consumption is currently exceeding the biosphere's regenerative capacity. A Footprint size larger than biocapacity indicates not 'hypothetical land' ... but the very real existence of overshoot – that is, of humans using resources and emitting waste at a rate that could only be sustainable if there were more biocapacity than actually exists ... Footprint accounting systematically underestimates human impact ... states its assumptions, provides transparent calculations, and makes use of official data such as published UN statistics. Ecosystems provide no immediate warning that limits are nearing. Without systematic resource accounting, that compares sustainable harvests to actual harvests, resource managers are in the dark (Wackernagel 1999: 387).

Indeed Rees demonstrates, defining Carrying Capacity "not as maximum population but rather as maximum 'load' that can safely be imposed on the environment by people", (Critical Load), that at current world population, we already need two additional planet Earths at North American standards, and five²⁷⁸ 'phantom planets' for the expected 10-11 billion over the next 100 years (Rees 1996: 2, 16).

Wackernagel in 1993 at the UBC Centre for Human Settlements, had just released in draft (Wackernagel *et al* 1993), the publication Wackernagel & Rees (1996).⁵ He explained that the

²⁷⁷ 'Interim', because acknowledged to be imperfect, and subject to continuous improvement.

key concept behind Footprint Analysis (EF) was appropriation of Carrying Capacity. It makes no comment about either social equity or policy, yet has implications for both, due to the condition of victims of this appropriation (especially LDCs), and to the serious overshoot and shared risk implied. Since 1993, the EF concept has spread globally, and academic debate culminated in a special Forum on the subject in Ecological Economics in March 2000 (vol.32 no. 3), drawing 12 papers on applications, findings, limitations and usefulness. Wackernagel and Rees his co-developer²⁷⁹ responded. Rees considered strengths to include its simplicity and appeal; reconnection of people to land; emphasis on urban connections to and dependence on, host ecosystems; provision of a Natural Capital accounting framework to balance Economics; respect for Thermodynamics and linkage with numerous Theories and authors such as Odum, Georgescu-Roegen, Ehrlich & Holdren (Rees 2000: 371-2).

Criticisms include its inability to predict, describe land and water issues fully, to deal with social aspects or toxic discharges, and its simplicity. However Rees feels no one Indicator can cover everything, and the limitations merely serve to emphasise that it gives the best case: reality is very likely a lot worse. The key strategy it offers is a Snapshot (available for time series), of our relationship to ecosystem support: the core issue of Sustainability (Rees 2000: 372-4).

Wackernagel sees EF as a stabilising feedback, something urgently needed in a system where technology easily overcomes Constraints, and Economics, by excluding such accounting, allows us to be blind to the ongoing overshoot (Wackernagel 2000: 392).

²⁷⁸ Actually a "severe underestimate".

²⁷⁹ Wackernagel developed the idea for his PhD under Rees' supervision.⁵

10.16.7 USE OF FUZZY SUSTAINABILITY SPACE AS A FUNCTIONAL (PROGRESS TRACKING) INDICATOR SYSTEM

The EPP recommendation is to encourage the re-emergence of a Regional scale self-concept and self-containment, even, or especially, as global-scale processes proceed. The scale of the system definition is arbitrary, but in a Sustainability context, should be Bioregion or catchment based. The challenge is to agree on regional definitions, as they should be the locus of local governance. The FSS described under Criterion Feedbacks proposed a model that could be developed once a Bioregion is demarcated (Tool: 3.7: Fuzzy Sustainability Space Structure).

A definition of Sustainability, and then thresholds, would first have to be developed for the Bioregion, preferably by Criterion. Stepped Benchmark positions would lead progressively along a trajectory (represented by a Fuzzy Rod) that could go towards the Sustainability Space or outwards towards collapse to a larger system. Snapshot (Condition) Indicators (black circles) locate system elements/parameters along this path, which can be diagrammed for public reporting, and zoned in 'Traffic light' colours for simplicity. The aim should be to keep the whole system within the green area with its boundary right at the threshold with the orange, to allow for creative adaptation. Any functioning whole could be so conceived and monitored.

Compass Indicators will assist in designing a stepwise journey back towards the pre-defined sustainability. Each system variable has an optimal operating range (OOR) and corresponding 'health needs' for 'High Level Wellness'. If any key variable is in extremis, it then becomes rate-limiting, and the whole system rigidifies, threatening function (even structure). By this description, Sustainability would be defined as keeping the parameters within their OORs, and the system within the bounds known to support a high quality of life as we know it (Max Neefian Satisfaction and Transactional Analysis 'OKness', not high quality of consumption!), plus optimal productivity for the managed ecosystem impacted by the development (as described in Table 55).

This implies the need for an auditing and continuous-improvement-and-action-plan: a (rule) reviewing system to be in place for best results - an Environmental Management System (EMS).

Some entraining variables have more Connectedness to the system, and with instability, have tremendous disruptive power; likewise, the whole system is under challenge as the control parameters (environment) change; it is then that redundancy (designed, engineered 'margins of error', or the functional redundancy of biodiversity) comes into its own (deserving an Indicator itself). Paradoxically, for the whole Biosphere, such (entraining) variables will often be very

small, like molecules and microorganisms. At social level entrainment is called 'leadership', the role of fire souls.

At smaller scales, the key parameters may become the Population of a particular species (which is why we should avoid local extinction). If the system is perturbed, the perturbation will be adjusted for, IFF this is within the system's capacity. Otherwise the system will be expanded as the perturbation is incorporated, or disintegrate. Indicator design would thus need to alert us to instability conditions/symptoms, or increasing rigidity (loss of resilience), and to healthy function (occupation of the green Sustainability Space, included on the psychological principle that 'you get what you notice'). Not measuring things is a well-worn government ploy to avoid accountability.

At smaller scales in Design or Environmental Management, each point on a fuzzy surface has its own characteristics, and a threshold (catastrophe) point beyond which it will transmit positive or negative signal to adjacent nodes and to nodes at other scales, which trigger at a threshold. Thus the design must respect these limitations and the health needs for each element. The emergent effects have a dynamic Attractor field pattern, the balance of which may shift if the variables' relativities (Interference Fields) change, and a new Attractor may dominate. An effort should be made to understand what these potential Attractors and Constraints may be. Such information for a project may be approached through a SWOT (Strengths, Weaknesses, Opportunities, Threats) Analysis and Criteria Population/Organism.

The other issue to keep in mind is that FSS Constraint is required to maintain Stability, but *Edge of Chaos* conditions are required to maintain Resilience. Thus the OOR for a parameter will be somewhere within the FSS or at the boundary, and the whole system will be in flux. Where we have interfered with Nature's adjustment mechanisms, we need to tune in to appropriate context for our bit of Nature, and do our best to artificially provide missing context. Thus, if we think we should provide fire for bush regeneration, we should also remember that Landscapes rely on patches to repopulate areas destroyed by various impacts. We need to understand how our relict urban patches are doomed and dysfunctional and intervene to protect the diversity their genes supplied across larger scales.

A 'Feasibility Study' would thus define the OORs and FSS rules that govern the Sustainability Space for a mini system (project). An approach to designing mini-systems (projects) could be to find the best level to work at by selecting a return time level that has enough detail not to discount anything important, but not so detailed as to be chaotic. It would be necessary to

identify the Control (large scale environmental or dissipative conditions) and Order Parameters (smaller scale aspects that can make or break the project or the viability of the biota concerned) and work out the threshold values (instability ranges) for the latter (for instance finances, biotic needs, public pressures). Functional redundancy needs to be built in from the start.

Taking the bigger picture, a trajectory outwards, towards to blue, larger scale systems is certainly an option, and one looking most likely at present. The logical progression from Earth scale is clearly near Space. Very much larger systems will have very different characteristics and even less concern for individuals (the mechanism level) than the global system today. We are already very stressed by being entrained as (N-x) components of a global system. New forms of energy and new understandings of the Laws of Physics and Chemistry may well facilitate further expansion: we may have very little choice but to adapt, but we face great risk, because life does depend ultimately on the pattern of the Controls.

10.16.8 TRAFFIC LIGHT INDICATOR

This symbolic, red-yellow-green signalling system, is a simplification of the Fuzzy Sustainability Space diagram. It can be used at project scale to track restoration and maintenance of sustainable status. It would also be appropriate for public reporting of parameter positions on the sustainability continuum (should be reported regularly alongside the weather, UV radiation, finance and so on): **Tool 3.9: Traffic Light Indicator**. Whatever Indicators are chosen, the more important thing is that there be a way to share their information: in the face of the public, like weather reports. The Traffic Light OOR Indicator is offered for such a purpose: to raise consciousness and entrain the public for *The Transition*.

10.17 CONCLUSION UHSE

Having attended to the range of possible issues covered by the UHSE Framework and explained the Model in some detail, it is now possible to retreat to an overview position and look again at the underlying skeleton. **Tool 3.10: UHSE Basic Framework** advances **Tool 3.4**, drawing together the chief features of the Criteria as presented in this section. I have found it to be of interest to professional designers (Poster display, Newcastle *Pathways to Sustainability* Conference, 1996), and to be a good teaching handout (OCW following). **Tool 3.14** takes this framework to a full set of subdivisions, which runs for several pages, so is not as 'portable' as the shorter version. The main connections of UHSE with Complexity Theory are summarised: **Table 113: CMES: Relationship of UHSE Elements to Aspects of Complexity Theory**. It demonstrates the potential for the UHSE elements to support an ecologically responsive approach to humans and their settlements. All elements are not necessarily called up in any particular case.

11 CONFLUENCE

11.1 INTRODUCTION

This final section draws together the practical outputs of the dissertation, first through the OCW (opposing City West) Case Study, and then through a synthesis of implementation aspects under the headings Structure, Process, Content and Transition.

11.2 CASE STUDY: OPPOSING CITY WEST PROJECT (OCW)

Even your blood is poisoned with chemicals
like the wine that bears your name.
Lineal polygamy has masked your face
with a colourful liberalism
that can never hide the promiscuous business.

And yet ...
I know you,
and you are still warm.
Your heart still pumps through hardened streets
the many, many people
who are your children
and heirs to your unfortunate diet
and old grey form.

Railway Poetry, student uncited source (possibly the student's father) from OCW Visual Journal, 1997.

11.2.1 INTRODUCTION

The following section briefly reviews an initial application of the UHSE approach to the process of a final year Architecture Design Studio ("Opposing City West"). This project provided insight into the dos and don'ts of using this framework as an educational tool, and assisted clarification of the model itself.

11.2.2 NATURE OF PROJECT

During the first semester of 1997 an opportunity arose to test some of the concepts developed above, through an invitation¹ to run a Design Studio for a group of 24 final year Architecture students at the University of South Australia. The task was to develop a concept design for a very large (1600ha) railway lands site opposite the new City West campus of that University, and to present the output as a model with supporting documents at a public exhibition at mid year. Referring to the (widely perceived) ugly, dysfunctional and locally insensitive design of the new University buildings, the project was ironically named "Opposing City West".

The overall aim was to ask real questions of a real public about the future of an area of land which could potentially have great significance for the 'entrance to Adelaide' and the character and socio-economic style and status of the city in the next century.

¹ ECOCO Global Ltd and Energy Architecture, two networks of ecological consultants based in Adelaide.

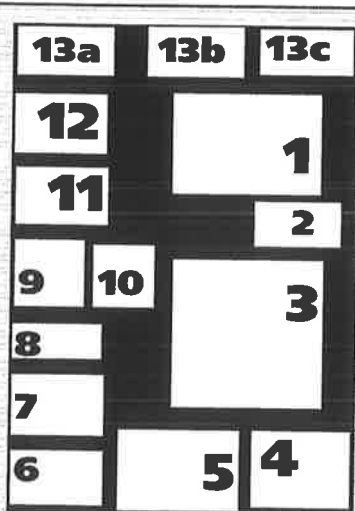


Plate 10: Collage: OCW Givens - Key

1-4 City of Adelaide & OCW Site

Map 1 labels key features of the OCW railway lands site opposite the University of South Australia City West Campus in North Terrace, shown in red on the Map 3 aerial, which is enlarged in Map 2. 4 views Adelaide from the golf links side of the Torrens Lake. The West end of Adelaide is being redeveloped, becoming an arts-educational precinct, with unsavoury enterprises starting to leave the notorious Hindley Street, the University of South Australia buying up many properties. Tourist Hotels, Arts SA, the Helpmann Academy, TAFE and new student accommodation are also located in this area. Background: National locational map.

5 View of Torrens Lake from the Weir

At Western end of the Lake.

6 24-Hour Cheap Parking

Located on vacant land to West of Morphett Street Bridge.

7 City Parklands

Small strip of public parklands between railway lands and North Terrace. City West campus on left across the road. This was original site planned for Adelaide Botanical Gardens. Most of the railway site was proposed to be converted to Adelaide Plains Botanical Park demonstrating flora of Tandanya Bioregion and selling plants and information for zeroscape home gardening.

8 Bus Parking

The suburban bus fleet spends its downtime in the South-West corner of the railway precinct, awaiting peak hour. Alternative parking place identified.

9 Traffic School

Miniature traffic system for bicycle training of school children. Presence of Police Barracks near Old Gaol, urgent need for skateboard park for adolescents and suitability of Old Gaol as entertainment centre (presently used for catered functions and scary overnight sleeping in 'haunted' wing), could be used as 'Blue Light Disco' - lead to concept of some of OCW area being committed to young people.

10 Old Signal Box

Remnant of early railways. Signalling now occupies a whole building (small square to NW of 'North' of North Terrace in Figure 1), with a large electronic map taking up a whole wall. Not feasible to move (\$200,000).

11 Old Adelaide Gaol

A sad institution bursting with local history, housing the mentally ill as well as the criminal until relatively recently. Interesting collection of artefacts and records, badly displayed on a shoestring by a small band of devoted volunteers. A real development opportunity, so linked into OCW concept.

12 Train Cleaning and Maintenance Sheds

Hazchem issues. This could be located out of city.

13a-c Railway Views

a: Like buses, trains wait on sidelines near the label 'railway lands' in Figure 1.

b: View towards Adelaide Station: Hyatt Regency Hotel (tall pink), city buildings, Morphett Street Bridge across centre.

c: Similar view on different axis further South and closer: showing Hyatt, Convention, Riverside and Exhibition Centres which face North Terrace.

Sources: Class (common ownership, from *Visual Journal*) & Author's photographs; Map Shop (3).



This is an area which the famous Colonel Light would have liked to have included as Parklands, is regarded by the avid protectors of the Parklands (Parklands Preservation Association) as 'stolen Parklands', but has never actually been Parklands, albeit wished so (Morton 1996:147-59). It has instead seen a long series of uses ranging from market gardening, sheep yarding and olive oil production, to domestic, sewage, slaughterhouse and railway coal waste dumping, and most of the project site has been under control of the Railways from the City's earliest decades: a tourist interpreter's dream. The location and Genius Loci of the OCW site are illustrated in **Plate 10: Collage: OCW Givens**.

The South Australian and City of Adelaide Governments are acutely aware at present of the declining, 'rust belt' problems facing the State and its settlements, and also of a serious trend to loss of population and business in the city centre, in favour of suburban centres which are presently exerting a multiplier/Attractor effect. For this reason, several Strategic Plans have recently been completed,² and a number of (arguably desperate and inappropriate) major projects have been proposed in an effort to lead or create economic growth (for instance a mercifully abandoned but exceedingly ugly star-topped hotel and office tower above retail premises in Rundle Mall). **Link: Plate 7: Collage: Metaphor**.

The Opposing City West concept arose from a desire to propose for comment in Adelaide, a large scale, long-term project of similar location and purpose to the Federation Square Project in Melbourne (railyards, central city and river proximity), but with the advantage of having no actual competition where an overseas consortium would come and 'do something to' the city. Rather, a conversation could be set up with the people of Adelaide about their preferences and passions, and the unique character of Adelaide could be defined and emphasised in a plan that could build on local strengths rather than the usual and current approach of emulating the international formula of ever more shops, offices, towers and hotels in an oversupplied city with a shrinking population. Initial assessment of Constraints and Opportunities is tabled in **Table 114: FRRRES: OCW 'SWOT' (Constraints & Opportunities)**.

11.2.3 PHILOSOPHY

The project philosophy was based on the wish to celebrate and heal the connection between Nature, humans and built environment, and to emphasise Realism. It particularly sought to address the orthodox didactic methods extant in schools of Architecture, whereby students are

² (Adelaide 21 Steering Committee 1996;City of Adelaide 1996;Economic Development Authority 1996;Hassell Pty Ltd 1996;1997).

commonly given a site, some instructions and a deadline, and allowed to work alone at home, with no necessary experience of ecological or social integration, nor of collaborative Design. "The integrative approach seeks to handle and appreciate complexity, and draw together into manageable format, the aspects of time, space, physical characteristics, functional patterns, Sense of Place, the policies and health needs of flora and fauna, and human society and its individuals, and of ecosystems at many scales. It started with broad consultation with stakeholder groups, and assessment of past and present land uses, for integration with potential future plans. It continued with considerations of multifunction and wholistic approaches to Design, with concern to provide linkages and appropriate access, and designs with benchmarks in mind that may later be audited to optimise learning and ongoing improvement. It did not expect to have an end point, but expected continuous evolution indefinitely."³ Building design was expressed through general principle and only broadly conceptual modelling, as is the case in the early stages of real projects.

11.2.4 OBJECTIVES OF PARTICIPATING GROUPS

The objectives were several:

1. To demonstrate new ways of approaching large scale developments in ways that took account of the ecological and the social before the economic.
2. To introduce students to conditions not dissimilar to a large architect's office, with a highly realistic exercise; to give them an opportunity to experience the analysis and design of large scale projects and to show them how to integrate the eco-social into their work.
3. To address many of the stated needs of the City of Adelaide for future development.
4. The style of presentation had many experimental (non-orthodox)⁴ aspects, with the intention of learning how better to teach about working with Complexity, how to access the richness of multiple inputs, how to avoid 'lowest common denominator' outcomes in this context, and to discover what would emerge when the human and the ecological were emphasised rather than the economic, and creative process was given emergence time.
5. The students expected material for their CVs, and to have the option to participate in any future work or activity generated by the project.
6. I had the personal goal of 'test driving' my ecological approach in an educational setting with a view to refining the core Unified Human Settlement Ecology matrix and understanding educational issues.

11.2.5 OCW DESIGN PROCESS

11.2.5.1 DESCRIPTION OF PROCESS

Students were 'engaged as architects in a large office', and told that they needed to be present and involved at all scheduled times or they would let the others down. The educational approach needed to be flexible, and to allow alternation between the structural and the functional, the intellectual effort of data collection and analysis, and the less tangible processes of personal experience, intuition and creative activity. At the same time, an effort was made to

³ Quotations from "Weavings" document.

balance individual effort with group approaches, and to notice the manner in which these aspects complement and extend each other. No actual design work was done until the second half of the semester. Plenty of time was allowed for

concepts to emerge, and when we felt 'stuck' as a group, we would ask everyone to do rough individual designs for the problem area and discuss them together in the big group.

The whole process of concept development involved a steady movement from the intangible to the tangible, from the sensory to the concrete, proceeding recursively and asymptotically towards an increasing clarity. One of the main aims of this studio was to allow this process to emerge naturally, so that even if more pressed for time in the future, students could recognize and appreciate the different aspects that ask for balance. Near the end of the process, clarification and refining became imperative so that something concrete could be put on the plan, but we were mindful in doing so that this is a concept plan, and likely to be challenged and revised in many ways.

The first sessions involved site visits, a requirement for an 'esquisse' to record intuitive impressions of the site, and group dynamics sessions to introduce the students to each other in new ways. Small groups were set up each to have a balance of people with different personality types (earth, water, fire, air)⁵ An array of experts was also brought in to give lectures or information on: City of Adelaide (Planning), Community Arts (Masters Students), culture/arts, local Aboriginal issues (Aboriginal elder), energy efficient Design (energy auditor architect), Engineering (site, Geology & Hydrology of River Torrens domain), principles of wetlands construction and potential sites (Catchment Board project manager), Parklands preservation (CBO President), data collection & management and Group Dynamics (2, Rounsefell), MultiFunction Polis Development Corporation.

⁴ See reference to outcomes below.

⁵ Representing practical/technical ability (earth), intellect (water), emotion (fire) and spirit/sensitive (air). This was done in a fun exercise which split up the usual pattern of friends always working together, and resulted in beautifully balanced, harmonious and productive working groups.

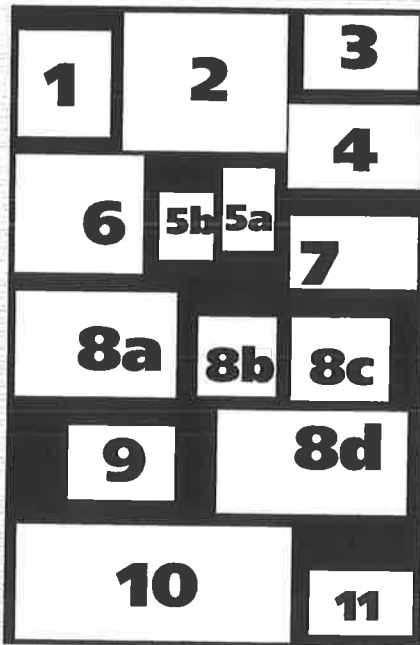


Plate 11: Collage: OCW Process - Key

1 Esquisse

One of individual student records of the first intuitive impressions of the site. All such art work and many photographs, promotional materials, data document and other items were scanned and burned onto a CD for each student's reference and to support future curriculum vitae.

2 Scale Map of Site

Achieved by photo-enlarging planning map. Rough Cardboard shapes used to argue about emerging concepts.

3 Small Team Discussions

One of the 'Earth-Water-Fire-Air' groups.

4 Community Interface

President of the Parklands Preservation Association (most foreground right) invited to discuss his group's attitude to OCW site as Parklands under potential threat from our project.

5-8d Basic Model Construction

5a-b Papier Maché relays

Papier maché for smoothing over shadow map to achieve 3-D model.

6 Shadow Map

Building contours with heavy cardboard.

7 Rough cardboard 3-D buildings & bridges on unfinished model (further conceptual argument).

8a-c Background tasks

Gluing, painting, structural support.

8d Scale models of existing buildings and railway infrastructure

Built to be put in situ and painted grey (background). Model is large (375 x 183cm - 12'3" x 6'1"), and built in three pieces.

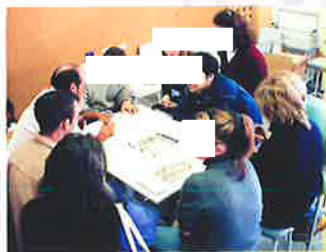
10 EcoVillage section of finished model

On banks of Torrens Lake, West of Morphett Street Bridge. Probably the most controversial concept in view of disputed 'Parklands' reclamation; argued for on basis of need to bring people for natural surveillance of an area presently deserted, abused and dangerous after dusk (marauding gangs preying on university personnel further along the river). Green business, student accommodation, recreation, arts and eco-demonstration opportunities identified.

11 Detail of Scaled Individual EcoHousing

Noticeably, women designed and made buildings, but also were the almost exclusive makers and placers of thousands of tiny trees, and the only ones to take an interest in the data management and documentation.

Source: Class (common ownership, from Visual Journal) and Author's photographs. Background: Model.



A system of group representatives was set up, and large group meetings were held often. The nature of the emerging processes was discussed throughout. A stakeholder roleplay was held early, and a Conflict Resolution group was necessary later in the process as some students started to slack off just as deadlines were becoming tight, (as is the usual practice for other Design Studios), and the hard working students objected. **Table 115: FRRRES: OCW Process** summarises the activities, groupings, types of work and processes at different stages as the studio progressed, salient points of which are illustrated visually in **Plate 11: Collage: OCW Process** following.

11.2.5.2 DATA MANAGEMENT

Data input started with the formal lectures, personal visits to the site and interviewing of visitors and a wide array of other interested parties. Students collected data from real community leaders, special interest groups, the public, State and Local Government departments and libraries. Formal data collection began after a presentation of the concept of Complex System processes and the Criteria of Observation used in different human settlement disciplines. The UHSE Criteria were used to develop lists of data required, and later used to organise the data collected into a substantial document "Weavings", which was not unlike an Environmental Impact Assessment. Rough diagrams used to describe the theoretical framework were made into a small 'reference exhibition' that was left on the wall throughout. These included the Allen & Hoekstra *Layercake*. The others are reproduced in **Figure 56: FRRRCM: Teaching About Connectivity**.

We relied on self-organising, complex system processes, as an intangible underpinning of the whole project. We fed these with constant alternation of approach between cognitive/empirical and intuitive/creative/sensory. Some Criteria are more important earlier, some later: a different emphasis was needed at different stages of the project. **Table 116: BIFREC: Change in Emphasis of Criteria with Project Phase (2)** summarises the change in Criterial emphasis through the design process in this project. Conversely, **Table 117: BIFRECRR: Criteria x Time - Second Order Matrix - OCW Project** traces the main issues for each Criterion when considered as a second-order matrix against 'Time', as constructed by assisted students. **Link: Criterion Rheotics: Table 102: Criteria: Change of Emphasis with Project Phase (1)**.

11.2.5.3 OUTPUTS

Apart from numerous sketches, bubble diagrams (**Figure 57: FRRRES: OCW Bubble Diagrams**), priority listings, energy sensing, and other small individual outputs such as sketch designs, a number of larger collaboratively-designed entities were completed: a vision, a project logo, a large, high quality model in three pieces, the data and process recording document "Weavings", a Visual Journal on compact disk documenting the process through photographs, sketches and other media, colour positive and colour negative photographic records and display materials for an exhibition with all its detailed work. The exhibition itself was prepared, but did not take place for logistic and financial reasons, but the concept was taken and explained to the Adelaide 21 urban strategy committee. Several of our ideas have since appeared in major projects around Adelaide, not necessarily through our influence. A self-selected group of students wrote up the data using the UHSE framework. I then 'corrected' the document to my satisfaction, and was able to identify ways in which the information given could have been differently handled. I subsequently designed another, more explanatory matrix for student use which has since been used outside my purview by Environmental Design students at the University of Canberra, with reportedly positive response.

The format for data collection and presentation provided to OCW students was as follows:

- Organising Principle and essence
- Definition in Ecology & extension to human settlements
- Theme[s]
- Scales relevant to this project
- Data types relevant to Criterion
- Data collected
- Data description: summary of key features from research
- Future design issues including design elements linked to the model.

The Criterion 'Indicators' has been added since this exercise, and 'Time' became 'Time/Change' and then 'Rheotics', 'Connectance' became 'Connectedness' then 'Connectivity', 'Constraints' became 'Feedbacks', 'Catalysts' is now subsumed under 'Feedbacks', 'Ecosystem' became 'Ecocycles'.

The project's conceptual outcomes are demonstrated in: **Figure 58: BIFRRR: OCW Resolution: Key Concepts Identified for Built Environment, Transport & Landscape** and **Table 118: BIFRRR: OCW Synopsis of Concepts**. Footprint estimates are presented in **Table 119: BIFRRR: Development Type, Floor Areas & Footprint**.

11.2.6 DISCUSSION: CRITICAL REVIEW

The initial refusal to give any instructions beyond going to and sensing the Site and the formal collection of data preceding design work, created severe discomfort in some students, especially those most efficient in taking and carrying out instructions. By about Week 4 there were a number of requests please to allow them to design something. Working in a group also created problems for those who preferred the normal solo working arrangements. We had expected more complaints of this type, but speculated that students comfortable with group interaction may have self-selected into our studio. We were able to demonstrate the process enhancement from switching from individual to whole group work, to sub-group work and back, with each serving to inform the others. For instance on several occasions individual homework (for example logo, sketch designs, esquisses) brought fresh approaches into the group awareness and allowed temporary group barriers to be overcome. Going away and doing individual work was valuable also in grounding the self in a large group situation where the collaborative process prevented any sense of personal control, yet counteracted alienation. Working in the smaller, functional groups was felt to be more comfortable, and effective for designing smaller, sub-site zones; but then it is necessary to keep in touch with what is happening on the whole-Site scale. This was achieved by a system of group representatives who liaised between the smaller groups and the leaders, and by having frequent whole-group sessions.

In the meantime, the initial efforts at group dynamics were paying off with smoothly functioning teams. The students' first impulse was to work in groups with their friends. By this means they had somehow managed to pass through most of their architectural studies without knowing many students outside of these cliques. It was explained that the real world was not like that, and so a means was devised to assign group members randomly on the basis of apparent skill and personality types, so that each group had a good balance.

By the end of the first half semester when the leaders held assessment interviews, students were well aware of the valuable learning process in which they were engaging and very happy with the way their groups were working. They were often Surprised at the amount of contextual information a major project requires, and enjoyed going out into the City and interviewing real stakeholders. At interview, students were also extremely perceptive in their self-assessment, for example all without exception demonstrated a clear understanding of the process, of personal barriers which they had felt necessary to overcome to work in such a way.

A great effort was made to collect all relevant data, with most students finding the given classification system useful in knowing what types of data to look for and how to collate it. All

students were asked about their response to the data collection system at interview. Four of the twenty-four had not read the small exhibition I had prepared, discussed in a lecture and left for some weeks on the wall. All but two, who had not thought about it, said they found it useful; about half were strongly enthusiastic, using words such as "invaluable", "essential", "good!". Without this structure, the mass of data easily became confusing. A smaller group of dedicated students committed themselves to the much larger task of integrating the group summaries into the skeleton of the document.

On review, we erred in the second semester by regrouping the students for the design phase, to give them the experience of adapting to a new set of co-workers. This 'creative destruction' disrupted the smooth group operations and appeared to be beyond the adaptive capacity of some students.

There was a significant political upheaval at the very end when the marks were published. This is not relevant to the design process as such, but had some important lessons for the leaders and the University in terms of assessment methods (feedbacks) and use of benchmarking standards.

Table 120: FRRRES: Educational Outcomes comments on educational strategies and student responses.

11.2.7 SUMMARY: LEARNINGS

Reviewing the process and outcomes, the number and range of outputs and the learnings available for all participating in this studio, were impressive. We are confident that when the students look back on this experience they will find that not only have they faced and competently dealt with a mammoth task, but that the learning from this type of doing will stand them in good stead in their future work. Each has a full record of the project on compact disk.

The situation did not allow sufficient time for teaching the UHSE system in depth. This meant that what I presented had to be simplified and superficial, yet I felt that there was still value in having a classification system for its own sake, even if the underlying ecological principles were not explicit. The loads of model-building, data collection, group meetings, document writing and design processes left little time for ensuring that the wider group fully understood the classification system. Those who did not engage fully with the system were also those who could not see a need to know about it, and in the context of the studio, not everybody did need to know. However the 'best' students (that is the high-involvement, high quality output, distinction and credit students) made a point of understanding what was offered.

As leaders we were extremely pleased with the richness and depth of experience overall. I do not believe that the best arrangement is suddenly to introduce such a system to students in the final year. It would be better to teach the system with more depth and more time spent working through matrices generating concepts and better understanding of connections. In doing this myself several times in the course of the studio, I was able to refine the underlying framework in several aspects. Time constraints did not allow a guided experience of this type (advice was given that such activity would be beneficial).

It is normally easy for an architect to be 'completely' trained and yet have few interdisciplinary skills, little understanding of Environmental Impact Statements or incremental environmental impact, no ability to assess or design for large integrated sites, little appreciation of creative process or group process, and poor understanding of the need to consider social, ecological or larger scale (strategic) planning context in designing buildings. This is also true of other human settlement disciplines, such as Civil Engineering, Building Science, (development⁶) and Planning. All these issues were actively addressed in our Studio, and enhanced by the UHSE system.

While used opportunistically and not designed specifically to test the UHSE framework, the results were encouraging over all, and valued by student users. Even with only superficial understanding, it enabled the efficient collection, interpretation and organisation of data for an uncommonly large site. **Link: Integrative Models: Figure 63: Report Card: Vårst Cohousing Community.**

⁶ Perhaps inappropriately gracing 'development' with the descriptor 'discipline'.

11.3 STRUCTURE: UNIFIED HUMAN SETTLEMENT ECOLOGY FRAMEWORK

11.3.1 INTRODUCTION

The following sections on Structure, Process and Content, draw together a framework for the application of a Unified Human Settlement Ecology generic approach to scoping, site assessment, concept development and design for pieces of human settlement at any nominated scale. They trace a thread from Ontology through Cosmology, Epistemology, Methodology and Technology. In the intangible areas of Ontology and Cosmology. The 'common EPP position' is recounted, based on my own 'clinical impression', a meta-view of EcoCommunity literature and direct questioning of Eco-fire souls. The claim 'should' emerges in a few places where an eco-social bottom line is evident.

An ecophilosophical relationship between Social Bias, Transactional Analysis and Transpersonal Ecology is drawn (partly after Fox), for synthetic reasons.⁷ But no particular ecophilosophical position is claimed as a *sine qua non* for a didactic UHSE approach, as this latter is available to mechanistic application by the scientifically oriented for physical reasons, even without metaphysical or Complementary reasoning or identification with a transpersonal self.

11.3.2 ONTOLOGY

The EPP would tend to embrace a Moderate or Transcendental Realist (Bohr: what we see exists, but is perceived through conceptual and linguistic filters), but Substance Monist (Mathews after Spinoza: universal substance connecting all entities as an embedded set of selves) or Moderate Wholist position (Bohr: whole/part relations important but do not explain everything). Complementarity Theory (after Bohr and after Redden: Physics and Metaphysics flowing in parallel), and Hierarchy Theory (after O'Neill, shyly), argue for an ontological basis for their structures, while Allen *et al*'s presentation of HT and Unified Ecology are explicitly epistemological. Gare claims a Process Philosophy, or Post-Onto-Theological Metaphysics for PostModernist Environmentalism, which calls on a 'symphony' Metaphor. Bohm relates to Ontology the Implicate/Explicate Order (Ocean Metaphor) and the Rheomode.

Fox distinguishes between three identifications of self, regarding the transpersonal ontological and cosmological identifications as being most helpful to ecologically sustaining objectives (the third is personal identification). Experiencing awe and astonishment at the mere fact of existence, that things are (ontological identification), tends to produce spontaneous openness to

⁷ This section is placed here because it relies on theory presented earlier in a number of loci.

the 'beingness' of other beings, and 'letting them be'. Deep-seated (inside-out) experience of self as part of a single unfolding reality (cosmological identification - participating in a process), available empathically through any Cosmology (mythological, religious, speculative philosophical, scientific), is not personally-based identification with all beings expanded to cosmic scale (Deep Ecology), but outside-in, an ongoing sense of an evolving, branching order, implying kinship with all other entities (as with EcoFeminism) (Birkeland, Dodds & Hamilton 1997:137; Fox 1995: 249-54).

Link: Criterion Community: Intangible Social Structures.

11.3.3 COSMOLOGY

11.3.3.1 GOD

The existence of God ('THE ontological argument') is not generally a hot EPP topic in non-academic circles (EcoCommunity sector). These EPPs tend to be non-religious but quite highly 'spiritual' people (EcoSpiritualism), without necessarily indulging in "silly beliefs about homeopathic medicine or tree spirits", or the adoption of Eastern philosophies, of such concern to Goodin (Goodin 1992: 83), which are indeed overt at Findhorn community (Ecospiritism).⁵ Many EPPs are ordinary urban Realists, especially at the ESD end of the spectrum. But many do tend to recognise at least an astonishing, mysterious intelligence behind the creation of the universe and natural processes, for which they hold deep respect.

Environmental Axiology is related to the transpersonal identifications mentioned above). Many are open to celebrating this through creative or healing human activities and rituals, including activities involving Aboriginal people or communitarian lifestyles.⁵ Thus at the opening of an EPP project in Australia, Aboriginal elders from the local ownership group are likely to be involved in the ritual.⁵

EPPs with organised religion are now starting to move towards a 'Deep Ecumenism' (celebration of God in the material world: Collins) that has much overlap with Deep Ecology and Mindell's Deep Democracy (Collins 1998: 246), or a 'Cosmic Christhood' (identification between mind and cosmos, with a transcendent, Transpersonal Ecology underpinning Environmentalism) (Fox 1988: 131).

Links: Criterion Community: Intangible Social Structures: Love as the Biological Basis of Social Life; Table 19: Theories of Justice & Virtue.

11.3.3.2 TRANSPERSONAL ECOLOGY

Fox defines Transpersonal Ecology as a sense of Deep Ecology that involves a sense of self extending beyond that relating to personal, ego and biographical self (Fox 1995: 197). As such it is germane to EPP self-explanation, but cuts no ice for those intent on responsibility-free ecological exploitation.

Environmental Axiology derives from the Greek Axios = 'worthy'. Ecophilosophical theories of value relating to the non-human world are central to intellectual debates on the ecological perspective. They are not emphasised in this work, as it is intending to be accessible as a generic programme. Such theories include Instrumental Nonhuman Value Theories (value recognised of non-human beings only in so far as they are useful to humans; including unrestrained exploitation and Expansionism, resource conservation and development, and resource preservation); Intrinsic Nonhuman Value Theories (the nonhuman world has at least some aspects of intrinsic value; include Ethical Sentientism, Biological & Autopoietic/Life Based Ethics, Ecosystem/Gaian Ethics and Cosmic Purpose Ethics) (Fox 1995: 149). These relate to Transpersonal Ecology as follows.

Transpersonal Ecology (Fox 1995: 196-247) is promoted by Fox as a distinctive approach that explains ecophilosophical positions through concepts derived from Transpersonal Psychology (named by Maslow and Sutich), the 'healthy side of psychology' (Fox 1995:289-99). Fox uses Transactional Analysis Ego State concepts to 'psychologise' EcoPhilosophy (Fox 1995: 204). He relates these concepts to pre-Freudian, Freudian⁸ and post-Freudian (TA) psychologies, here referring to them as three selves within each individual (TA: Parent, Adult and Child): desiring-impulsive (lower, primitive, child-like, id-like, present-oriented, animal nature), rationalising-deciding (rational, adult-like, ego-like nature) and normative-judgmental (higher nature/conscience, parent-like nature).

Fox then goes on to relate these kinds of selves to the different positions taken about the nonhuman world. Exploitation and Expansionism (Douglas' entrepreneur) are desiring-impulsive, self-centred and uninterested in others or the future. Resource conservation and development and resource preservation are Adult Ego State related, all essentially rational, mini-max strategies, mediating between real external constraints and the desiring-impulsive and normative-judgmental selves, and differ from each other in inclusiveness of the definition of 'resource' (economic or all forms of capital respectively). These correspond to Douglas'

⁸ TA theory distinguishes the Freudian Ego-Id-Superego concepts from Adult-Parent-Child Ego States, but this is esoteric in this context.

Bureaucrat; Fox makes much of the rationalising function of this Ego State. On the one hand the Adult is supposed to be 'in the executive' and will rationalise post hoc to achieve this appearance, where other 'selves' actually made to decision. **Link: Models & Mindscapes: Metaphors, Paradigms & the City.** More importantly, rationalising takes the form of 'mini-max' strategies that economically trade off minimum psychological discomfort with maximum advantage in a managerial fashion, balancing competing internal and external competing demands, and producing 'maximum sustainable yield' outcomes: an inherently resource-based and realistic approach. The 'responsible management' represented by Allen *et al* and Holling belong in this category (Fox 1995: 203-13).

Intrinsic Value approaches relate to the normative-judgmental, parent-like self, which lays down normatives, expectations and codes of conduct (Douglas' Sectarian), and includes such movements as Vegetarianism and Animal Liberation (Fox 1995: 214).

Links: Criterion Community: Clues to the Convivial Society; Criterion Organism: Basic Human Needs & Sustainability Spaces; Criterion Indicators: Table 109 (Sustainability: Priorities in Development).

11.3.3.3 ETHICS

Fox expects that the adoption of a Transpersonal Ecology perspective can justify the rejection of Ethics-based approaches:

In contrast to the narrow, atomistic, or particle-like conceptions of self that underlie the desiring-impulsive self, the rationalizing-deciding self, and the normative-judgmental self, the transpersonal ecology conception of self is a wide, expansive or field-like conception from the outset. This has the highly interesting, even startling, consequence that ethics (conceived as being concerned with moral "oughts") is rendered superfluous! The reason ... is that ... *[with such a sense of self]* ... (assuming that one is not self-destructive) one will naturally (ie spontaneously) protect the natural (spontaneous) unfolding of this expansive self (the ecosphere, the cosmos) in all its aspects (Fox 1995: 217).

If Zohar's point about the need to find a balance between particle self and group field self is taken seriously, relating to a self-field alone may be problematic in the mainstream world.

While many people achieve a state known in TA as the 'Integrated Adult, a transcendent state from which all possible psychological strategies are available, similar to Maslow's 'Self-Actualizing Individual', and while many do have a transpersonal, field consciousness, I would argue for balance as an ideal, and that many other people are indeed suicidal, most people are now operating on a mini-max⁹ survival economy, and the 'moral oughts' Attractor is a powerful and distorting driver of world religions and other Cosmologies. We may be able to create experience

⁹ Maximisation of sustainable yield; ie maximum yield for minimum damage; 'yield' may be economic, social, political, ecological or any other valued resource. Links into definitions of value (Fox 1995: 212).

and education that promote transpersonal ideals, but the prospects for short-term change are low. EPPs have little option but to make room beside them for others of whatever Cosmology, meeting them first at their models of the world, as Maturana defines Love, while also walking the talk of a new balanced mainstream, attracted to transcendent ideals.

Link: BP 5.2 (TA).

11.3.3.4. METAPHOR

Remembering the complex, ecological working Metaphor arrived at under Metaphors & Mindscapes, an Ecology of Metaphors proposed for EPP work could include:

- Ocean of energy (Implicate Order, Bohm); Emergence (from Being/Becoming: Prigogine)
- Knots in a cosmological net (quoted by Fox after Naess below; clumpiness of matter, Davies); Biomagnetism (Deterministic Chaos)
- Leaves on the Tree of Life (Fox preferred); kinship, socion, survival vehicle
- Superorganism (Gaia: Lovelock; Biocentric); Knots in a biospheric net (organism, Naess)
- Ecosystem (including organism, garden, web, net, resilience, abundance; zero waste; pulsation, ecocentres, ecocycles, circles, biomimicry -RMI; environ, *muda*¹⁰)
- Eco-subsystem lenses (UHSE Criteria, machine, satisfier, fortress, crystal, bazaar, global village)
- Rheomode - Bohm (action, resilience, being & becoming, Design mentality, lean thinking - RMI)
- Complexity (synthesis, attunement, simplicity, emergence, holon, pattern)
- Learning society, personal mastery (multiple literacies including ecological, scientific).

Negative Metaphors that may help keep us focussed:

- Oiloholism (Neil Harvey)
- Destructor, destroyer
- Greed
- Psychosis, self-destruction, mean, hedonist, self-interested 'economic man', Stroke-deprived.

Link: Models & Mindscapes: HSE & Metaphor; Table 12 (Metaphoric Potential).

11.3.3.5 ATTITUDE

Based on a Cosmology valuing Complementarity, liveliness and allowing space and time for creativity, a number attitudinal attributes are thought by EPPs to be desirable: Conceptual Pluralism and Eclecticism, cooperation, collaboration, Love (à la Maturana), social inclusiveness (within reason), processual openness, creative problem solving (respect for people per se and Nature per se), an experimental, learning approach (not necessarily a benchmarked EMS), and financial Realism (a new skill emerging by trial and error, of necessity, communality and ingenuity at lower scales (policy integrity at larger scale: true cost pricing, user pays, non-negotiable ecological limits). Persistence, community inclusiveness, mastery, compromise, burn-out and pragmatism are also often present, for better or worse.⁵

¹⁰ Taiichi Ohno (Hawken et al/ 1999: 125).

If large, top-down projects are to have optimal eco-social outcomes, the Community aspects are challenging, but still the best route to synthesis and a lively result. The community building in preparation for Cohousing usually takes at least two years.¹¹

Link: Criterion Community: Glue.

11.3.3.6 'SUSTAINABILITY'

There are two main problems for human settlement designers, builders and managers, first to come to terms with and acknowledge the frequency-driven, embedded and fragile complexity of the natural systems with which we are dealing, that we must heal, not just sustain, and secondly, to find professional approaches that enhance their function, resilience and dynamic stability.

The EPP group's approaches and experience, like the earlier derided but now largely integrated knowledge of 1960-70s environmentalists, is available for those orthodox managers and designers in the 'real' economic world who come to appreciate the need for change (Berg 1990: 285).¹²

As business is beginning to appreciate the need for sustainable practice, to re-appreciate human commitment, and to recognise the cost savings of materials and energy efficiency, a number of excellent books have been written, which apply directly to their clients, the decision makers in business and industry (for instance see Anderson 1998; Berle 1991; Cato 1995; Haferkamp 1987; Hawken 1993; Hawken *et al* 1999; Korten 1999; Natrass & Altomate 1999; Romm 1999).

All developments have finance and some level of business management to be reckoned with. The challenge is not to use the 'triple bottom line' concept as a tradeoff tool, but to find smart ways that support the welfare of all three strands at once (Hawken *et al* 1999: xi). The '*Natural Capitalism*' Metaphor promoted by the RMI and Hawken, may well provide the catalyst needed for business to find comfort in the concept of becoming ecologically conservative, without feeling it has to 'believe in tree spirits'. But again: EPPs insist the system must move to an eco-social Attractor (actually a 'spiritual' shift) or it will not have sustainable outcomes. Thus four bottom lines are implied: Psycho-Spiritual, Social-Learning, Ecological and Financial **Link: Methodology: Integrative Strategies** (below).

A worst case scenario can help develop healthier priorities: what would no longer be available and would have to be restored for us to survive? This would prioritise first survival, the biospheric services essential for life (clean air, water, soil, vegetation, plankton ...), then real

¹¹ Kathryn McCamant, of McCamant & Durrett, Berkeley, personal Communication, 1993.

needs for individual survival (the above plus food, shelter, human contact, psychological survival needs. Satisfaction of individual proclivities and wants are resoundingly secondary. A class of Danish senior students at a Steiner School in Ålborg, was given a 10-week exercise of preparing for a journey to another galaxy. They had limited choice of what they could take. Their initial choices included individual stereo equipment and little food, but there emerged through stages, a keenly appraised list of survival-related items, appreciation of community values and mutual dependency, shared equipment, and contingency planning.⁵

The key strategy advocated by Berg (Berg 1990: 281-8), Theobald ('envisioning the "*Healing Century*"')(Thackway & Stevenson 1989;Theobald 1998a;1998b;1998c;1998d), 'mission led future' (Ellyard 1998: 100-1), The Natural Step International ('Backcasting', 'Compass'), Transactional Analysis ('future-pacing': a term originally from Neuro-Linguistic Programming), Greening Australia ('mission directed targets')¹³ and many other change agents, is not to work with forward projections of today's gloomy picture, but to go forward and develop a detailed sustainable future vision, and then work out the steps to achieving it ('Backcasting'), or to start immediately to practise behaving accordingly, applying *Positive Incrementalism*.

As Ellyard says:

Green culture will come from promoting two broad areas:

- green ways: the values, ethics, beliefs, paradigms, behavioural patterns, customer preferences, and professional ethics and practices needed for an ecologically sustainable society;
- green ware: the designs, products, services and technologies which will be needed to realise an ecologically sustainable society (Ellyard 1998: 105).

Ellyard identifies four kinds of sustainability: ecological, economic, social & cultural. He challenges the view which assumes economic growth and ecological sustainability to be mutually exclusive, identifying five kinds of unsustainable growth. These are patterns which often characterise present concepts of growth: jobless (economic growth with rationalist downsizing), ruthless (positive feedback both sides of rich-poor gap), voiceless (economic growth without democracy), rootless (growth of dominant cultures at expense of non-dominant such as indigenous), and futureless growth (squandering of natural resources and environmental function for short-term gain, at expense of future generations) (Ellyard 1998: 100-111).

¹² Berg describes the process for the Green City Program for San Francisco, initiated by his *Planet Drum Foundation*.

¹³ Involves visioning to discover *Preferred Futures*, followed by setting goals, targets and key action principles (Greening Australia 1993). Other supporters of this approach are Henderson (mentioned again below) and The Natural Step (Compass tool).⁵

JVNIC entrants identified eleven areas of sustainability: ethical, ecological, spiritual, social, cultural, economic, health, intellectual, educational, industrial and temporal (sustainable time horizon) (Rounsefell 1994b: 135).

UHSE would claim a dozen general types: Community (relationship), Landscape (pattern), Elemental (physical, climatic), Genial (sensory), Biotic (lively). Organic (healthy), Collective (Attractor), Ecocyclic (processual capacity), Connective (appropriately disconnected), Supportive (constraining within OOR), Temporal (appropriate rating) and Indicatory (transparent).

Ellyard notes that environmentalists have managed to further marginalise their cause by the very strategy they have used to correct that condition: by insisting that Sustainable Development be called 'Ecologically Sustainable Development' (since Ecology is usually marginalised in favour of Economics), ESD has been viewed as ecological only and thus irrelevant to Economics and social conditions.

But he continues:

The world's people will have either a Planetist future or no future worth living for. The exciting part is that committing oneself to developing a Planetist future will create huge opportunities (Ellyard 1998: 180).

11.3.4 EPISTEMOLOGY: UHSE AS A FRAME-OF-REFERENCE

11.3.4.1 INTRODUCTION

A key sustainability strategy is to ask the questions in good faith: 'How will this action affect the larger system?' and 'What role does this (*vegetation, animal, population, water, community, culture, natural entity*) play in the larger system and the local system?' The point of defining the Unified Human Settlement Ecology Criteria is that they represent different ways of observing reality based on Ecological Theory itself (remembering Allen & Hoekstra's original term 'Criteria of Observation'). They can be seen as Epistemology, and a type of multi-dimensional Complementarity, in that they are all simultaneously valid, they describe a single reality, and each uses a different type of measuring or assessment system. They are selected by the user to suit the context. **Links: Subatomic Scale: Bohr's Complementarity Principle, Synergy of Complements, Pluralism; Ordering Principles.**

The UHSE model puts the Quantum 'both/and' and individual/group approaches into practice, valuing mechanistic and organic, tangible and intangible, structural and functional, structure and content, large to small, black-and-white and grey. The objective is not to control the

information, so much as organise it, and to use it for the creative purpose of generating a situation-appropriate, emergent outcome. The concept is helpful, of mentally walking around a project, taking different perspectives.

Beyond the internalisation of some social and ecological issues that are often alienated as 'externalities', it is not necessarily that different data will be gathered from those collected at present. Rather, an epistemological shift is indicated, that will synthesise the familiar material in a different way, and this democratic and teachable arrangement will be congruent with the scientific structures underlying the Ecological Paradigm. It does not demand a particular set of technologies, but does say 'this is how Nature seems to work; if your goal is alignment with natural processes, then these are the types of things you'll need to think about.'

For the purposes of design and development, a strict, mathematical, multi-scalar system definition is neither feasible nor casually teachable. The Criteria become handy 'pegs' on which to hang information. Ecologists or landscape ecologists should automatically be hired for large projects (while a working knowledge of their fields is essential for project development and management). Yet much can (and presently must) be achieved intuitively. The scientific background can provide legitimacy for this approach or guide research.

11.3.4.2 BEST OUTCOMES

Examples given are not claimed to be 'right', unique or 'best practice'. Most are derived from eco-literature, OCW, JVNIC or 1993 field cases. Indeed the concept 'World's Best Practice' is inappropriate in ecological settings, as 'best' can only ever be determined according to local conditions including Ecocycle Net Budgets, that is, by local source/sink outcomes and local biotic productivity. The closest one can come to best practice strategy is arguably through 'best practice thought' and 'best practice process', but even then, local context can make major differences in advisability of particular practices. Criteria for a 'best' outcome will include a lively, multi-diverse, fully functioning system, co-dominated by indigenous biota, flexibly adapting to environmental change and supporting the long-term needs of participating biota. Its ecological services will be both bioregionally self-contained and appropriately participating in higher and lower scales. Human activity will be spiritually advanced (in I-Thou relationship with self, near and distant others and in transcendent selfness with Nature), resource-parsimonious and scaled within available ecosystem services.

The 20-step Process described below is one process available to a professional repertoire. Its virtue in this context is its origin in the Science of Ecology itself (Holling's Infinity Loop). But its

'bestness' quality will depend on the integrity of and level of commitment to its ecological underpinnings. Despite human preoccupation with resources, for the Biosphere there is only one System Condition for Sustainability in the end: that the Earth's responsiveness remain within life's Sustainability Space. The more we take other biota's share of the biomass, overharvest the resources, pollute and infest our habitats with exotics, and cover Nature's productive surfaces with asphalt, the more the further we drive the system variables out of their OORs. Our usual economic and development systems are pathological, exponentially growing perturbations. The more the perturbation, the more rigid the system and the more prone to collapse. Any ecological development we do in our corrupt system will amount to no more than Positive Incrementalism. But we should not forget the butterfly's wing.

11.4 PROCESS: WEAVING THE BACKCLOTH

11.4.1 METHODOLOGY

11.4.1.1 CONCEPTUAL BRIEF

11.4.1.1.1 Introduction

A repertoire of conceptual tools for EcoCommunity development would include, to advantage, the following. They of course need to be interpreted and complemented through the appropriate professional knowledge.

11.4.1.1.2 Integrative Strategies

As mentioned above, a 'triple bottom line' (3BL) simultaneously takes account of economic, environmental and social aspects. The instructions to Jerrabomberra Valley National Ideas Competition competitors included the desire of judges to see what 'integrative strategies' could be implemented in that context. **Links: Criteria Community (glue functions), Connectivity.** Reflective EPPs see the 'triple bottom line' as a necessary step for those who would not normally take a wholistic view, because their motivation is indeed to 'save and celebrate the planet', not vexatiously to interfere with the Dominant Paradigm. But 3BL is just the latest victory on the road to persuading the mainstream to understand Ecology.⁵

Integrative strategies need to be based on an acknowledgment of Wholism: in complex, hierarchical systems, the whole is more than the sum of the parts, and a wholistic approach seeks ways to respect that. The both/and, part/whole or rate dependent/independent, tangible/intangible, Complementarity approach, is an example of this in practice.

The constraining context (upper level constraint system) for human settlements has increasingly become economically driven (positive feedback) with deregulation (negative feedback removal) for trade, but often very high levels of Constraint in other areas (such as planning and building regulations), often not helpful.

The EPP struggle through this implements a belief that eco-socially sustaining, non-economic (wholistic, human, ecological) values must gain Attractor status as a matter of urgency: a single but different, broadly-speaking, spiritual bottom line, not a triple one (Economics, like Technology, is a tool). By 'spiritual', they usually refer to ethical, meaningful, 'right relationship' with other people and planet (as above).⁵ The values-driven bottom line then expects to entrain its proper tools. Indeed one small decision, one small compromise, can literally set in concrete an

error of judgment. EPPs act as if such an Attractor were in place, seeking to enhance its appeal by Education and example, in order to demonstrate the potential for improved quality of life, but their work is always flawed, for external or internal reasons.⁵

If one must think in threes, an appropriate trio might be LIFE (beings becoming, resilience, response-ability) - KINSHIP (values, right relationships, creativity, mystery) - SUBSTANCE (Energy & Materials) (currency, parsimony, simplicity).

11.4.1.1.3 Backcloth & Traffic

The establishment of Backcloths that are likely to support particular Traffics has been alluded to as a q-Analysis concept. **Link: BP 5.3: q-Analysis.** Holling made similar emphasis in the context of Landscape Ecology (Holling 1995: 29-30).

We are designing a life-sustaining Backcloth on which to run, or from which must emerge, the Traffic of our society, our city, our neighbourhood, our building, our room, our furnishing element, our people ... whatever scale be appropriate, so like a researcher, we must first decide 'what is the Traffic?' (as with the familiar business training question 'what is your business?').

Phone interviews with (now the late) Peter Gould (USA) and Dr Jeff Johnson (UK), both closely involved with q-Analysis from its inception, confirmed that the Mathematics was inaccessible to the ordinary human settlement professional. Gould's advice to me¹⁴ was to forget the Mathematics, and concentrate on the concepts of 'Backcloth and Traffic' and 'Q-connectance'; that even simple understanding was very useful and probably sufficient for most practical purposes.⁵¹⁵ This I found very helpful, and it also gave me confidence that it was potentially useful to pursue mathematically-based concepts for the wisdom they contained, rather than their mathematical prowess.

The Backcloth concept accommodates the concepts of an 'Attractor Landscape', the Fuzzy Sustainability Space, the Transactional Analysis Script structure, including 'Drivers' (Counter-Injunctions) 'Stoppers' (Injunctions); and the "Fifth Discipline" and the Meadows "Limits to Growth" style of Systems Theory incorporating Reinforcing (+) and Balancing (-) Feedbacks and circular thinking (long and short timescales) (Meadows *et al* 1972; Steiner 1974).

The Backcloth is the complex fabric of positive and negative feedbacks, from the Interference Field (richness of Connectivity) of which, entities are perceived to emerge. The longevity of a

¹⁴ Phone interview 1996.⁵

Supportive Backcloth depends to a large extent on the strength and character of its Attractor Landscape in particular, on the locus and circumstances of its system of Constraints, which can never be perfectly known.

The 'Traffic' will usually be the project itself, but the concept can be used in much the same way as 'Organism' – at any scale, as a tool for addressing holonic function. The 'SWOT Analysis' (Strengths, Weaknesses, Opportunities, Threats) beloved of organisations for their Business Plans, can help to identify what some of the Drivers and Stoppers might be for a particular project, and thus, what elements may need to be woven into the Backcloth to support long term survival. A Constraint Map is a useful reference, developed using the UHSE Matrix and Designer Questions. **Links: Hierarchy Theory (Constraints); Criterion Feedbacks; HST: Nonlinear Approach to QRA; Tools (below).**

11.4.1.1.4 Context Rebuilding & Replacement (Backcloth Building)

For Ecosystem protection, appropriately locating activities within the Critical Threshold capacity of the local Ecosystem (Fuzzy Sustainability Space) must be planned with awareness, for all exotic imports including humans. Wherever technology has enabled short cuts, a natural constraint has usually been overcome, to ecological disadvantage, and will need healing and balancing sooner or later (later coming at far greater cost than preventive action). Context destruction and the necessary replacement may reach ridiculous levels, as in Adelaide where a coastal marina development was recently forced by State Government against impressive community resistance. This now requires millions of dollars to be spent annually on sand carting to correct the serious interference with natural sand flows up the suburban coast. From an EPP perspective this is ignorant and preventable ecological folly and wanton resource waste.

When exotics are introduced, the extent to which they require context replacement will depend on their biomic sources relative to present location. But exotics need to earn their keep through appropriate biotic contribution. **Link: Criterion Landscape: Imitating Nature by Design.**

We need much better information about differential carbon sequestration of plants, and to be conscious of the loss to local ecosystems of the biomaterials (nutrients) and specific ecological services (such as pollination) that resource extraction, 'waste' burning and (urban and rural) vegetation clearing represent. The answer to a lower CO₂ uptake by mature bushland or forest is not to replace it with plantation monocultures. We need to totally rethink biodiversity,

¹⁵ Gaspar's "Cova da Beira" study demonstrates a rather complex application of Q-analysis to a rural regional design problem (Gaspar & Gould 1981).

Ecocycles, nutrients, water, transport and urban form issues before planning the site subdivision and housing. This is a particular responsibility of large scale tract developers, the planners who approve their plans, the policy makers who set the rules and the communities who do or do not demand appropriate behaviour of their delegates. Ecocycles have natural scales, each to be addressed. (Relative) confinement of materials sourcing and waste management (Ecocycles) to Bioregional Scale (City-Region) is a long-term goal demanding import replacement (which is also of economic benefit), where smaller scale constraints are no longer feasible. Nearly all development now requires initial and ongoing balancing action (such as bush regeneration and creek restoration to improve the healing : damage ratio). **Links: Criterion Ecocycles: Ecological Services, Urban Metabolism, Molecular Pollution; Confluence: Scoping.**

11.4.1.1.5 *The Human Brain as Fuzzy Computer*

The orthodox approach in Science and Mathematics, based on Probability and differential approaches has been to try to track by equation every single relationship, in academia to catch and worry each distinction to exhaustion, and in management, to try to control everything.

Link: BP 5.10: (Mathematics).

Systems thinking and creative thinking are key EP designer skills, as they are in business. To trust in both our own brains and the process of the site or project object, as complex dynamic self-organising systems, with multiple parameters, a complex Interference Field constrained in various ways by the structures and feedback systems we impose and impose on, then we can start to entertain the deliberate use of the brain in new ways, in particular for pattern recognition, and relate better to the new ways in which computers can assist this process - an inevitable extension as the size of the data set grows. The approach to complexity suggested here, takes the mass of data, sifts it lightly by 'browsing', then with a frame-of-reference in mind (provisional scope and framework), 'parks' it in the preconscious mind with a 'request' for patterns to emerge.

This is essentially a right brain process in so far as it seeks to generate multiple and creatively connected options, a left-brain process in so far as it requires an over-riding framework, measured data and constraints to be set, and an integrative process in so far as it must produce an emergent result which respects all these and all the components.¹⁶ Such creative exercises

¹⁶ A simple test for mental rigidity and creativity from Buzan's book was tried on the planners in my 1991 survey (theme of 'Visionary Planning'). In a group of 50 with a 1:4 female:male ratio, 13 men and two women declined to play; the median was 8% below universal average; of the top four scorers, three were women (Rounsefell 1991a: 72-4). Another finding from administering left- and right-brain styles of visioning was that the right tended to prioritise social, mental, physical, emotional and spiritual health in planning contexts, while the left spoke of urban form, density and satellite cities, transport systems, conceptual ecological sustainability and appropriate technology (Rounsefell 1991a: 75).

work through mimicking basic brain function. **Link: BP 5.5: Applications of Quantum Theory & Complementarity: Psychoneurophysiology of Change.**

One way to achieve this semi-mechanistically is to use Tony Buzan's 'Mind Mapping', which involves (*inter alia*) the setup and organisation of brainstorming (Buzan 1988: 119-129). These processes involve initial 'datastorms', which are ultimately organised into or produce patterns of concepts from which the best for purpose are chosen.

A number of other creative/mental flexibility strategies are also teachable. Training in sensitivity to positive and negative space (as in many training courses in the Graphic Arts could be invaluable to other professions not so trained)(for instance see Edwards 1999: 115-135). 'Gestalt Thinking' is similar, involving conceptual reversal (and is second nature to gifted, creative minds).¹⁷ Yin-yang thinking appreciates the morphing of an entity into its opposite. **Link: Subatomic Scale: Synergy of Complements.**

De Bono's 'Po' technique for generating new concepts is described below (**Link: Confluence: Data Management**). De Bono has written many other books on creative mental mastery (for instance see De Bono 1972;1976;1985a;1985b;1992;1994;De Bono 1998).

Viewing a scene with de-focused eyes or dissociated mind may reveal patterns not available to focused attention.⁵¹⁸ (Also see N.E.Thing Enterprises 1994).

The ideal in design and project development is to allow sufficient time for the brain to do its creative work, singly and collectively. This can take the form collectively of putting the project aside for a few days, meditation, 'mucking around with models', brainstorming; individually by walking with a neutral mind, taking a long hot shower, giving or receiving a massage, drawing contour maps of the site by hand, or doodling on paper. Sleep can be used as an opportunity for problem-solving, by thinking about a problem as one falls asleep, with an attitude of requesting the brain to sort it out over night.⁵

Pursuing a complex initial path enables the emergence of issues of importance that are perhaps discounted or hidden. But working at the scales 'appropriate to the project' reflects the TNS 'simplicity without reduction'¹⁹ concept and Allen *et al*'s/Costanza's 'complexity is a matter of scale', grain and extent definition issue. **Links: UE & Extension to Human Settlements; Scale: General Review.**

¹⁷ The young woman/old woman picture is a well-known demonstration of Gestalt reversal (Morgan & Welton 1986: 71).

¹⁸ Impressionist art training.⁵

Divergent issues are traced a reasonable distance until the relevance of their connectivity and the elements of their mechanisms are understood. But eventually, a crisp outcome will be required, so the process must asymptotically focus the emergents through the project objectives. Organising information around UHSE Criteria is a good start. Functional Analysis is another.

Most complex systems exhibit what mathematicians call Attractor states to which the system eventually settles, depending on the properties of the system (Lewin 1993: 20).

Lewin emphasises the paradox of Complex Systems, that within a divergent complexity lies a quiet core of astonishing simplicity:

Murray Gell-Mann has a good phrase for it: Surface complexity arising out of deep simplicity ... Complex adaptive systems are pattern seekers ... they interact with the environment, "learn" from the experience, and adapt as a result (Lewin 1993: 14, 15).

De Bono in "*Simplicity*" argues for the value of Simplicity: the pros and cons of its use as an imposed strategy and the inefficiency of setting up complex processes when simple ones would do (De Bono 1998). This type of thinking comes into its own after the concept development stage. His 'Ten Rules' are tabled in **Table 121: BIES: Simplicity after De Bono**.

De Bono emphasises knowledge of subject as an essential pre-requisite for simplifying approaches, as trade-offs will have to be made with other values, and these must be conscious: the 'where?', 'why?' and 'for whom?' questions need to be asked for simple goals: simplicity of production? of use? of maintenance? of operation? of repair? - these often conflict (De Bono 1998: 183).

In order to make something simple you need to know your subject very well indeed (De Bono 1998: 72-3).

Any valuable creative idea will always be logical in hindsight - otherwise we would be unable to appreciate the value of the idea ... Because such ideas are 'logical' in hindsight, we have always believed that they could have been reached by logic, with no need of creativity ... it is totally false ... based on passive information systems. In self-organizing 'active' information systems asymmetric patterns are formed. This means that the route from A to B may be round-about but the route from B to A is direct. That is the basis for both humour and creativity (De Bono 1998: 55).

With ecological issues, simplicity in human systems saves resources of all types and is aesthetically pleasing. But natural systems rely on their complexity and functional redundancy as insurance for survival, belying their superficial elegance. Thus while De Bono may know his system well enough to advocate simplicity as one of the key virtues for modern life, blind espousal of his other principles is ecologically dangerous if the issues are not well understood, as he acknowledges. **Links: Summaries: Sections 4-8 (simplified descriptions of theory underlying this dissertation).**

¹⁹ Teaching 'sustainability' involves a process in reverse of the design approach: the 'trunk and branches' are used to convey the generic message 'without getting lost in the leaves'. But for design, the leaves must be explored as needed.

The '*Lean Thinking*' and '*Design Mentality*' of *Natural Capitalism* have many simple qualities, as does the general 'doing more with less' attitude to design espoused by many EPP euhemeri. This type of simplicity is about cutting waste out of systemic processes, seeking elegant solutions. RMI experience is that Nature of a very fine source of such apparently simple ideas, that have actually evolved over millions of years of trial and error. **Links: Criterion Feedbacks, including Table 100: (Natural Capitalism).**

11.4.1.1.6 Pre-Emptying Environmental Impact Assessment (EIA) Through Design: Constraints, Imitating Nature, Lean Thinking & System Efficiencies

Cumulative Effects Assessment, which has not yet reached a standardised format, was mentioned above as an EIA extension for environmental management. **Links: Criterion Rheotics; HST: Time & Change.** Here we want 'cumulative impact for the better': a 'triumph of small decisions', an intention that implies community education and entrainment.

EIA itself may be preempted by the use of Koslowsky's Threshold Analysis which attempts to build the assessment into the process of design itself by mapping and segmenting the area, and attempting by a modified Delphi method to remain within ecological thresholds in the local environmental context (Kozlowski 1986; Kozlowski & Hill 1993). GIS design systems use overlays based on approaches such as McHarg's (Hanna & Culpepper 1998: 115-161). The UHSE approach may well be usefully adaptable to a GIS framework.

Designers should design or build nothing without having read the Rocky Mountain Institute's works on radical energy and resource reduction. Radical redesign saves far more than minimal change, which is more expensive. 'Lean Thinking'²⁰ has been proven to produce dramatic savings in Japan (Toyota) and the USA (industry) (Hawken *et al* 1999: 80, 111-124, 132). See "*Muda, Service and Flow*" (Hawken *et al* 1999: 125-143). Human settlement design awaits similar rethinking. For instance:

... by visiting a job site where builders are constructing a custom house ... you'll notice periods of recurrent inactivity ... these lags aren't taking place because the workers are lazy. Builder Doyle Wilson discovered that five-sixths of the typical custom-house construction schedule is spent in *waiting* for specialised activities to be completed and fitted into a complex schedule, or in *reworking* - tearing out and redoing work that was technically wrong or that failed to meet the customer's needs and expectations. Eliminating even part of that wasted time can create a huge competitive advantage for a savvy construction firm (Hawken *et al* 1999: 126).

The question should be asked: how can we imitate and co-evolve this project with natural processes?

²⁰ (Womack & Jones 1996).

11.4.1.1.7 *Prioritising Healing: Resilience and Dynamic Stability*

Healing requires knowledge of pre-human and pre-settlement conditions: geomorphology, flora and fauna, and local ecosystem function. This is part of the initial data collection. Healing is likely to take decades and require attention to basic needs of relevant biota, and to Connectivity (protective barriers, sacrifice areas, context replacement and so on). Designers should refer to Ecological Planning and Design literature (see addendum to Bibliography).

Imitate Nature and give it protective freedom wherever possible.

Use '4 Rs' of resource conservation: Reduce, Reuse, Recycle, Repair.

Use the '8 Strategies' of habitat healing: regeneration, restoration, enhancement, reinstatement, preservation, modification, protection and maintenance.

Links: HST: Stability, System Structure & Evolution; Criteria Organism, Population, Biotics, Ecocycles, Connectivity; Models & Mindscapes: the EcoCommunity-Sustainability Literature.

11.4.1.1.8 *Generalism*

It would facilitate cross-disciplinary teamwork to train a generalist group familiar with all the relevant areas, who would then be available to orchestrate inputs of people with more specialised knowledge. The potential role of skilled generalists in development teams was emphasised by Boyden when he reviewed his work for the Man and Biosphere Program (Boyden 1984: 19). Opportunities exist in multi-disciplinary university departments such as Geography and Environmental Studies,²¹ for the specific training of skilled generalists, who should preferably also have policy, business and management training. Such people could have roles in education, research, policy, planning or large development projects. Their role would be similar to that of a general physician in relationship to a general practitioner, both being generalists, but the physician operates at a much more complex level, and has a higher level of training in the body's internal systems and their interactions.

11.4.1.1.9 *Generative Work*

Whatever project is in train, those with EPP consciousness are considered honour bound to work at broader scales in whatever way they may have impact, whether as teachers, mentors, consultants or CBO/NGO participants.⁵

²¹ The University of Oregon has a Multi-disciplinary Faculty, whose staff in 1993 appeared to be similar to those in an Environmental Studies department, but a little broader.⁵

A working knowledge of systems thinking is helpful to counteract and challenge the leverage and public deceit with which skilful, eco-destructive, self-interested decision makers and gatekeepers presently control public information at larger scales.

At smaller scales, getting something up and running, even if compromised, is better than hot air, and EPPs are becoming impatient with talk, as we now have plenty of information to go on with: they feel that what we need now is action, problems to solve, research to do, projects to demonstrate, knowledge to share, a 'talk to walk'.⁵²²

11.4.1.2 A NEW APPROACH TO DEVELOPMENT

11.4.1.2.1 *Developers as Servants*

There are very good arguments for re-thinking the way we go about human settlement development.²³ 'Development' is a leading destructive force against Ecosystem integrity, biodiversity, climate stability, water and air quality and human health. Priorities and commitment are at issue, not just ignorance.

Australian developers believe the market is happy with what they are producing: "They're buying them, aren't they?" or that the apparent market is the only one: "we know what we're doing thank you", damning their captive customers to a well-entrained naïveté and ecologically shabby deals: "We have a 'sustainable version but nobody is interested.'" "Yes, yes, of course we promote it"⁵ "It costs more." (re: adequacy of housing range and availability of 'green' choices). Or that 'family values' should be the only ones locally: "Why would you want to get close to your neighbours? Our family is really close – we don't need anyone else." (re: "Would you consider developing Cohousing?").⁵

It is difficult to imagine Australian developers agreeing to be the servants of communities (**Link: Criterion Community: Figure 22 Cultural Bias Analysis: Entrepreneur group, The Formal Regulatory Sphere; Criterion Feedbacks**), or instigators of the development of a community, which they then serve, but this is the direction sustainability needs to take, and which is being modelled overseas.⁵

It has been demonstrated quite clearly that developers are able to successfully lead public opinion, and set up exciting new approaches to community and resident participation in the design and development of EcoCommunity and Cohousing projects.⁵

²² For instance personal communication Kathryn Burge, fire soul, TNS Australia, 12/2000.

I saw some excellent strategies in the early phase Adelaide Halifax Project (Ecopolis Pty Ltd and Urban Ecology Australia), Muir Commons Cohousing Davis and several other Californian projects (McCamant & Durrett, Berkeley CA), Ahmanson Ranch, Ventura County California (Ahmanson Land Company), early process Bamberton Vancouver Island Canada (DPZ²⁴), Mariendalsvej Cohousing for the elderly [*sic*] in København (Holst, Kristiansen, & Mortensen) and another small Cohousing for seniors in Odense (Housing Association) in Denmark, to name a few. In these cases, the developer had involved the future residents well in advance of the design work and throughout, or the community had initiated the process and entrained developers.⁵ McCamant & Durrett emphasise that Cohousing is "as much a process for developing housing as it is a new housing type" (McCamant *et al* 1994: 279, 273-81).

On destruction of biodiversity, developers can also be intractable: "Just tell us where we're not supposed to develop. We always get what we want by leaning on local government anyway, but it costs us heaps to go to court. All we want is certainty." (re: discussion, developer biodiversity awareness training seminar NSW).²⁵ Yet in the City of Salisbury (Adelaide) recently, a botanist was taken to a large development site to meet with the developer through the influence of the Urban Forest Biodiversity Program. Once the reasons were explained, siting of major infrastructure was obligingly changed to avoid fragmenting a significant patch of remnant vegetation. Such successes should not depend on NGO opportunism, and should not be after-thoughts.

Developers may be approached individually or collectively about 'certainty', but the longer term needs a combination of government leadership, policy levers, Development Plan backing and education, particularly around Landscape Ecology and meeting developer needs in alternative ways, keeping profits and risks reasonable. **Links: Funding & Finance below; Criterion Community, Organism: Infosheet Organic Order: Principles of Building & Planning for Meeting Human Needs.**

Developers have no place in their present form as entrepreneurs and speculative initiators of any development, as we can not afford the continuing damage.^x The developer of the future could (*inter alia*) be skilled in systems thinking, green finance and creative partnership building for experimental developments, using influence to stimulate long-term consciousness in governments (indeed leading local government in innovative sustainable practice), setting up

²³ This was one of the core objectives of Urban Ecology fire soul architect Paul Downton, who recently completed (11/2000) a PhD (University of Adelaide) on the subject (personal communication 1993).⁵

²⁴ Duany Plater-Zyberk ('Dee Pee Zee').

²⁵ Personal Communication, Strategic Planning Project Manager, NSW.

and facilitating community and group processes and conflict resolution, implementing radically efficient building strategies, passive solar site design, water management, biodiversity conservation and restoration, using healthy materials and designs, local materials and skills, optimising materials use and recycling. **Link: Funding & Finance.**

11.4.1.2.2 Funding & Finance

Australian developers regularly refuse to implement the Backcloth a community would need for ecological and social, even economic sustainability. They believe 'green' to be not affordable and that their selling prices would be increased by implementing sustainable strategies that cost more up-front but have lower long-term maintenance costs. Most have never heard of or considered negotiating Green Mortgages, Energy-Efficient²⁶ Mortgages, Location-Efficient Mortgages,²⁷ self-build or linkages with intentional communities. They take only a short-term view, not caring that the consumer and government could make massive savings on infrastructure and running costs in the long term.

Developers justify their cost structure by referring to the large risks they take in speculation, and holding costs.⁵ Of course if they ceased to speculate, and started doing the development work required in partnership with communities of interest, they would save on cost, risk, promotion and marketing. If they did radical Sustainable Development they would save massively on infrastructure. If government rethought its land release and long-term discount rate rules, and if Development Plans supported local government policy, and paid for enough planners to do a proactive job and for time for strategic, landscape and statutory planners to meet regularly, a completely different scene could emerge.

Australian developers also assume there to be no market for 'green' housing,²⁸ but USA developers have used target market analysis to identify near-retirement baby boomers, 60% of whom consider themselves to be 'environmentalists'. It is unlikely that such people would reject sustainability if marketed well, green mortgages were available, the economics made sense and the houses looked reasonably 'normal'. Recreational retirement (Chaffin) and ecotourism (Selengut) are two examples of successful exploitation of niches so identified (Rocky Mountain Institute 1998: 106-109).

²⁶ Colorado E-Star energy-efficient mortgage, rating and finance program (Rocky Mountain Institute 1998: 267).

²⁷ Under development in California; correlates location, transport efficiency and household transportation expenditure to enable affordable mortgages (Rocky Mountain Institute 1998: 268-70).

²⁸ Interview with prominent Adelaide developer 1994; MFP Australia policy to hide green aspects of Mawson Lakes.⁵

'Socially Responsible Investment' (SRI) or 'Social Initiative Investment' (formerly 'Ethical Investment') are now stock market leaders.²⁹ These and pension funds (Bamberton, Mariendalsvej) are potential enabling sources for experimental developments. In Denmark, Housing Associations, Municipalities and National Government schemes support experimental housing and community building.⁵ Could one of these have funded the Halifax?

The American experience is actually that lending institutions find green development to increase long-term financial viability, and greatly decrease infrastructure costs (which in Australia are increasingly being shifted to developers as land acquisition trade-offs). Accelerated appreciation of property values has also consistently been shown, making sustainable housing an excellent investment for owners and a new niche for developers (Rocky Mountain Institute 1998: 4,10).

Cohousing, self-build, Community Land Title, Cooperatives, government-seeded Housing Associations, special grants (such as Healthy Cities Project funding, Commonwealth Government Energy, Natural Heritage and Greenhouse initiatives and Arts grants) all have financially relevant aspects that are poorly or not exploited in ordinary tract developments in this country.

The potential cost savings from self-build, LETS and community-of-interest volunteering are also overlooked. This represented an estimated \$2million worth of human input provided by some 700 volunteers in the Halifax case.

The lack of consistent Local Government Council support for the Halifax Project, and loss of State Government ownership of the original MFP, have ensured their failure. The most effective way to kill new initiatives, especially for EPP demonstration projects, is to cost them out of the game by authoritarian delays in approval (Sun Village, Queanbeyan): a common strategy, requiring enormous persistence and resilience in EP demonstrators.

The Aldinga Arts (with Permaculture) EcoVillage South of Adelaide has collected up some of the fallout from Kooringa Cohousing Cooperative (Burra)³⁰ exists only because of (eventual) State Government support and continuing ownership during the planning period.³¹ The project is now undergoing the market test, with a sympathetic realty agent, Housing Cooperative and Permaculture promotion and a marketing plan to restore community size lost over the years of struggle. At this point land sales cover purchase of the land, and the infrastructure depends on

²⁹ Value of SRI in the USA moved from \$529b in 1997 to \$1,497b in 1999 (2x general market growth rate); UK figures for 1998-9 were \$1.7b → \$72.b (Australian Conservation Foundation 2000: 30-31).

³⁰ A Permaculture, Cohousing cooperative that failed for complex reasons, including Government withdrawal of funding for Cooperatives (only Stage I funding was assured), and closure of the last Burra Mine, which resulted in depopulation of the rural town and an ethical dilemma about building new structures in a place experiencing a population and real estate values crash.⁵

³¹ Designer, *Energy Architecture* had in desperation to round up five Ministers for a joint meeting to obtain this support.

further sales, and local council resistance and delays, have so far been without holding costs to the purchasers. The unusual sewage treatment plans have already had to be abandoned due to authoritarian resistance to systems unproven in Australia. Aldinga will now have the system used by New Haven, whose credentials are well established locally.

With the Halifax, delays due to remediation meant that the final plans were presented to a Council very differently composed from the relatively 'green' Council that had encouraged the Ecopolis bid in the period after the first battles were won. This combined with Ecopolis' inexperience in dealing with large urban engineers (thus losing control of the application process), and an orthodox Council's lack of imagination and appreciation of the economic and demonstration potential this award-winning plan had shown.

No effort was made to find funding from other sources, not even Green Mortgages.³² The State Government may have been able to be encouraged to support the project through its business potential. The potential multiplier effect from having a central, demonstration radical, thoroughgoing eco-city project, with tourist, green business, green technology outlets, genuine pedestrian focus and strong community involvement, has been passed up for a safe, 'yuppie' complex, which does not dare to look different from its (largely unattractive) conservative surroundings. It is predictable that this project, which attracted international attention and a number of awards for its forward-looking stance, will now hardly raise an eyebrow in a world in which low-energy light bulbs and low-flow shower heads are unremarkable, and even these are now in doubt.

The Green Mortgage³³ approach was supposed to have been tried by the MFP for its New Haven Project (**Table 122: FRRRES: Green Mortgages - New Haven**), but a copy of the agreed State Bank-MFP offer established that the deal was so unsatisfactory that uptake was unlikely (as proved to be so).⁵

A fate similar to Halifax, for similar reasons is in train for the rural City of Whyalla, which had embraced the EcoCity concept as its self-reinvention strategy to survive the withdrawal of the giant BHP steel company. The MultiFunction Polis collapse into slightly less unsustainable suburbia has followed a similar pattern. In so many cases, where we could have been leading, we are opting for unsustainable, 'safe' actions, missing opportunities, yet in the USA:

³² The funding found and rejected by Delphin for Mawson Lakes was the type of option the City of Adelaide could have sought had it been truly committed to the EcoCity concept.

³³ The concept from the USA and Europe, is that the money saved from utility bills through efficiency measures, is used over the long term to pay back the initially higher cost of the house. In this case, the loan was dependent on the householder's installing a geothermal, reverse cycle air conditioning system. The houses were built in a low income area

... the financial rewards of green development are now bringing mainstream developers into the fold at an increasing pace. It is possible - indeed it is the norm - to do well financially by doing the right thing environmentally. For example, project costs can be reduced, buyers or renters will spend less to operate green buildings, and developers can differentiate themselves from the crowd - thereby getting a big marketing boost (Rocky Mountain Institute 1998: 10).

11.4.1.2.3 Delivery Systems

The current 'no', 'tradeoffs' and 'can't do' approach to eco-innovation needs to become 'can do', 'both/and' multi-functional, parsimonious and smart thinking. Delivery systems were an issue raised in JVNIC entry 125,³⁴ which noted that implementation of innovation in ESD and new technology is almost always hampered by existing delivery processes, particularly compromised by short-term finance. This entry relied on a robust, formal, New Town structure with joint government partnership and an equipotent, triumvirate delivery system, including executive Board and CEO, tertiary agency (researching, recording and comparing), and social justice arm (communicating between CEO and resident action groups). The Attractor core would be long-term community and ESD interests, not short-term finance. This would be enabled by long-term finance, control of land without owning it (government would have to agree to this), and visionary interface with the community: a formalised fire soul structure.

Developers as modern businesses, normally do speculative work with some imaginary community in mind, and spend a lot of money creating markets, promoting their product. These funds could be put towards actual Community development instead. Once traditionally commercialised, there appears to be little hope of real sustainability (MultiFunction Polis, Halifax, New Haven). Eco-communities presently start with a community and spend most of their time and money fighting the orthodox processes, usually ending up with a highly compromised outcome. This was the case with most of the Australian projects I looked at (Crystal Waters, Halifax, MultiFunction Polis, Sun Village Queanbeyan, Whyalla EcoCity Core Site). Danish and Swedish cases (municipality and national support) and the Aldinga case (finding land), demonstrate that even minimal government support, can make a huge difference.⁵

11.4.1.2.4 Human Community

In Freiburg im Breisgau, the successful, long-term regional transport plan was Community-initiated. In Arabella Park, a nearby suburb, the Ökostation Community centre, Biogarten,

where air conditioning would be the exception. Air conditioning in itself is inappropriate in housing supposedly designed to demonstrate energy efficiency.

³⁴ University of Canberra.

organic gardens, community workshops and meetings were all built, developed, maintained or run by local Community. These were all accommodated within a much larger, integrated development that included major elements such as an artificial lake, a vineyard, a sports centre, two schools, a full-sized athletics track, a viewing tower, children's playgrounds and science-teaching gardens and extensive housing. **Link: Plate 17: Collage: ESD (1) Der Seepark.** But in Adelaide, the substantial Community-of-Interest (hundreds) associated with Urban Ecology Australia and Ecopolis Pty Ltd was brushed aside once commercial forces came into play.

I saw evidence in apartments in Denmark and Sweden, and interviewing a Housing Association manager in Odense, Professor Bill Perks and David van Vliet in Calgary, and Kathryn McCamant in Berkeley, that just adding community facilities without involvement of future residents in the design process, results in infrequent usage,⁵ as distinct from the design improvements, cost savings and the very active commitment of a community involved right through the development process (McCamant *et al* 1994: 280). The Odense experience was that while all Housing Association developments required a resident committee to manage the common areas and buildings, unless such teams were led by effective people, a Sense of Community failed to develop. The Association had actually moved to replace such a chairperson, with magical results.

Common houses without coherent Community tended to be used as storage or garbage collection places. Where the glue was strong, they were used for creative, 'switched on' activities, for meetings, parties, picnics, washing machines, eating, music making, recycling, meditation, hobbies, child's play, cafés, book, clothing or appliance exchanges, and so on.⁵ The bottom line remains: without the Community, ante or post facto, there is no EcoCommunity, no Co-anything. **Link: Plate 2: Collage: Blå Kilde Gårde.**

Academic interest was taken in Mariendalsvej, as Canadian researchers (Perks, Van Vliet and others³⁵) were involved in and reported the design process for their own purposes (Perks & Van Vliet 1993; Perks & Wilton-Clark 1996).⁵ Some useful learnings about social conditions conducive to productive collaborative planning processes with user communities, are recorded in **Figure 59: FRRRES: Mariendalsvej Cohousing for the Elderly** and **Table 123: RRES: Danish Building Research Institute Conclusions.**

In effect then, Community itself is the key missing element for sustainable settlement development. It is not good enough for civil society to allow developers ignorant of

³⁵ University of Calgary.

sustainability issues to dictate what should be built. Community capacity-building is a top priority. **Link: Criterion Community.**

11.4.1.2.5 Education

All stakeholders in the human settlement development game need training and capacity building, in all countries, not just LDCs.

In reality, even now, there is little suburban tract developer experience in Australia in putting together all the elements of an integrated, wholistic, ecologically sustaining project.³⁶ The large planning, landscape planning and engineering firms dominate the development scene, so hold potential keys, but are commercially compromised and still wedded to top--down, hard engineering approaches.⁵

Residents are also often seriously ignorant,³⁷ and often resist change towards sustainability fought for by LandCare and other local CBOs from their own communities.³⁸ Since EPPs insist that the resident community be involved from the outset, and since this group is normally the last to be consulted in large residential developments, a most unusual approach to development is called for, one that does not privilege the developer at the expense of client, society and ecosystem. It is also a bad idea to do public consultation or partnership deals with communities that do not understand the issues, so education is absolutely essential, at home and at work. The question is 'By whom?'

A number of educational packages are now available, including TNS '*Sustainability Made Easy*' (for general public, businesses, local government), 'Muddy Boots' Workforce Environmental Training (Queensland and elsewhere), LA21 ESD Package (SA local government for LG staff), City of Manningham tailored training packages with EMS (local government), the *Global Action Plan* sustainable lifestyle courses (general), Australians All years K-12 Environmental Education package (school children) and others. I would suggest that State and Local Government Leadership, coordination and funding are needed, and *Healthy Cities* is one potential delivery structure. All formal Education sectors are in transition to taking more responsibility.

³⁶ The Australian Institute of Project Developers has no guidelines, education or requirement to consider or adhere to any code of sustainable practice.⁵

³⁷ At a recent social event attended mainly by specialist doctors, nurses, physiotherapists, teachers and politicians, when asked about the topic of my PhD, I responded "in short, Sustainable Development"; in nearly every case I received blank expressions and was asked "what's that?"

³⁸ I was recently peripherally involved with such a case, where a large amount of money was wasted. The local government presided over the replacement of a beautiful, integrated, sustainable wetland restoration design, already paid for through local LandCare, by Commonwealth National Heritage Trust funding, by a lowest common denominator, engineering based solution that alienated community and addressed water flows but not the ecological or aesthetic issues.

Some secondary schools are taking up the TNS approach,³⁹ which includes direct work with the school as a resource user, and the option of participation in the annual Australian Youth Parliament on the Environment. As mentioned elsewhere, the new Australian Industry Training Advisory Boards have, if willing, a major role to play by requiring all courses to contain a sustainability component, as they do for Occupational Health and Safety.

Meanwhile, EPPs such as Urban Ecology Australia focus on learning-by-doing to encourage community capacity building, especially in community building and alternative physical building (mud brick, strawbale).

11.4.1.2.6 Land Tenure

Community Land Title is well suited to EcoCommunities. **Table 124: BIES: Community Title (SA)** lists the main features, advantages and disadvantages of the South Australian Law. **Links: Criterion Landscape: Human Scale Design & Urban Form; Criterion Biotics: Different Scales of Occupation of Landscape.**

11.4.1.2.7 Retrofit

Three JVNIC entries refused to design EcoCity structures on the basis that there was enough development already. Redevelopment and infill were recommended.

Adelaide is still blighted with empty office space from the 1980s' speculative building boom – buildings that had no supportive Backcloth in terms of need or function. It is good to see that many of these are now being converted to residential, which is needed, but the Traffic they will support, the serviced apartment market, is still questionable as there is a serious shortage of large, affordable, family-sized accommodation, and families who would prefer a city address need a strong supportive Backcloth. Schools are closing and families head for the suburbs once their children need space, safety and Community.⁵

Development should never proceed unless a clear need is first established. An ever-expanding new housing market is an inappropriate basis for a sustainable economy. All goods and services should be produced on an as-needs basis; how to do this is problematic, but financial; policy levers such as luxury taxes are one solution. The reuse of building materials is mentioned above and elsewhere. Sometimes materials and energy considerations over the long-term make it advisable to replace buildings (creative destruction), as radical long-term improvement is often not otherwise possible, but then, recycled materials should be considered (Hawken *et al* 1999:

³⁹ Private schools to date, eg Geelong Grammar Victoria, Marbury SA.

Dematerialisation.

11.4.1.2.8 Partnership Transcending Social Bias

While activists can afford to be purist,⁴⁰ and most commonly 'Sectarian' (after Douglas), EPPs operating in the 'real world' know they have to take account of the other Social Bias positions, and thus are most effectively placed in a Transcendent position. What this implies is partnership in action for 'sustainability', already identified as the underpinning strategic theme for the Habitat II UN Conference in 1996. This tendency has been seen in recent years as funding has become scarce in general.

Major environmentalist groups have moved away from purely adversarial positions into conditional partnership with former foes such as big business (no doubt self-serving in both cases, and described as 'win-win'). This is a compelling option in a world where the available leverage has shifted to global scale and MNCs, while community fragmentation and self-centredness have successfully removed most viable opposition to large scale economic forces, and seen drastically reduced membership levels of environmental NGOs.

Examples of such confluence are the input of Greenpeace to the Sydney Olympic 'Green Games' initiative, and the recent launch of the Australian Conservation Foundation's "Blueprint for a Sustainable Australia" (Krockenberger *et al* 2000), in the enthusiastic presence of national leaders in politics, business and industry, trade unions and social services, for instance:

This balanced Blueprint for a Sustainable Australia calls for leadership; leadership by governments, businesses and all members of society. Those of us in business need to decide whether to sit on the sidelines and watch our country degrade or to engage, be progressive and play our part in securing our natural advantage. It's time to decide. It's time to lead (Greg Bourne, Regional President, BP Australia & New Zealand.)

Far from being mutually exclusive, the concept of Sustainable Development and the driving forces of business share much common ground. Indeed, the future belongs to those businesses who play a proactive role in devising ways in which we can meet our commercial needs and sustain the world we live in. At the same time those industries who do not embrace the principles of Sustainable Development will find that their licence to operate will come under increasing pressure. Natural Advantage makes an important contribution towards our level of understanding how we can achieve true sustainability (Richard Pratt, Chairman, Visy Industries).

In this context, EcoCommunity implementers should look around for sponsorship from selected partners in business and government, a strategy unfortunately overlooked by the City of Adelaide in its rush to replace its Halifax EcoCity with orthodox luxury apartments on 'financial' grounds.

⁴⁰ Or perhaps no longer can, as they are starved out by conservative cuts to their government subsidies.

The Australian Conservation Foundation has recently arranged to take on TNS training including the package “*Sustainability Made Easy*”, as having defined the Blueprint, they realised they had no strategy for implementation.⁵

11.4.1.3 SCOPING

11.4.1.3.1 Introduction

Scoping, as already seen, is the process that sets up the framework of scales, Criteria, grain and extent of a project brief. These may be refined as the project proceeds, but initial costings will rely on a fairly accurate assessment of these aspects. **Links: Hierarchy & Scale; Unified Ecology: Approaching a Structural Framework, Combining Criteria & Scale; UHSE: Scale & Scoping.**

11.4.1.3.2 Scaling

At an elementary level, Scaling can be approached by taking each Criterion in turn and asking what scale range has relevance for this Criterion for this project, acknowledging the different rules extant at the different scales, the need for research to define these relations, and the need to set up connections, integrations or relative disconnections between them.⁴¹ Approximate ranges are iterated in the Summary Tables for each Criterion (UHSE) below.

The biosphere is under threat, so biospheric scale impacts should always be accounted for whether required by law or not; and the strategic context is relevant at much higher scales than the local (for instance International Conventions, National ratifications and State laws and regulations on human rights, shelter, biodiversity, health, fire and the like); submicroscopic/molecular scale is germane to ecological and human health, so should usually be included as well. These connections should be traced throughout, not just thought of as parenthetical statements, ready to be dropped as soon as a financial constraint appears (the usual practice), that is, they need to be re-prioritised to a higher level in the service of a ‘triumph of small decisions’ and of conceptual integrity. EPPs attempt to honour elders and their wisdom.⁵

A Scale Analysis Diagram can help scale and record the scope for a particular project; **Tool 3.11: Scale Analysis Table** gives an example. **Links: Table: UHSE Criteria x Scale; UHSE: Scale & Scoping.**

⁴¹ For instance in policy making and indicator development.

11.4.1.3.3 Prioritising Rheotics: the Long-Term and Evolution

The Rheomode is still an emerging art. Initial scaling should address both space and time. As for the native American '7-generations' responsibility, appropriate eco-design timescales should accommodate indigenous trees (say 150-500 years) and geological time (especially around non-renewable resources). History and future generations are essential scaling points, while allowance for change and evolution (such as Grow-Housing, Permaculture ecosystems) are key differences between linear and cyclic approaches. Do not sell off railway corridors. Avoid covering Nature's productive surfaces with concrete. Allow for life cycle, vegetation and social evolution, room for mangroves to migrate inland, and cradle-to-cradle looping of materials, not just cradle-to-grave. **Links: HST: Time & Change; Criterion Rheotics; Criterion Landscape: Imitating Nature by Design & Landscape Planning: Permaculture.**

11.4.1.3.4 Chunking

Chunking is a strategy that increases efficiency of conceptualisation and optimises function, thus minimising costs as well, but has Reductionist side effects that need simultaneous recognition. It is used in organisations to make data or decisions more manageable ('drawing a line somewhere', 'redlining') and as the basis for committee systems. It is used in Statistics to conflate categories where the number of items, 'n', is insufficient to gain a significant result from a more specific category (increasing generalism). It is used in defining industrial sectors for convenience, but this may cause problems. For instance with Australia's ESD strategy in the early 1990s, it was belatedly realised that a number of 'cross-sectoral' issues existed that had been omitted by the sectoral approach.⁵ Cross-sectoral reports on such issues as women and Aborigines were hastily added.⁵

Holon Theory (Hierarchy Theory) spoke of the internal cohesion of holons, which share frequency spectra, with increasing difficulty and weakness of communication outside such time-functional groups: these are 'natural' chunks. Once the scale ranges are defined (space-time), then aspects at the same scale (space, time, concept, function) can be chunked for consideration together under Criterial headings: that is, things that function together are considered together. This is illustrated in **Table 125: CEES: Chunking (a) by Spacetime (large) & (b) by Functional Region** and **Table 126: CEES: Chunking (c) by Project Site (spatial) & (d) by Functional Element**. The UHSE framework is a type of chunking based on types of function. Buzan's *Mind Maps* and the *Information Spiders* illustrated elsewhere (Figure 37, Tool 3.3), are chunking tools that seek to draw together natural chunks into a Conceptual Hierarchy.

11.4.1.3.5 Stakeholder Inclusion

The definition of communities-of-interest is theoretically broad and inclusive. With bottom-up EcoCommunity, time and financial constraints make even marketing a major problem, as is the accessing of local community stakeholders, the smaller the project scale the more difficult. Due process and legal challenge are prominent as obstacles and both tend to adversarial attitudes as currently operating (for instance local government invites neighbours to object to a development).

Project Community, neighbourhood external Community and Biotic Community are all key stakeholders in a real sense, especially in the long-term demonstration, education and co-evolution sense. **Links: Models for Post-Industrial Community below; Criterion Community: Living in Community.**

11.4.1.3.6 'Sustainable' Regions

If our Place-Consciousness is 'Bioregion', this can flow back to influence habitat healing and protection, building approvals, purchasing policy, community education and so on.

Sustainability is best dealt with not as a particular end-point, but as a commitment to minimal impact within a process of monitored continuous improvement. Impact is unavoidable: it is a fact of living for all beings. However there is much we can do with an organic, ecological vision: a commitment to healing the damage, voluntary constraint, parsimonious consumption, respectful relationships, and to living in celebration of life locally, with awe in the dynamic and creative processes of chaos and the extraordinary orders that continually emerge.

Theoretically a sustainable region would be self-contained in subsistence basics (food, water), (especially housing) materials, waste management and energy, and have its own, regularly-reported indicators. Urban, rooftop and wall gardening, urban Permaculture, community gardening, microgardening and urban forestry are all options recommended by EPPs.

Bioregionalism should imply a shift of governance to a two-tiered one consisting of national and regional scales. With so many imports, building a 'sustainable' house is presently impossible. At regional scale it is still impossible, but a region can set radical targets as do the City of Manningham's 'Stretch Goals'. Where imports can not be avoided, compensating strategies are appropriate. For instance Urban Ecology Australia guarantees to plant trees to compensate for paper use at its conferences; Permaculture Convergences (Conferences) participants plant trees, as did Catalyst '95 and '97 attendees; *Green Fleet* and *Forest for Cars* collect money from

motorists to plant trees for CO₂ absorption.⁴² Ecopolis Pty Ltd had intended to restore and revegetate an eroded rural creek in the process of extracting earth for the Halifax Project buildings, emphasising an urban-rural healing connection.

Permaculture and Bioregion groups around Australia have divided up most of the country and given it bioregional labels, behaving as if such entities were formally in place. This is not and can not be, neatly done. The boundaries are quite different from those Biogeographical Regions mentioned under Genius Loci, and are used as a general orientation and consciousness-raising measure, not to justify a museum approach to biodiversity preservation.

11.4.1.3.7 Fuzzy Sustainability Space & Indicators

Having defined one's Bioregion, one is then in a position to map the Fuzzy Sustainability Space for that region, from which will flow an understanding of the part one's own project may play in enlivening that area, and the steps to be taken to shift the system to the green-orange and green zones of the local Traffic Light Indicator.

11.4.1.4 DESIGN PROCESS

Having thrown off natural controls and limitations, modern man [*sic*] must replace them with an at least effective man-made pattern (Mumford 1972: 150).

11.4.1.4.1 Introduction

This section oversees the confluence of all the preceding, to suggest a generic, 20-step process for unified human settlement design at a nominated scale range. Six key strategies are reiterated here, along with the process as a whole: start with the land, design Nature in, base designs on basic needs for high level biotic (including social and ecological, and restoration) liveliness, use Precautionary Principle, minimise energy use and set up as many ways as possible to learn and evolve. Permaculture has two more: 'Every element, many functions', 'Every function, many elements'.

The ultimate design, if there is such a thing, is the marriage of what is best for the land and what is best for the people who live there. What we call a "design" is really only a pictorial representation of the implied inter-relationships between objects, structures, plants, animals and humans. The drawing only gives information about placement of types of species and nothing about their interaction, which is the most important thing about any ecosystem (Mars 1996).

⁴² The unifocal concern with tree planting, while a change in the right direction, does little to redress biodiversity problems as such, and can be predicted to cause other imbalances if habitat considerations are not integrated into these ideas.

11.4.1.4.2 Site Visits: Start With The Land

It is well known in Conflict Resolution that humans need to depersonalise the 'other' in order to inflict damage and maintain conflict (Kohlrieser 1999). A similar situation exists with environmental abuse (Rounsefell 1993a). **Links OCW, JVNIC; Criterion Landscape.**

It is not ecologically appropriate to sit in a distant city and draw a plan to be superimposed on a map, assuming that any geomorphological, social or ecological impediments can be simply technologised away. This attitude was very marked in the early MultiFunction Polis designs (drawn in Sydney) with their visual axes (Plate 5: Map 1), huge 'rafts' to be constructed from a rare patch of uncontaminated soil, leaving a hole which would become a lake; mangroves to be swept away "but more will be planted in another place".⁵ The later Mawson Lakes project 'required' enormous earthworks, land 'sculpting' and wetland building preceding land release, yet now has poor greenspace continuity, and wild Nature is subdued to accommodate a grotesquely sterile Ecology, similar to the original village plans and ordinary sprawling developments, with smaller land and housing footprints - but a new golf course nearby, as big as the present development. **Plate 12: Site Plans** displays some of these patterns.

As noted, the JVNIC winning entry included land sculpting and located housing in a sensitive woodland. Only five of thirty-two proponents discovered that there were six endangered species on the site, and only a handful visited the site prior to designing 'EcoCity' elements for it. In fact the Competition was fatally flawed because it had no Community, and until one existed, there could be no properly-attuned EcoCity design.

Ecological Design requires a careful personal Site Assessment because:

1. For ecological sustainability, it is essential to work with Nature (McHarg 1992; Mollison & Holmgren 1978; Spirn 1984; Van der Ryn & Cohen 1996; Yeang 1995), at or below the scale of the Bioregion, to enhance or coat-tail on natural processes rather than confronting, overwhelming or simplifying them; to discover and respect local ecosystems and their absorptive capacity, and other ecological entities; ecosystems must be carefully assessed as a baseline and in order to achieve fully conscious design.
2. This is impossible without detailed local knowledge. The UHSE Matrix can guide such data collection, but a working knowledge of the reasons for such collection is also essential. Local people and CBOs are experts on local conditions in refreshing, and often challenging ways. The best public ownership, the least social dissonance and the best ecological outcomes emerge from respectful (active listening and responding) public, scientific and other stakeholder communication, preceding decision-making, with developers filling a service role, rather than an entrepreneurial one.⁵⁴³
3. There is no other way to fully experience the Spirit of Place.
4. There needs to be a commitment to doing a local State of Environment and Impact Assessment for preventive design (design for needs, liveliness and high level wellness for human and related biotic communities), and to achieve this, existing and potential communities need to be identified in advance and included before design stage.

⁴³ Example: Duany Plater-Zyberk USA: Bamberton: cautionary tale: very promising project but still not built because environmentalists were not consulted about its location. As they said, it was a 'good project in the wrong place' (Source: Derek Mallard & Canadian Greens President, Joan Russow).

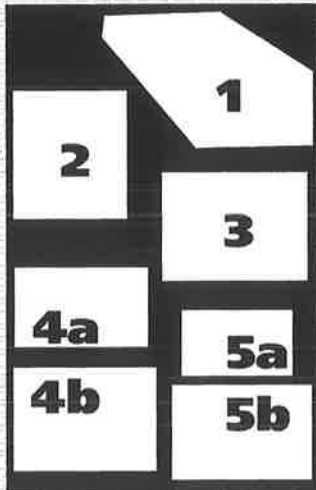
5. A useful strategy for this is a Constraint Map, which is best appreciated from the site itself: an ecological equivalent of a 'SWOT Analysis' identifies ecological strengths (ecological resources present, biodiversity, relative resilience to likely impacts), weaknesses (fragility, connectance issues), opportunities (ecological and other resources available for enhancement, exploitation, healing or integration into human habitat processes such as food production, appropriate industry or waste management), threats (impacts likely from the types of human interference planned).
6. The important, small details of a site will often be overlooked unless observed at the right scale, which is not available from the usual maps and plans.
7. Habitat matrix, relationship to bioregion, climate/weather, natural stormwater flows, and soil types are very early aspects that must drive an ecological design. Details about water flows can be guessed from contour maps, but all these things are best appreciated by direct observation with scientifically-informed interpretation. Science involves the observation of phenomena, seeking patterns of invariance over appropriate time frames.

11.4.1.4.3 *Designing Nature Into Urban Settings*

An approach that claims 'What we really need are practical strategies for "preventing the loss of biodiversity"',⁴⁴ is starting from the wrong end. The first question from an ecological perspective is 'How can we identify, invite in and celebrate the local biodiversity here?' An inventory is needed. The next is 'Where and when is the water?' The next question will relate to understanding the local climate-vegetation associations and associated fauna and their needs: the interface between the Traffic and the Backcloth through complex and often indirect processes. And then humans have to be fitted in with minimal impact. Interpretation obviously varies tremendously with site.

⁴⁴ (Webb 1995: 7) emphasis added.

Plate 12: Collage: Site Plans - Key



1 Aldinga Arts-EcoVillage (rural fringe S of Adelaide)
Aldinga has some 140 housing sites, of which 44 are attached (200 sq.m town house blocks), and the rest a mix of 450 and 600 sq.m, cluster housing, and a substantial community centre including a projected Arts Centre. On-site sewage treatment, power generation (wind and solar) and Permaculture food production are planned. The ponding system will integrate waste water and stormwater management, while providing human and biotic amenity. Creek restoration has begun with indigenous native seed collection and tubestock production. All houses must be committee-approved, have 'natural' or earth-construction looks, but experimentation is welcomed. But strictly no free dogs or cats, and no big dogs at all. Community Title.

2 Whyalla EcoCity Core Site (14ha)

Recently re-named to be no EcoCity at all, despite claims such as "The Whyalla City Council is committed to creating a better living environment for the people of Whyalla through making this city an EcoCity, a city which is more sustainable over the long term, which lowers real costs to the community and which strives for best practice in meeting State and National environmental targets." The housing is drawn up here as mainly separate dwellings or duplexes. There is little space here for food production, but the landscape plan (\$18,000, lists serious weeds [olives] and only 30% indigenous native plantings⁵: not appropriate for an EcoCity. **Link: Plate 4.**

3 Kolding Kommune Fredensgade/Hollændervej Urban Renewal

This project shows the potential for retrofit of connected housing enclosing a central area, usually under-utilised, creating EcoCommunity potential. Here, an integrated, central, ecocycling 'Bioworks' processes wastes, sewage, water, and produces energy and food. There is plenty of room for social amenities, and safe play for children. Public funding, rent relief and special grants ease socio-economic processes. Rental tenancy helps enable such work. Information: Dansk Byplan; Torben Gade, architect. I heard of a similar project in Davis California, where residents pooled resources to buy housing for community centre and education. Just pull down the back fence! From the air, most Australian cities have large tracts of houses arranged back-to-back in blocks.⁵ Block 6 project in Berlin processes sewage and waste water from a square of medium-rise apartments, through a series of constructed wetland/ponding system, relying on selective plant use. This incorporates recreation area and a small effluent forest.⁵

4a-b Mawson Lakes and Shearwater Land Release

a: The creek is retained but the detail shows little more than street trees and pocket parks. **b:** is located above the chart on the left of a. Neotraditional style is rife. See Image 5.

5a-b Laguna West (3400 units on 1045 acres)

While theoretically compatible with Eco-development, and overlapping in many of the Community-oriented aspects (pedestrian and transit priority, increased density, mixed use, social diversity, natural surveillance), and while ecological principles are mentioned in the NU Principles (see D&C6.4), projects rarely reflect this, and especially tend to omit energy aspects and direct biodiversity healing and conservation. Neotraditional development also has a tendency to wear a Romantic Metaphor (finials and pretty colours) divorced from the realities of climate (little passive solar design (eg in hot climates, no overhangs or useable verandahs, few trees), Nature (over-controlled public and private space, 'lollipop-on-stick' vegetation, with serious poverty of wildness/natural disorder, wildlife habitat and creative freedom). Another tendency is to build canal developments, which usually replace functioning wetlands.

5a is the original orthodox plan for the area, which protects quality housing from the highway by placing commercial and low income apartments as a barrier. The **5b** Neotraditional redo reverses this pattern, bringing transit and higher density living right into the mixed use commercial centre. Most housing is separate, with connected building only appearing in the prime real estate waterfront area near the town centre. This layout is designed to bring services to as many people as possible within walking distance. The land is probably used more productively, but the natural creekline is eliminated. The end result was a standard development with no promenade nor transit, mainly thanks to the banks.

Sources: project promotional material; personal observation; RMI 1998: 91-94; Katz 1994: 19.

Exceptional resource people for EPPs are the natural resource project officers, public relations officers and environmental planners from local government and catchment boards. In SA, the Urban Forest Biodiversity Program project officers attached to local government are extremely knowledgeable.⁵ The significance of a working knowledge of their subjects will increase markedly for other professions in the next decades, and should start now by inclusion or consultation, before the design stage of projects.

Link: Criterion Landscape.

11.4.1.4.4 Needs Based, Criteria-Enriched Design

Wholistic understanding is approached first through the selection of appropriate Scales and Criteria, then by looking for linkages. To demonstrate to view-switching intended by the Criteria, Allen & Hoekstra, use the example of the mites which clean human skin pores, which may be seen as a nested Community (a Community within a Community), as a Community in balance with its resource base (human skin), as an exploding Population (in disease states such as Scabies), *[or as individual Organisms with policies, relationships and survival needs]* (Allen & Hoekstra 1992: 283: 261-2). These may be studied objectively, but with humans especially, the values and aims behind the choice of what to study are also relevant. Previously, Theory has tended to espouse a single Criterion, scale or Complementary extreme and discount the rest, often taking the form of professional fashion in 'best practice', such as the 'post-modern' fashion of buildings without eaves or useable verandahs. Many babies have thereby been thrown out with the *[proverbial]* bathwaters.

To design an Attractor Landscape for one or a small number of species or groups (Populations), one goes to Organism to discover which basic needs may provide leverage (the usual behaviour of the market research sector, but Nature needs this too), and to that Community and the Community Criterion for an understanding of the relationships that may pertain in competitive, collective or other designated environments. Being asked to deal with Scale, one may remember not just Populations of large creatures and trees, but also micro biota and soil organisms; not just geology, but soil structure; not just immediate timescales, but long term; not just molecular pollution but macro wastes and negative vistas. One will probably design in signifiers for a congruent Genius Loci, with local assistance. One may fence some spaces as a Repellor for non-target populations (such as those predicted to behave⁴⁵ inappropriately) or to separate two incompatible Populations (such as visitors from breeding wildlife). Ecocycles will bring attention

to resource availability (including local food, water, bushland and building materials) and loop closure for wastes, while the Elements and climate of the place should inform how shelter is approached and materials/energy managed. Criterion Feedbacks describes the positive and negative feedback context that supports a particular entity (space, place, process, event). Criteria Rhetorics and Indicators should allow for future review and evolution.

Research into models of fields of variables as in Fuzzy Cognitive Mapping, demonstrates that they will usually settle into an Attractor pattern after a few iterations, and that the results of this in Nature are sometimes counter-intuitive due to indirect Connectivity and incomplete information. The challenge with design is to set up a strong Attractor pattern with a Backcloth able to support it for the required duration (100-500 years?). Larger settlements capture growth and resources by positive feedback Attractor potency ('urban multiplier effect').

That being said, and having regard for ecosystem services and Nature's needs, Landscape scale considerations should grace all designs whether rural, suburban or urban, and appropriately trained Landscape professionals should be used if possible (preferably with Natural Resource Management background or loyalties, not orthodox Horticulture). Prioritise quality over quantity.

Through the ages the standard prescription for urban illnesses - and perhaps as effective as more specific remedies - is retreat to some little village by seacoast or mountain - that is, restoration to a pre-urban natural environment ... Though man [*sic*] has become the dominant species in every region where the city has taken hold, partly because of ... the system of public controls over both man and nature he exercises there, he has yet to safeguard that position by acknowledging his sustained and inescapable dependence upon all his biological partners (Mumford 1972: 144).

Link: Plate 19: "Rainforest" (Endpiece).

11.4.1.4.5 *Precautionary Principle*

The inconvenient Precautionary Principle (Deville & Harding 1997: 18-22) is successfully kept at bay by claiming that apparent sustainability for one Criterion and timescale implies sustainability for others. This should never happen in ecological development, and the Principle is regarded as an article of faith.⁵ **Link: BP 5.4: Problem of Cause.**

11.4.1.4.6 *Learning System*

EPPs are usually committed to learning-by-doing, a mastery activity for which no formal system can substitute.

⁴⁵ Or dress inappropriately in some human settlement contexts!

Whatever indicators and Benchmarks are defined, for larger projects they should be a coherent, internally consistent set, such as those based on an initial Backcasting exercise, with a clear definition of the Sustainability Space the project intends to occupy, the actions, the actors and the review process. Plan-Do-Audit-Review.

Government support for an experimental approach to ESD and EcoCommunity design is a powerful ally for creativity and learning, and the areas for attempted mastery should be clearly defined, justified and presented as an exciting challenge when seeking funding and community support. The results can then be honestly audited and reported to the public domain to accelerate collective learning. Special conditions will apply to key systems like on-site sewage treatment.

Several communities I visited had a learning process to undergo around the function or implementation of alternative systems (Fuzzies Farm, Hundsted experimental housing area, Aldinga, Crystal Waters). Australian regulators tend to stop experimental approaches, not allowing or being interested in learning. Most States have now accepted composting toilets in built-up areas, but this is still a problem in SA, despite the fact that a Dowmus large-scale composting system has been in successful use in rural SA by the Australian Army for some years.⁵

Link: Criterion Indicators.

Digital technologies are likely to play a part in future learning systems, and may well enable rapid spread of practical information at a time when such knowledge is becoming urgent.

11.4.1.4.7 20-Step Design Process

Tool 3.12: 20-Step Design Process follows a process thought through in the context of concept development for a large urban site (such as City West). The steps are not intended to be strictly linear nor necessarily ordinal. Theoretically it should be applicable at any scale and location, assuming that the underlying Organising Principles operate in the manner described throughout this dissertation, but particularly as in OCW Project, the constant alternation between facts and values, structures and functions, individual and group, past present and future, large scale and smaller, action and reflection, all asymptotic with respect to the long term objectives. **Tool 3.13: Design Process Loop** is a general aid to conceptualising the process at larger scale.

To ensure also that it is an ecological design process, then a number of extra requirements emerge. These are taken care of thematically by the UHSE Matrix and other tools (next section),

which may well not be needed by experienced professionals, but is suggested as a good place to start in Higher Education, especially in professions where ecological or sociological training are not the primary focus of the curriculum, or where training is patchy.⁴⁶ **Link: City West Case Study.**

The table is only part of the business. The Backcloth is woven, some structures emerge, and thereafter an ongoing reciprocal process is nurtured into the future between Backcloth and the Traffic represented by the project outcomes, with periodic review and creative destruction as required to keep the entity tuned to its environments. Obviously, the designers, if not the future owners, will not necessarily view such processes and priorities as will those in long-term charge of the development. **Links: Criterion Organism (Oregon Experiment); BP 5.3 (q-Analysis) HST: Holling's Infinity Loop, Figure 28: Holling's 'Infinity Loop' Model.**

11.4.1.5 DATA MANAGEMENT

The Opposing City West Project found that UHSE Criterial headings were 'invaluable' in directing and organising the complex data management required for such a large enterprise. **Link: Case Study: OCW.** The tools listed under Technology below are presented as a group in Volume II for convenient access. The UHSE framework was used as a conceptual framework intended to cover all bases. This was not, of course, checkable through implementation in this setting. As far as I could judge, we covered all the necessary information (and some unnecessary, as claimed by a student critic who could not see the importance of worrying about the nesting habits of ducks to the design of buildings). It was possible to assemble all the available data in files related to the Criteria, and then review them in a second cycle to see what material we lacked. This I refer to as 'Matrix-Assisted Data Targetting'.

The data document Weavings, was of substantial size. There was a major disruption when I discovered that some students had been directly quoting material from written sources, without citation. It was quite difficult to weed out such instances from a collective effort. One would think that university-trained professionals would have been taught such basics (there were final year students), so in employing data-managers, this is something to be aware of and preempted.

The project data-trail has team communication, educational, promotional, learning system and legal significance. OCW and other experience have shown the value of recording as you go:

⁴⁶ My initial concept of a teachable framework was derived from my medical training, which relied on an internalised

record as much as possible photographically and electronically, with multi-media in mind, consulting marketing professionals early in the process if this will be relevant later, so as not to miss the opportunity for capturing 'before & after' impressions.

11.5 TECHNOLOGY: TOOLS

11.5.1 INTRODUCTION

See Volume II for collection of tools developed for use with the UHSE approach (Appendix 3).

11.5.2 MATHEMATICAL UNDERPINNINGS

BP 5.10: What Mathematics for the Divergent Sciences? raises questions about the Mathematics available to researchers in the Social Sciences, making a plea for a coherent, non-probabilistic, new approach to nonlinearity, that can be teachable as a package for such purposes. The paper is labelled 'Background', being peripheral to the general purpose of this dissertation, but would come into its own if the context were research, rather than design.

11.5.3 TOOLS LISTS

As usual with complex systems, a matrix scheme is capable of superficial simplicity with escalating detail as the divergent information paths are followed down the scales. The intended principles and method of use are seen in **Tool 3.1: Use of Matrices**.

This is followed by a second table, **Tool 3.2: Tools & Uses**, that spells out conceptual tools available to practitioners concerned that their work be eco-socially sustainable. As explained at the end of the UHSE Section, there is a 'family' of Tools based on the UHSE Matrix concept, with slightly different uses of increasing complexity (**Tools 3.4, 3.10 and 3.14**; also **3.6 Community Cascade**). These are structural (skeletal) Tools. **Tool 3.15 (Second Order Matrix)** and **3.15 (Questions for Designers)** are 'Brainstorm trigger' Tools designed to help put flesh on the bones. **3.7 (FSS Structure)**, **3.11 (Scale)**, **3.5 (Hierarchy)** and **3.8 (Boundaries & Constraints)** work more with the Systems Theory side of the concept. **3.3 (Spider)** is a useful, general information storage device of no claimed uniqueness. **3.12** and **3.13** are process Tools, **3.8** is an Indicator Tool, and **3.17** collects up a broad spectrum of creative and structural strategies from UHSE, Complexity Theory and beyond, that may be useful in designing, building or maintaining EcoCommunity.

The two **Databases, 4.1: Places & Learnings** and **4.2: Sustainability Strategies** (Appendix D) can also be used as Repertoire Tools or resources that can indicate the types of strategies used or recommended in ecological design by a wide range of people and groups.

11.6 CONTENT FOR THE FRAMEWORK: PATTERN REPERTOIRES

11.6.1 INTRODUCTION

As mentioned under Methodology, my first activity in approaching this dissertation was to make a collection of lists of the principles or attributes of Ecologically Sustaining Development. These formed the basis for my letters to embassies, universities and government departments, asking to visit and see implemented examples. Now that the UHSE model has been described, it is appropriate for completeness, to present some of the work of hundreds, if not thousands of thoughtful people who put themselves to the task of compiling lists of what they considered essential for sustainable or radical eco-developments, in the period from just before EcoCity 2, Adelaide and UNCED (1992), to 1999. Inclusion of all the lists is not practicable. I have selected a representative range from a stack over 30cm high, choosing to indicate trends in EPP and some ESD recommendations from different scales and sectors. Many are appended in Volume II, together with the collated tables: **DB 4.2: Sustainability Strategies** which are available not to read in detail, but as a resource, and to observe the pattern of patchiness, even in EPP brainstorm.

Lists were organised by UHSE Criteria by assigning codes according to their subject matter, sorting, decoding and assigning to tables of Criteria x Subcriteria (plus extra columns to represent any common subthemes). The result was a constellation of strategies which usually turned out to be second order or more, as required for sustainable, multi-functional outcomes (as would be worked out on a Self-Referential Matrix). Many issues were thus difficult to assign to a single Criterion, as strategies and concepts were not designed with UHSE in mind, but had a resolutely multi-faceted complexity, conceptually, strategically and by target problem. This is not unexpected, in view of the inherent complexity of the Backcloth with which we are dealing and the transformational robustness and 'multifunctionality' specifically sought by EPPs. However it is a characteristic that makes this type of information very difficult to classify, research, teach or work with: hence the serious contribution of intuitive and *Fuzzy* processes. In addition, since every project must be interpreted to site and scale, the principles of systems thinking become the Integrative Strategy par excellence, and functional benchmark, while the list of solutions becomes a smorgasbord full of potential, but not something to justify righteousness. 'Best Practice' is a false God so long as it excludes the synthesis of strategy with local situation.

11.6.2 COMMENT ON COLLATED TABLES

Not surprisingly, the individual lists reflect the ideological position of the authors, but overlap is also strong, despite the rarity of specific duplication of listings. For instance the Australian Conservation Foundation leaned heavily on Nature and biodiversity conservation, and the University of British Columbia Centre for Human Settlements emphasised social equity. In the National Strategy for Ecologically Sustainable Development, the Australian Government made a claim to concern for environment but with democracy towards all components of its list (goal for the strategy, balance of emphases required), but effectively undermined this through economic contingency: it made four of the seven Guiding Principles economy-dependent and advised that the global dimension of environmental impacts be "recognised and considered" (not necessarily acted upon) (Commonwealth of Australia 1992b: 9, 8). It insisted on the (discredited)⁴⁷ claim that strong economic growth and international competitiveness must be the bottom line, and saw environmental protection as secondary to and a benefit of those things (what I have called the '*sine qua non* economic argument': the resource-exploitative RED⁴⁸ position).

Table 127: ESCM: Australia's Goals, Core Objectives and Guiding Principles for the Strategy directly quotes Australia's Goals and Principles, underlining the points at which potential 'copouts' may be expected (and have subsequently eventuated).

The ecological lobby sees this type of exposition of principle as misleading 'politician speak', and are much more likely to attach concrete strategies to their principles, or failing to see the difference, muddle the two together. For example the comprehensive collection of 'eco-patterns' referred to in Table: Entry 101: Patterns of Sustainability comes across as a kaleidoscopic ragbag, albeit an innovative and well-reasoned list in detail. The shorter list of Eight Principles from the Ventura County Citizen Planners (Citizen Planners of Ventura County 1991),⁴⁹ both spells out design and policy criteria and raises questions, but also has this quality:

Table 128: ES: Citizen Planners of Ventura County.

Amusingly, I asked the CEO of MFP Australia (1992) for a copy of the MFP's 'Mission Statement'. He helpfully provided me with a 50-page document! An inability to crisply define what the MFP

⁴⁷ To cite just one of dozens of references, Hueting's analysis of the myth "Production Must Grow to Save the Environment" demonstrates clearly that growth depletes the environment, and "Those who argue in favour of both growth and environmental conservation, or even for growth in order to save the environment, are therefore either blind to reality or are gambling on technologies that have neither been invented nor become operational, thus risking the basis of our existence" (Hueting 1996: 86).

⁴⁸ Resource-Exploitative Development.

⁴⁹ The Citizen Planners Project of Ventura County: 'An ongoing educational and consensus building forum established for the following purpose: "To create a comprehensive plan for Ventura County to improve the quality of life by creating sustainable communities and preserving the integrity of the natural environment." Stage One entrained a massive effort of dozens of community members, including 24 environmental consultants, and county staff, the Gildea Resource Centre, environmental, business, university and school groups, developers, planners, the Community Environmental Council, the

was about appeared to dog its public face throughout its turbulent life, and to lose it many potential supporters. If the 'triple bottom line' slogan had been appreciated then, MFP-Australia may have seen out its intended 30 years, as it was one of the first to attempt to synergise 'People, Technology [*Economic Development*] and Environment': a statement the CEO could have pointed to instead.⁵⁰

It was found in the Jerrabomberra Valley National Ideas Competition that strategies presented by competitors were plentiful in areas where practitioners were already incorporating them into their work (such as energy efficient housing, water management and attention to Sense of Place), but that recommendations were very scanty in other areas (such as transport energy, large scale change strategies like policy, and integration of IT&T, alternative land and housing tenures and governance). But despite these deficiencies, there was an extremely strong demand, perhaps interpretable as a yearning, for far more community involvement in all aspects of lifestyle choice, designing, deciding, building and governance. **Figure 60: FRRRES: JVNIC Theme Report** collates theme densities, concept constellations and sustainability strategies x UHSE Criteria.

There is a similar trend in the collected lists, indicating a degree of favouritism, but also the evolution of knowledge, as new issues have emerged. There was a central core of strategies and concepts that were mentioned by a number of writers, but there was also a wide spread of elements. As with the JVNIC material, two main types of list were found: conceptual and strategic. The more orthodox, academic and Government-led, resource-conserving strategies for ESD, and the outputs of processes run by these large types of institution, tended to focus more on policy, economics and resource efficiency, often mentioning the necessity for attitudinal change, but not actually offering much in terms of implementation or education. The EcoCommunity movement tended to include these types of approach, but to see the grass roots, community 'glue', 'bottom up' partnerships, servant leadership, eco-spirituality and 'human capital' issues as being at the core or the sustainability conundrum, a '*sine qua non* EcoCommunity' position (the 'ECD' mentioned above).

Once again, the collated lists emphasise areas such as community development, materials and energy efficiency, water management and biodiversity, with which 'Sustainable Development' is most often associated. Catchment- or Landscape-Scale thinking, planning and land-healing

Tri-Valley Environmental Institute of Thousand Oaks, and others (Citizen Planners of Ventura County 1991: 4, and pers.comm. Jeanette Scoville, organiser).

⁵⁰ I was actually given a slide set to take on my research journey in 1992, which included one where this triple-bottom line vision was quite clearly spelt out.

processes are now emerging; Landscape Ecology (as distinct from Landscape Architecture) awaits affirmation as a key profession in Australian Urban Development. IT&T and electronic aspects of transport have yet to appear in lists, and almost nowhere were indicators mentioned except in specialist publications. Low mentions also, were Economics in urban design, Elements other than water, soil health and development, risk thresholds, Aboriginal History in Genius Loci, non-physical human needs in development, exercise or crime & safety needs in Planning, information as an Ecocycle component or form of capital, relative disconnection, Constraints & Limiting Factors, and transition ideas. I could have selected lists to fill most of these, as I did with Transit-Sensitive Urban Design and Mindful Markets, but the point is not to fill up all the gaps so much as indicate where the issues may be if one were working on a demonstration project. Nobody can have a final word, because to be sustainable, the local must be flexibly integrated. Informed choices need better information so we can choose amongst a range of economically affordable options.⁵¹

11.6.3 INTEGRATIVE MODELS FOR POST-INDUSTRIAL COMMUNITY

11.6.3.1 Introduction

In 1991 Pepper reported on his extensive investigation of communes in the United Kingdom. His findings were that communes were unlikely to provide useful models for sustainable community, mostly since they were often deficient in sustainable practice, were losing the energy to resist the easy ways represented by the unsustainable mainstream, and were too difficult for most ordinary mortals. They were potentially useful models, if only in the circumstance that the present low *Gemeinschaft* society⁵² should suddenly, through material crisis, revolutionise itself into one with radically different ideas and behaviours (Pepper 1991: 218-9). The intentional community residents I visited in the USA and Europe could not have disagreed more, seeing themselves primarily in a teaching role of 'butterfly's wing', and making a quiet but significant impact.

Pepper's definitions of '*Gemeinschaft*' and '*Gessellschaft*' have more clarity than most. Both would fall in Douglas' high Grid axis, with the former being low, and the latter high, Group. *Gemeinschaft* is basically communal, with inter-personal solidarity based on the glue of kinship or common interest, with one version representing a dominance hierarchy (Douglas' bureaucratic structure), [another perhaps another Adams-style '*survival vehicle: the Sect*'], and

⁵¹ Link: Lenzen lists Tables 91, 92 (Lenzen 1998b).

the whole being an organic totality greater than the sum of its individuals. *Gesellschaft*, the view that society is merely the sum of its individuals, is competitive, fragmented, atomistic, individualist, each with equal rights to property and possessions, but the *Theory of Virtue* gives further rights to the successful (Pepper 1991: 6;Wenz 1988: 1-53).

Link: Table 19 (Theories of Justice & Virtue). If we are to avoid the excesses of 'Economic Darwinism', then in the present system, the successful need to be persuaded that their fate walks in common with that of lesser mortals, and governments need to honour their role and act on civil society's behalf.

While *Gemeinschaft* and *Gesellschaft* now seem old-fashioned terms, in our skewed society they have rarely been more relevant. We did evolve under *Gemeinschaft* conditions. **Link: Criterion Organism: Human Psycho-Social Needs.** Pepper's analysis likens the green critique of industrial society to "all the dissenting voices that accompanied the rise of modern capitalism over the past three hundred years", but records a pair of differences: the claimed immanence of a real environmental crisis as never before, and a bioethically based 'Ecologism' (Pepper 1991: 10). He refers to McLaughlin & Davidson's comparison between communes of the 1960s and the 1980s,⁵³ the former on the whole more negative, rebellious and anti-Victorian [*my term*], the latter more positive, integrative and wholistic (McLaughlin & Davidson 1985: 100-102).

The challenge most recently has been, still recognising the human need for Community, to produce a form that will be suited to the realities of contemporary life, while still meeting the needs of ecosystems and quality of life standards. Changing patterns in lifestyle and family structure since the early 1960s, have seen radical changes in housing needs and socio-economic arrangements that often leave families without adequate social support. What forms may now emerge?

Young people are delaying childbearing, often for a decade or more. Fewer children are being born. The Australian media⁵⁴ recently described a large, currently unmet need of 'Generation X' for long-term rental accommodation without cooking facilities: dormitory style housing used as a base for commuting to outsourced meals, usually shared communally at restaurants and cafés. They have no routine day, are often students, run one work life and another social life, marry and breed much later, are more communal, and 'graze' on snacks if at home during the day.

⁵² Concepts from Tonnies. *Gemeinschaft* indicates a community of intimate, enduring social relatedness with church and family as glue. *Gesellschaft* indicates a society of loose organisation, "impersonal, contractual and calculative" (Mann 1983: 143, 145).

⁵³ 1990s in my copy, presumably projected, as also used in Pepper's text.

⁵⁴ ABC Radio National 'The World Today', 21 January 2000; Adelaide Advertiser 22 January, 2000.

They need a completely different style of dwelling from that of the baby boomers whose needs have been and continue to be met by developers who are themselves baby boomers (for example the three-bedroom house in suburbia) (Hurrell 2000).

The following section reports on a number of implemented developments I visited, stayed and worked in, in 1993 and subsequently. **Link: DB 4.2: Places & Learnings.** These are overviews, some reported visually, with comment on the features I found most useful for consideration if implementing such developments in Australia. The most fully-featured examples are mostly of the intentional, EcoCommunity or Cohousing™ community type (Findhorn, Overdrevet), while some integrated ESD, top-down developments, usually at larger scale and more urban/suburban, are worth mentioning (Der Seepark, Arabella Park).

EcoCommunity and Cohousing meet the need of a much broader group and would probably save a great deal in social security and health costs in an ageing population. Most ESD developments are currently disappointing in Australia and elsewhere, and poor in community values.

The most integrated expression of sustainable lifestyle I found was the EcoCommunity or EcoVillage, which usually combined aspects of commune, Cohousing, Permaculture or organic gardening, cooperatives, the Arts, and with some, energy and water sensitive design. The top-down, ESD approach, is best exemplified through denser, mixed use, transit-oriented development has scale and some energy advantages, but is not necessarily child-friendly⁵⁵

11.6.3.2 Intentional Community

11.6.3.2.1 EcoCommunity

An EcoVillage is a
human-scale
full-featured settlement
in which human activities
are harmlessly integrated
into the natural world
in a way that is supportive
of healthy human development
and can be successfully continued
into the indefinite future

(Gilman 1991: source Global EcoVillage Network, 11/1999, Internet).

⁵⁵ *Barnevennlig* is a Norwegian term, meaning 'child-friendly' that has started to be used in planning and design in English. For instance 'child-friendly' and 'family-friendly' may apply to public open space, buildings, hospital wards. In Danish: 'Børnevenlig' (*barnə wenli*) is used for houses and sit planning. (Sources: native speakers Norwegian & Danish).

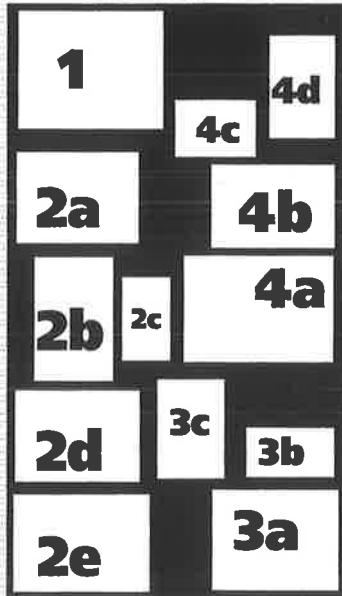
Findhorn Community is one of the largest and longest-surviving intentional communities in Western countries (in 1993, 31 years and 180 - reduced), and a base model for many subsequent ones (Australian communities Crystal Waters, Fuzzies Farm and Aldinga all acknowledge conceptual links). It has a strong spiritual tradition, including tree and garden spirits, and still makes a substantial income from *New Age* experiential, personal growth courses and related paraphernalia. **Figure 61: BIFR: Findhorn Information Sheet** has the 'organic' look (unlike its overseas marketing material) mentioned above, but its content displays the community's wholism. As discussed elsewhere, it has contributed to knowledge about community glue, attunement, common purse, optimal size, governance and ecovillage building techniques. **Links: Confluence: Criteria: Community, Organism: Building Biology. Plates 13 and 14: Collages: Findhorn (A&B)** illustrate many features of this impressive intentional community.

Findhorn's Vision is:

"A centre of spiritual service in co-creation with nature, encompassing education and community."

(From *"The Findhorn Foundation: Programmes May-October 2001"*).

Plate 13: Collage: Findhorn (A) - Key



1 Findhorn Community (1962+)

From 1993 Sales Catalogue. 180 in community proper at 'The Park', plus 200 'outliers' of shared vision, living nearby, and 50 at Cluny Hill (former 180-bed hotel in bad repair, bought for £70,000 and used for business and educational events: Findhorn B). Several other buildings in locality used for workshops. Small satellite community on Isle of Erraid (Hebrides). A non-profit charitable trust. Spiritual, welcoming all religions. Average age 40 (formerly 25); turnover 4 years (formerly 8 months). Waiting list for positions.

Trading wing 'New Findhorn Directions' includes 'The Phoenix Centre (whole foods shop, books, gifts, artefacts, music); apothecary, mailorders, Findhorn Press, Findhorn Music, Findhorn Bay Caravan Park and Windpark energy). Wider community activities are organised by Outreach Department: twice yearly conferences, workshops, presentations (UK & Abroad), support of *Trees for Life* and reafforestation of Caledonian Forest and Isle of Arran (*Holy Island Project*). Pottery and weaving studios produce crafts for sale.

Note the photo (30th birthday 1992) infrastructure: the Community House, the central meeting and eating place. Numbers attending meals are substantial (vegetarian, grown organically at Cullerne House). Rules reportedly excessive (but responsive/emergent). Complementary community links with Steiner School, One Earth magazine, alternative data management (computing), solar panel production and distribution, other retreats and workshops and local artists and craftspeople. In 1993: power, control and delegation issues were foreground. Increasing number of employees for specialist positions. Concern that elders were drawing financial support but no longer contributing. Claimed shortage of money, despite appearance of thriving industry in many quarters. EcoVillage building was drawing substantial funds. Community apparently divided into 'powerful' hard workers and 'powerless' grumblers.

2a-e Arts Centre 'Universal Hall'

Findhorn buildings are mostly self-built or retrofit, often with substantial contribution from resident artist visitors (special examples are Universal Hall and Nature Sanctuary). Venue for regional symphony concerts: another community service.

a: front, displaying massive stained glass wall. **b & c** show internal angular view of wall and door closer external view.

d: concert hall interior: note artworks and massive timber construction (needed to support the stone roof).

e: Coffee and light meals outlet at back of Universal Hall.

3a-c Genius Loci: Love

Commercialism, competitiveness and community conflicts notwithstanding, a strong ambience of love and spirituality pervades Findhorn, and is expressed all around in beautiful works of caring: **3a&b:** a flower garden and a path both at The Park; **c:** tapestry hanging in the ballroom at Cluny Hill.

4a-d Nature Spirits: the Findhorn Nature Sanctuary

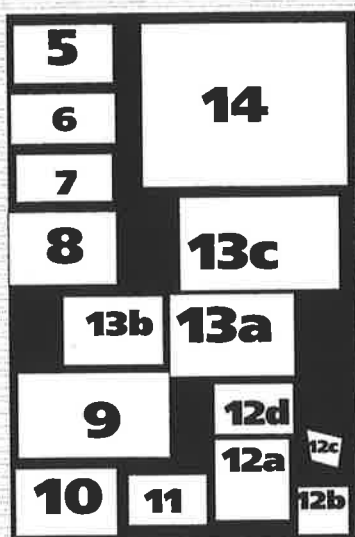
a. Lovingly built by a visiting artisan. Local stone, logs, recycled whisky barrel window frames, wildflowers and grass sod roof. Surrounded by superb, seated garden. Approached by visually delightful path (**4d**).

b & c: Interior of Nature Lodge. Ceiling formed from massive radial logs and thick glass. Floor marked with zodiac-related, spiritually significant patterns. Split, polished rock in centre, with fresh flowers. Taizé sessions held here at dawn (based on Swetina 1993). Ambience is extremely peaceful, soothing, and supports a loving, respectful, reflective attitude.

My personal response to this building was quite unusual. In the three days I was at Findhorn I found myself drawn to visit it many times and just sit there.



Plate 14: Collage: Findhorn (B) - Key



5 Planning Department

With its centre (The Park) - formerly a caravan park, next to a still-active airforce base - and its satellites, Findhorn needs and has the services of at least one architect/planner. Visitors feed into the programme of constant improvement, building and restoration. My task (I paid to stay there and participate) was to help restore the historic caravan in which Peter Caddy and his two women founders (wife Elaine Caddy and Dorothy Maclean) lived in the early days.

This 'working visitor' strategy has also been taken to a fine artform by Fuzzies Farm, which has used willing and paying backpacker labour for most of its substantial building programme (\$12 per night in 1993 if you don't help, \$8 if you do: the atmosphere is inclusive and friendly, with a glass of wine and round of appreciations before dinner each evening).

6 Apothecary

7 Art Studio

The Craft Studio and a Clothes Recycling Boutique are nearby. The output of the weavers is perhaps the most remarkable: the unicorn tapestry in Findhorn (A)3c is a special case, but the tapestries for sale are also very beautiful, abounding in rich colour.

8 Guest Quarters

Note sod roof and solar HWS.

9 Adolescents' Arrangements

This distance from the main community allows teenagers to make a lot of noise without disturbing the rest of the community. Note sod roof of meeting house, and distant windmill that supplies the community. The windmill is located near the RAF airfield, which does have an annoying frequency of intrusive takeoffs and landings.

10 Greenhouse (Mainly Flowers)

11 Recycling Centre

The level of sorting for recycling at places like Findhorn and generally across Canada and Europe, was in 1993 still more detailed than it is in Australia today, except at such places as *Revo/ve*, at the ACT tip. Even airports were sorting into glass, paper and 'other', but most of the community (and Danish municipal) bins at least sorted glass into different colours. **Link: Plate 2: Blå Kilde Gårde (more comprehensive).**

12a-d Eco-Strategies

a: Glasshouse (EcoVillage); b: Blown newspaper insulation; c: Triple glazed Swedish halogen window; d: Sod roof.

13a-c Experimental Housing

a: 'Bag End Cluster' Baubiology designed housing (Link: Table 82).
b: Whiskey barrel experimental house with copper roof.
c: Singles quarters in EcoVillage: designed for 10, divided into two sets of living infrastructures.

14 Cluny Hill College

This is a vast, once-'stately' old hotel with a grand ballroom and beautiful woodwork. It was in a dreadful state of repair in 1993, and undergoing slow, organised restoration by community members. Much of the business interface of Findhorn occurs here, but there are also offices etc at The Park. On the hill below the building is a beautiful garden ('of course'). Out the back, I was introduced to the 'tools': all the domestic and other equipment is named, cherished for its function, no matter how lowly, is well-maintained and has a personal storage place. This respect for tools was also a prominent feature of Fuzzies Farm, without the emphasis on naming.

Sources: Caddy (1994); Interviews, field research, community literature, lecture by Peter Caddy; Author's photographs; background: Image 3a..



11.6.3.2.2 Cohousing

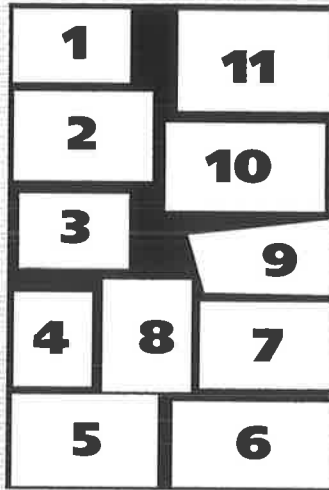
Cohousing, (housing together), is defined as a cooperative, constructed community where groups of people build together but retain private quarters and share costly resources, maintains a healthy (and negotiated) balance of privacy and group activities (McCamant & Durrett 1988: 203). It began in Denmark (1970s), has spread across Europe and the United States in particular, the name being trademarked⁵⁶ by McCamant & Durrett. Cohousing models an attractive, not too 'weird' balance between communalism and functionality for contemporary conditions, with substantial social benefits.

I met with Kathryn McCamant in Berkeley, California, who referred me to several projects including '*Muir Commons*' in Davis, which I visited, along with '*Village Homes*', the original Corbett energy/EcoCommunity. I also had a long discussion with David Van Vliet (then University of Calgary), whose study with his supervisor Prof Bill Perks, of Scandinavian intentional communities is mentioned elsewhere (Perks & Van Vliet 1993). I subsequently visited over a dozen such developments in Denmark, Sweden and the United Kingdom including '*Overdrevet*' (Århus), '*Rainbow Cooperative*' (Milton Keynes UK), '*Mariendalsvej*' (København) and '*Det kreative Seniorbo*' (Odense), the latter two for seniors. I also participated in several months of Cohousing community development meetings related to the Halifax Project in 1994-5.

Speaking to Northern Hemisphere Cohousing residents convinced me that this is a deeply satisfying, sometimes tiresome, but very appropriate arrangement for raising families and keeping ageing people socially involved. Cohousing mimics in a modern, non-hippie way, the conditions under which humans evolved (living in community). The access to an 'instant community', the very rich social network without compromising privacy, and the sharing of overheads, chores, bigger tasks, interests, child supervision, caring for older members and many other things, most persuasively argue for Cohousing as a solution to the social fragmentation and alienation so common today. While most of the communities were primarily interested in social aspects, most were also passionate about living out an ecologically correct lifestyle with each others' help. Above all, many impressively happy children were noticeable, far too busy enjoying each others' company to care about watching excessive television. Adults who do not fit in tend to sell out, so the group self-selects for compatibility over time.⁵

⁵⁶ 'Cohousing' is a Registered Trade Mark, as is 'Permaculture', although the words have passed into the vernacular. I have not checked the currency of the marks, but initially recognised their original status as an internal convention here. I have been forced to remove all registration symbols from the text, however, due to a serious 'bug' issue with MS Word and damage caused by using the Masterdocument feature, which has residual problems despite complete rebuilding of the document on several occasions. In Denmark the term is spelt 'co-housing'.

Plate 15: Collage: Overdrevet - Key



1 Carpark: Peripheral

I arrived by bus and train from Århus (18km), and had a very long walk with my bags to reach the community. Cars are not a prominent feature of Danish society, but seem fairly well-represented here. But a large number of bicycles is also evident around the Common House.

2 Common House

This houses a number of core activities: office; child's play; meals and meetings, energy production and management, clothes washing and drying and noisy adolescent activity. I took an interest in common houses and their functions, finding that while apartment blocks in Scandinavia are usually provided with such spaces, and while resident committees are usually in charge of maintenance activities, the presence of a community firesoul

or committed leadership group seems to be a prerequisite for intensive use. In some high density Uppsala apartments, in one block the common space was a box room. In an adjacent block, there was a well-organised laundry system with shared commercial scale equipment, a small kitchen and a meeting/party area used approximately weekly. In smaller Cohousing such as Muir Commons (Davis CA) or Overdrevet, high levels of use, including shared meals at least part of the week, are common. Cohousing is emerging in large building retrofits and warehouses, but may need extra determination to succeed under structural constraint. For instance a child's birthday party in a common room at Rainbow Cooperative in Milton Keynes (two rows of connected Victorian housing) the crowd could hardly move, but it was a very jolly party.

3 Kitchen

A large, commercial kitchen. Private dwellings also have cooking facilities in a living-sitting area. After a huge amount of activity and cleaning behaviour, I was a somewhat surprised Australian to find that community dinner was a bowl of vegetable soup with nice bread.

4 Basement Energy Works

The energy system is computer-controlled. The hybridisation and backup arrangements are located in the basement of the Common House, with waste heat captured to dry washing. Energy comes from windmill, solar rooves and diesel backup. Newcomers are pushing for connection to the grid instead of replacing the mill (see text): their interest in Cohousing is purely social.

5 Housing

There are 25 dwellings, built in 1980, arranged around two grassed areas that contain children's outdoor play equipment and a few seats. The community was originally a more radical offshoot of *Sol og Vind* (30 units with renewable energy built at Beder, also in 1980)(McCamant & Durrett 1994). A squalid shed near the farmhouse was occupied by a somewhat exotic sculptor.

6 Organic Garden

The original property was a farm. Housing is clustered in one area, leaving large areas for an organic farm and orchard. A pig provided manure for compost, and innocently awaited Christmas.

7 Old Farmhouse

This provides storage and has an apartment for adolescents leaving the community, to practise self-care skills and isolated living. This concern for adolescent needs here and at Findhorn contrasts with Australian tract developments, where adolescents are feared and seen as alien. See also image 9.

8 Small Children's Indoor Play Area (Common House)

9 Adolescent 'Dive' (Basement, Common House)

10 Solar Roof

Solar technologies provide 15% of energy needs, despite Northern latitude. How much more potential in Australia?

11 Windmill (on leased land further uphill).

Sources: Field Research, interviews; Morten Elle personal communication; Author's photographs.



Plate 15: Collage: Overdrevet displays the main features of this Cohousing EcoCommunity in Århus, Denmark. It is now second-generation. Figure 63 gives details of another Danish Cohousing group (Vårst). See also DB 4.1. **Link: Criterion Community: Living in Community.** Some disadvantages are the time taken in meetings if delegation is not practised, and the need to have the social skills appropriate to participatory democracy, including standing by community decisions one may personally disapprove of, and the need to maintain careful behavioural standards to balance the inter-personal proximity.⁵⁷ **Figure 62: FRRRES: Advantages & Disadvantages of Cohousing** lists many of the pros and cons.

Figure 63: FRRRCM: Report Card: Vårst Cohousing Community is a transcription from unstructured notes of 1993 to a framework based on the UHSE model to test its adequacy at finding a place for all the information proffered and for discovering post facto any information gaps. The framework worked well, and indicated gaps in Biotics, Elements, Genius Loci and the systems Criteria. I concluded that it could be helpful for self-audit or eco-audit data recording.

Senior Cohousing is actively pursued in Odense, Denmark, where a study has identified ten themes in the establishment process: **Table 129: BIFRRRES: Senior Co-housing Research (Odense).** **Link: Confluence: Process: Methodology: Community: Figure 59: Mariendalsvej.**

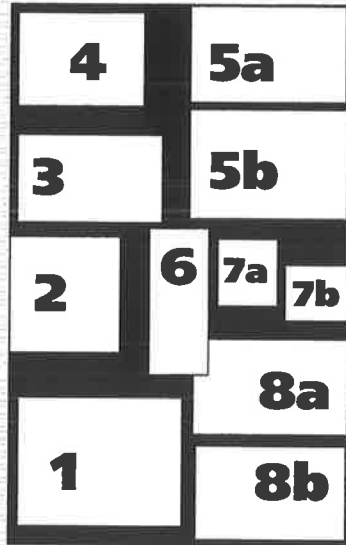
11.6.3.2.3 Permaculture

Permaculture, mentioned often above, is a comprehensive approach that acknowledges the complex dynamic systemic nature of human attempts in many ways to align with Nature, and offers a conceptual, strategic and wholistic framework for a lifestyle centred on Sustainable Agriculture (food production) at personal and community scale. Although practised by a few in cities and more recently promoted for urban dwellers, most of its theoretical and practical experience has been rural, suburban fringe and third world (the origin of many of its concepts, and the destination of recycled wisdom) (Morrow 1993).

The theoretical segments of Molison's Designers' Manual contain small sections on complex systems, connectivity, chaos, order, evolution and principles derived from these for practical use. Most of the activity recommended is socially ethical and environmentally utilitarian, constructing new, productive ecosystems for subsistence use, but also including restoration of endemic species and ecosystems. Two thirds of the integrated entries in the JVNIC recommended Permaculture

⁵⁷ One community still carried the scars from open relationship standards indulged in during the 1970s, and nearly succumbed to the trauma that resulted.

Plate 16: Collage: Permaculture - Key



Most of the following comment refers to Crystal Waters in rural Conondale near Maleny, North of Brisbane. Maleny itself is a remarkable Attractor for alternative lifestyles and has many functioning co-ops alternative businesses, a radical, child-centred school, and a lively health store with organic restaurant, a popular meeting place. CW in its modern incarnation was designed and implemented by four men (Lindegger, Tap, Young & Goodman). The population is approximately 150, about 1/3 children. Only a handful are seriously applying Permaculture Principles. Many eat at the Common House (vegetarian). There is a well-established visitors' centre and appropriately humble but adequate teaching facilities. The 4-kilometer road creates a lot of motor vehicle traffic, which could have been avoided with the preferred, clustered layout. This layout encourages the rural retreat market.

1 Dam System Crystal Waters

CW has 15 dams, which are used for recreation, amenity and emergency, but not general use for supply reasons. Gutterless bitumen roads with common-trenched utilities have saved much expense.

2 Experimental Housing: Domes

Many EPPs are very enamoured of the concepts of Buckminster Fuller. But domes have been found to be problematic in Australia: heat tends to be concentrated, cross-ventilation is difficult, furnishings don't fit unless custom built. One solution is to elevate the dome above a vertical wall (as they have done for centuries in the Middle East). Crystal Waters encourages and has, a wide variety of self-build experimental dwellings. One of the favourites is Alexander pattern language design. See also Image 3 and Plate 9 (5, 7). Reference Patterns 192: Window Overlooks Life and 221: Natural Doors & Windows (Alexander *et al* 1977).

3 Cobb Construction

Cobb is mixed by foot and kneaded like bread. I helped Yanto Evans at Cerro Gordo build part of a tiny demo cobb house: He came from his LDC work to teach self-build to poor Americans whom he saw as equally badly off to LDC destitutes.

4 Stewart Sherwin

First inhabitant of CW cemetery. Worked tirelessly before he died to establish and endow *Genesis Foundation* for education in ecological sustainability. Refused to die until project was complete, the Foundation was registered as a charity, and the money 'safe'. Bought land and funded rainforest restoration on this hill.. Fuzzies Farm has a grove named after him.

5 Verandahs

a: Alexander Patterns: 163: Outdoor Room; 167: Six Foot Balcony.
b: Back Verandah: typical Permaculturalist's Zone 1 (needing continual observation).

6 Flowforms

Developed first at Virbella Institute by small artist-technical group; history back to Roman times; replicated oxygenation of water by river rocks; now made of fibreglass, ceramics or concrete. This set developed by sculptor John Wilkes (Mollison 1988: 102; scanned from Pearson 1994: 26). Much promoted by Permaculturalists for health and beauty.

7a-b Composting Toilet & Toilet Compost

Dean Cameron of Downmus (Maleny) took me for a tour of experimental domestic composting systems he had installed at CW. Downmus has gone on to develop larger scale systems, both wet and dry, in use by the Australian Army in arid SA, and also systems suited to large city buildings. Approval has been difficult as governments fear new and fear reducing revenue of privateers.

8a-b No-dig Gardens

a: No-dig with newspaper under, built up from compost and pea straw. **b:** Circular designs are common in Permaculture, for functional and symbolic reasons.

Sources: Field research, interviews, conducted tour of composting systems (Dean Cameron); Author's photographs; Crystal Waters except 6 (citations & scan as above), 7a (Author's garden, Adelaide).



or Yeomans Principles (Foulsham & Rounsefell 1994: 124; Mollison 1988; Yeomans 1993). **Links:**
Criterion Elements: Water; Figure 37: Permaculture Spider; Criterion Landscape:
Imitating Nature by Design: Permaculture; Figure 38 Permaculture Material from
Aldinga AEV.

Like Halifax, Aldinga Arts EcoVillage and Kooringa Cohousing Cooperative for five years to 1996, has put countless hours and many years into internal community and concept development. Another challenge has been the earning of local community acceptance. Information and invitations to open days and information sessions, delivered through a 600-house letterdrop, CBOs, public notice boards, articles in 'Green Connections' and other media, and word of mouth, have still missed four ignorant of the facts, who turned up to complain.

Most effective has been the presence of detailed signs on the road outside the property during monthly open days. There were 45 submissions, 40 contra in the first round of objections. The second round has seen only eight responses, three in support, two with discomforts based on incorrect information, and three with minor concerns only.⁵ The community of Nature is also being included, local seed has been collected for regenerative planting and creek restoration, even before land sales, and the first tubestock is ready for planting. The Site Plan was seen in Plate 12.

Aldinga will have Community Title tenure, and has a Community Committee charged with local governance activities such as defining and approving housing designs, setting local rules, dealing with common lands, pets, and infrastructure, which has already produced a detailed Covenant structure. Cats and dogs will only be allowed if confined or on leads, and large dogs will not be allowed. A large proportion of the land will be commonly held, and personal blocks are small. Funding will be sought through Arts grants to establish a substantial Arts Centre.

Once established, Aldinga should have potential to be a significant Attractor of regional interest, much like the array of alternative community living, trading, financing, education, innovating and general cooperating around the remarkable town of Maleny, North of Brisbane, which includes Crystal Waters 'Permaculture Village'. **Link: Weaving the Backcloth: Community;**
Plate 12: Collage: Site Plans.

Permaculture has proved quite elusive to photograph, as most places I visited, including Crystal Waters, say they believe in Permaculture but practise something very diluted. I am expecting a visit to the *Food Forest*, an SA Permaculture farming and training property, will have more to demonstrate. **Plate 16: Collage: Permaculture** explains some aspects.

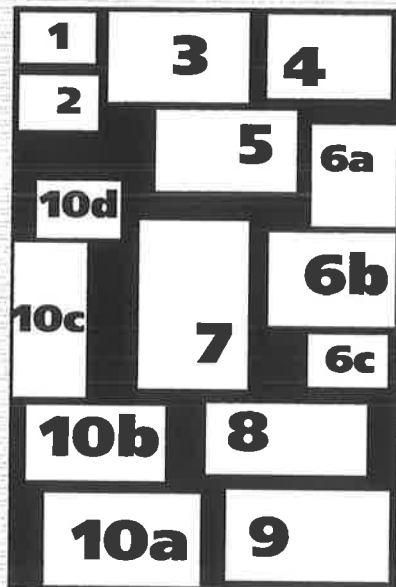


Plate 17: Collage: ESD (1) Der Seepark - Key

1 Explanatory Sign

This sign lists dozens of different features of the Park. The central area is recreational, with a large artificial lake with various places to be or sit. It is all very organised, but a few wild places remain of the far side, beyond the path.

2 Surrounding Residential

Cars are excluded from the Park. Nearby roads are kerbless.

3 Pontoon Bridge

This is quite a massive structure, and looks expensive.

4 & 5 Athletics & Sports

There is a great emphasis on sports, and these complexes are no doubt well used by the several local schools, including two on site.

6a-c Biogarten

Education is a very strong theme. The Biogarten conducts ecological education for school children, and supervises experiments. For instance they were growing tobacco and standardising its responses to ozone, for which it is a sensitive indicator. I had photographed some dying London plane trees in Nice, and wondered if they too are good indicators, or whether it was really toxic in Nice. Another part of the Park, near a young children's playground, is an area full of large installations designed to teach Physics by first hand experience.

7 Viewing Tower

The several 'aerial oblique' photographs on this page were taken from the top of this tower, which is both an Attractor and an exercise opportunity. The statue is the only public art I noted on site, but the artistry in the Ökostation and the Biogarten gate (6b), is inspirational.

8 Vineyard

The plantings in this Park are organically tended. The orchard in 10c is also organic. I believe wine is to be produced.

9 Housing

Several styles and ages of housing were present, mostly connected buildings of apartments. This is an older example. This is one of many that are set back but face directly onto the Park. Some of the yards are very large. Not much food production was apparent.

10a-d Ökostation

This community-built meeting and education centre is also very active in working with children and the general public. This is not a tourist centre: none of the literature was in English. The interior was shown in Plate 9: a massive basketry of whole trees. The Ökostation has many sustainable activities and features. It has substantial thermal mass (10a), a sod roof, special energy features (including glasshouse technology), and the pond in 10b is a constructed wetland processing waste water.

Its staff take care of the organic gardens and orchards, the Biogarten, experiments there and in the Ökostation, and the demonstrations, so they are very busy.

Brochures and booklets in the community area include lists of local artisans and alternative technology specialists, and contain contacts for institutions interested in sustainability, such as ICLEI. Notices alert visitors to local eco-activities and political events, as well as meetings, seminars and workshops held regularly in the building.

Sources: Field Research, interviews on site and Planning Department, Freiburg im Breisgau; Author's photographs; background Image 7.



11.6.3.2.4 Top-Down: EcoCommunity

Table ECD vs ESD expressed a composite view of the difference between the top-down attempts to implement sustainable practices, and those of community-driven projects espousing Urban Ecology principles. These latter are thought of as 'bottom up', but are in practice still mostly led by a fire-soul or a core group with greater technical knowledge, and with big groups this means 'more bottom up'.⁵

Many community working parties and authors have carefully, laboriously, often heatedly, worked on the definition of best practice for EcoCommunities and Sustainable Developments, but so few have been fully implemented that it has not been possible to monitor their performance as integrated entities, and much of the work is intangible. Most implemented examples were in fact basically Cohousing developments, with more or fewer ecologically sustainable features. Thus the 'objective' aspects of sustainability are and will be, slow to emerge. Those with the will to implement such developments, rarely had the resources to do all at once (for instance Lost Valley, Cerro Gordo and Alpha Farm, all Oregon USA; Fuzzies Farm, Crystal Waters and Sun Village in Australia),⁵ and would commonly argue against haste in any case, seeing evolution and direct community input and 'ownership' as essential, as supported by **Figure 64: ES: Eight Steps to a Sustainable Community.**

Two planned large, top-down 'EcoVillages' (population circa 10,000) that I visited in the USA and Canada by major developers (for example DPZ), (Bamberton on Victoria Island and Ahmanson Ranch in California) in 1993, are both delayed if not cancelled by conservation issues, involving respectively, sensitive ecosystem (sensitive Saanich Inlet, steep forested slopes, indigenous issues: apparently insurmountable) and endangered species (California red-legged frog and 'extinct' San Fernando Valley spineflower found on EIA).

Unlike Bamberton (DB 4.1), Ahmanson Ranch will probably go ahead, as "environmentalist claims have been shown to be exaggerated", a radioactivity scare beat-up by opponents has been proven false, and the developer has committed 90% of the 13,000 acres of land to open space, committed resources to an Oak Tree Mitigation Program, tree relocation within the development area, natural wetland protection, eight acres of constructed wetlands, urban runoff management and water reclamation for reuse, exit flow water quality program, 100-foot buffer zones, and protection, research and conservation programmes for the two endangered

species. Ahmanson⁵⁸ has also teamed up with a CBO Institute (Las Virgines Institute for Resource Management), to monitor and manage local wildlife & endangered species issues, including captive breeding of species rare in the area (Anonymous 2000a;2000b;Chan 2000;Heal the Bay 2000;Lystra 2000a;2000b;2000c;Shepnick 2000;Sherman 1999) followed up 02/2000.

The threshold to actual implementation is quite difficult to transcend in Australia.⁵ In Denmark the University of Ålborg has been set up as a key centre for Urban Ecology.⁵⁹ The Danish attitude of support for 'Urban Ecology experiments' has much to recommend it. This often involves government financial support in the early stages while research into effectiveness proceeds. The Danish Housing Institute makes information on housing experiments publicly available (for instance Dansk Byplanlaboratorium 1992).⁵ With wind power, a National Government subsidy was provided, starting to be withdrawn in 1993 as the industry became self-sufficient.

Many of the Danish communities I visited were funded by Housing Associations (including the small scale Cohousing for well-heeled seniors in Odense – but still built by the local Housing Association); another (København) by pension funds, one in Ålborg had a complex, government funded arrangement where ownership was transferred after 20 years of rent payment. Another pattern was for a group to purchase an existing large residential property (hotel, caravan park, religious holiday camp, farm), providing conferences, short courses, accommodation or other services to defray costs (Findhorn's Cluny Hall at Forres, Findhorn, Lost Valley, Cerro Gordo, Alpha Farm, Hundsted, Overdrevet, Rainbow Cooperative Milton Keynes).⁵

As mentioned above, in 1993 en route to Europe, I visited Professor Bill Perks and David Van Vliet at the Faculty of Environmental Design, University of Calgary. They had just completed a major study of over 30 Scandinavian EcoCommunity projects as part of their desire to apply what they learned to assessing the feasibility of an EcoCommunity Demonstration Project they were planning for Calgary.⁶⁰ An overview of the practical barriers and difficulties they identified, with suggested solutions, is tabled as: **Table 130: FRES: EcoCommunity Implementation: Issues & Solutions from Swedish EcoVillage.**

The similarities between Canada and Scandinavia noted by Perks and Van Vliet, are remarkably parallel to my own experience in Australia.⁵ The actual proportion of Australians prepared to

⁵⁸ Ahmanson Land Company funded the intensive *Ventura County Citizen Planners'* process mentioned above, that led to the VCCP list of Sustainability Principles and a supporting booklet (Citizen Planners of Ventura County 1991).

⁵⁹ A similarly named Melbourne Institute is based on formal Ecology in an urban setting, not the full spectrum of Scales and anthropocentric focus that *Urban Ecology Australia* and the Ålborg centre espouse. A synthesis is clearly urgent, as this dissertation is attempting to initiate.

⁶⁰ The existence of this study was the cause of a major re-direction in my PhD.

invest housing-scale finance in community-oriented dwelling arrangements would have to be established, but broad-scale change is unlikely without demonstration sites.

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it's the only thing that ever has (Margaret Mead). *[Frequently quoted by EcoVillage builders, EPPs in general and the late Robert Theobald]*

11.6.3.2.5 Top-Down: RCD (ESD)

The MFP has been described and illustrated in several places above. I visited other large-scale, top-down developments, including False Creek (Vancouver), Der Seepark (Freiburg im Breisgau) and Arabella Park (München). False Creek (Vancouver) is a good example of high quality, high density development, demonstrating that high density does not have to be oppressive as long as design is good and there are recreational amenities nearby. There have been problems with community in the years since establishment, though, related to tenancy. Not surprisingly, it has been found that a rental relationship is not as conducive to respect for property as resident ownership, where there is no other relationship to the property. In Denmark and Sweden, where apartment dwellers are tenants but have security of tenure and management is charged to committees of residents, pride in the standard of management is the common but not universal.⁵ Blå Kilde Gårde is a good example of the harnessing of this potential. Security of tenure, often at issue in Australia, is much more respected in Europe and often legally enforced.

Link: Plate 2: Collage: Blå Kilde Gårde.

Freiburg im Breisgau is in the picturesque South-Western region of Germany, near Switzerland. Der Seepark is an extensive, mixed use, suburban development that includes many sustainable features (**Plate 17: Collage: ESD (1) Der Seepark**).

While accessible by public transport, it is not particularly dense over all. Despite plentiful 2-storey row housing, recreational and other facilities take a very large area (see Plate 12: Site Plans). On the other hand, it is strong in community input, in particular through the Ökostation, the organic gardens and vineyard, and the Biogarten experimental/educational centre.

Education is further emphasised through a standing science (Physics) hands-on display area for children. There are two schools on the property, a large gymnasium, a full-sized athletics facility with race track, and numerous play and recreation areas around the artificial lake and elsewhere. Another large ESD development was in progress, which I was not able to visit, but the intention was to have learned from Der Seepark, and to have more advanced features.

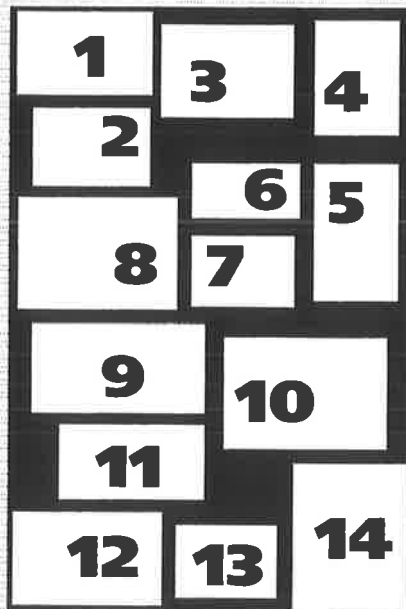


Plate 18: Collage: ESD (2) Arabella Park - Key

1 Transit Interchange

The railway discharges its passengers underground, and they come up to the surface by escalator. Buses were not very frequent at the weekend here, and there was nowhere to sit.

2 Non-Skid Paving

The 'not-absorptive paving' mentioned in the text.

3 Entry Road

A boom is just discernable at the top of this steep road. Traffic is not able to enter the precinct.

4 Residential Above Commercial

This was mentioned earlier in Plate 8. It is a common arrangement in Europe, for instance most of old Paris and new Almere central.

5 Table Tennis

Bird droppings indicate that these tables are rarely if ever used. Note high density residential in background.

6 Public Art: Sculpture

Children enjoy riding these.

7 Public Art: Fountain

This style of 'art' is extremely austere and unchallenging, except perhaps in trying to avoid tripping on the little drain collecting the fountain's water.

8 Public Art: Lighting Effects

Strange confection of lighting in front of office buildings: not the most sustainable decoration, but probably looks good at night.

9 Ground Cover Near Residential

Not good to roll on, but apparently the path is lit at night, and the overall impression is green.

10 Sitting Places

This is a very urban style of precinct. There is quite a lot of green about, but not on the buildings, and all controlled. What would Manning or McHarg or Mollison have said? The area is one with street trees and large apartment blocks, not altogether unpleasant: plenty of shelter, but nothing 'wild'.

11 Bicycle Shelters

Most were empty, hopefully explaining the absence of people.

12 Circular Seating

Seats a little far off the ground and circle quite large, but pleasant design (translucent moulded plastic). Very clean grounds with bins available.

13 Internal Car Park Entrance

Entry to these was padlocked.

14 External Entrance to Car Park

Overall, this is a good example of how an enhanced-density development might look and be connected to transit. But there appeared to be very little concession to Community as such. I could not make a judgment as to ecological sustainability (embodied energy etc) without having better inside information, but there was no superficial evidence of it (no educational signs for example). The Genius Loci would have to be described as austere, controlling and unwelcoming.

Sources: Field visit, Author's photos; advance discussion with Prof Peter Newman. Background: Image 7.



Arabella Park is again, mixed use (**Plate 18: Collage: ESD (2) Arabella Park**, above). I was disappointed to hear a diatribe on its inadequacies from a female architect I met on the train, as it was recommended to me by Professor Peter Newman as a high quality, high density, Transit Oriented Development (at higher scale than local eco-social detail).⁶¹

It is indeed well-connected to transit, and located at the end of a fast train run from München. One emerges from the station to find oneself in a rather unwelcoming bus interchange, sheltered, but with nowhere to sit. A non-secure bicycle shelter is found amongst the buildings and car parking is hidden underground. Arabella Park has the recommended arrangement: some high-rise devoted to business, some to shops below with residential above, and some residential only.

The entire area is under the control of either ground cover or paving. There was one small, very busy restaurant open, which appeared to be the only public outlet open on a Saturday afternoon, located on a modest plaza. Despite the weekend timing, the precinct was otherwise almost deserted. I found the ambience Repellor, especially the 'artistic' aspects: rather cold, and with the exception of the rhinoceros sculptures, not particularly *child-friendly*. Near the residential area there were wide expanses of ground cover, of non-contact visual appeal, concrete table tennis facilities, and circles of pleasant plastic, fixed seating, where the circle seemed a little too large for normal conversation. A small group of approximately 6-10 year old children was playing in the steps to the carpark and ranging around the concrete sitting places, appearing bored, and terrified of strangers (me). Looking out for ESD features, I thought I had found some absorptive paving until closer inspection revealed patterned (non-skid) concrete (Plate 18). I was unable to find anybody willing or knowledgeable enough to explain the development at a less superficial level, so I opted to move on to an even more gloomy place, Dachau concentration camp.

⁶¹ I was not able to discover anyone with reliable knowledge of ecologically sustainability.

11.7 TRANSITION: A CHARM BRACELET

We live in times of great uncertainty. It is now generally accepted that the way we live and use our resources is completely unsustainable. **Table 131: BI: Eight Major Uncertainties on Biosphere 1** lists the main ecological uncertainties we face as a result of present behaviours. The last section referred to some of the experiments in progress at the EPP coalface. What do EPP authors think we should do about our predicament, to move towards an honourable and viable balance with Nature?

There is a revolution coming. It will not be like revolutions of the past. It will originate with the individual and with culture, and it will change the political structure only as its final act. It will not require violence to succeed, and it cannot be successfully resisted by violence. It is now spreading with amazing rapidity, and already our laws, institutions and social structure are changing in consequence. It promises a higher reason, a more human community, and a new and liberated individual. Its ultimate creation will be a new and enduring wholeness and beauty - a renewed relationship of man [*sic*] to himself, to other men, to society, to nature, and to the land (Reich 1971: 2).

Although this momentum was lost in the 1980s, its proponents discounted and its rhetoric inundated by the increasing impact of individualistic, Market Libertarianism through the last two decades, this ecological mission statement of the 1970s has changed little when compared with the expressed goals of today's Ecology, Reconciliation and Social Justice Movements.

In 1971 Reich summarised the nature of the American eco-social crisis under the following headings, which could as well describe our present situation:

1. Disorder, corruption, hypocrisy, war.
 2. Poverty, distorted priorities, and law-making by private power.
 3. Uncontrolled technology and the destruction of the environment.
 4. Decline of democracy and liberty: powerlessness.
 5. The artificiality of work and culture.
 6. Absence of community.
 7. Loss of self
- (Reich 1971: 4-8).

The sense of transition now everywhere apparent, was powerfully brought to public attention by Alvin Toffler in 1970 through his famous "*Future Shock*", and subsequent works (Toffler 1970;1980;1991), and other works such as Capra's "*The Turning Point*", Henderson's "*The Politics of the Solar Age: Alternatives to Economics*" and "*Paradigms in Progress*", Ferguson's "*The Aquarian Conspiracy*" and Goldsmith's "*The Great U-Turn*" (Capra 1982;Ferguson 1980;Goldsmith 1988;Henderson 1979;Henderson 1991).

Must we remain forever trapped between two obsolete visions? [*the agricultural and the industrial*] ... we no longer need to ping-pong back and forth ... the arrival of the Third Wave [*the high speed revolution*] alters everything ... [*and it*] turns out to have many features - decentralized production, appropriate scale, renewable energy, de-urbanization, work in the home, high levels of presumption [*sic*] to name just a few - that actually resemble those found in First Wave societies ... looks remarkably like a dialectical return ("*The Third Wave Question*" Toffler 1980: 346-7).

The need for new political institutions exactly parallels our need for new family, educational, and corporate institutions as well ... our search for a new energy base, new technologies, and new industries ... the upheaval in communications ... the need for restructured relationships with the non-industrial world ... accelerating changes in all these different spheres. Without seeing these connections, it is impossible to make sense of the headlines ...

Other, more traditional conflicts between classes, races, and ideologies will not vanish. They may even ... grow more violent, especially if we undergo large-scale economic turbulence. But all these conflicts will ... play themselves out within the super-struggle ... two political wars raging around us simultaneously ... a politics-as-usual clash of Second Wave groups battling each other for immediate gain. At a deeper level ... these co-operate to oppose the new political forces of the Third Wave.

This analysis explains why our existing political parties, as obsolete in structure as in ideology, seem so much like blurry images of one another ... parties of the Second Wave ... basically committed to preserving the dying industrial order ("*The Coming Super-struggle*") Toffler 1980: 446-8).

The battle for dominance between the 'mainstream' and the eco-social is becoming more intense as the effects of Globalism, Corporatism and Economic Fundamentalism start to trigger responses from those disadvantaged by them. There is much confusion as to what to do, the façade of certainty of most western politicians notwithstanding. For many, only a full, spiritualisation of life on Earth will do, radical revision of faiths that depend on ancient Holy Books (especially Christianity) is terrifying some into fundamentalism and calling others back⁶² (for instance see Bennett 1991; Cock 1991b; Fox 1988; Spong 1998; Spretnak 1986).

Spretnak, concerned to find a constituency for the painful changes required, says we must have a multidimensional approach that addresses the ecological function of human capacity for transcendence, and appeals to intellect, feelings and spirit. We need:

... capacity to go beyond present conceptions of self-interest, and to locate self-interest in the context of the needs of the planet; the capacity to go beyond societal realities, to be outside (Cock 1991b: 2).

Spong⁶³ says:

There is also ample reason today to believe that the species of life known as *Homo sapiens* is not eternal. We have fouled our environmental nest so thoroughly, we have overpopulated our world so irresponsibly, we have developed weapons of mass destruction so totally that human survival faces, at best, long odds. We human beings appear to be incidental, both to the past life and to the future life of this planet ... Yet all of our religious understandings ... still assume a radically anthropocentric universe ... the vast majority of the traditional Christ language has become inoperable ... Jesus as the agent of God's divine rescue operation ... we ... are not born in sin ... We have rather emerged out of our evolutionary past, and we are still being formed ...

.A saviour who restores us to our prefallen status is therefore pre-Darwinian superstition and post-Darwinian nonsense ... this old traditional view of the Christ has died as a viable alternative ... [*we must accept this to move further and*] ... a sweeping change of the theological landscape (Spong 1998: 98,99).

Henderson feels the best survival tactic is to recognise the process and the optimal destination (The Age of Light), and work towards that without becoming caught up in the instability, the

⁶² See Spong quotation at end of dissertation.

⁶³ Anglican Bishop of Newark, New Jersey, in a radical work seeking "A new reformation of the Church's faith and practice", "*Why Christianity Must Change or Die*".

"flip-flop" between old and new belief systems. To live co-creatively with Mother Earth and cybernetically design all organisations and societies at all scales to "incorporate feedback at every level of decision making ... from those people affected by the decisions" (Henderson 1991: 47-70, 91).

The evolutionary transition she describes, philosophical and personal rather than merely technological, runs as follows:

BREAKDOWN (of disabling belief system: that human nature - economically, for example - is immutable: fundamentally insatiable, competitive, selfish, greedy)

BREAKTHROUGH (new personal cultural visions, cognitive dissonance, changes in awareness, cultural confusion)

EVOLUTION (towards the 'possible human' [Houston]: new paradigm, ethics, lifestyles, communities, mind-brain concepts, spirituality, moral positions, relationships to technology) (based on Henderson 1991: 136, Plate 5-25; Houston 1982).

Resistance to the idea that there may be an environmental crisis requiring action is now shifting, not that the Science is becoming more certain, but in my view, because the early impacts of climate change through extreme climatic events are becoming personally undeniable.*

In the absence of adequate government leadership, large corporations who are including environmental accounting in their Annual Reports, are also pressing governments for legislation to protect them financially⁶⁴ if they take bolder initiatives, and supporting new institutions and activities such as the Business Leadership Council or the Pugh Centre on Global Climate Change (established 1998).⁶⁵

Saul in "*The Unconscious Civilization*" reminds us that Corporatism is currently enjoying its third or fourth return in 100 years (Saul 1997:93). However there is concern about loss of Democracy and Social Justice, and environmental issues are also recently seeing a quiet return to public consciousness, assisted by the Internet. Environmentalism itself is starting to be corporatised, and many environmentalists now seek to be co-opted into industry (**Link: Social Bias Analysis**), which is apparently beginning to be influenced by a combination of consciousness raising through major United Nations conferences, a growing pile of worrying scientific reports on climate change, continuing public pressure, concern for corporate image, inclusion of environmental courses in university curricula, and modelling of financially successful eco-

⁶⁴ Through carbon credit, conversion grants, regulation, user pays and other schemes.

⁶⁵ Twenty-two of the world's largest corporations are working with the former US Assistant State Secretary for Environmental Affairs (Eileen Clauson) through the Pugh Centre, based on acceptance of the urgent need for a serious response to current scientific evidence of accelerated climate change. This includes making a thorough emissions inventory, setting short and medium term targets for immediate action and implementation of real emission reduction strategies, at the same time as working for corporate growth. While this does nothing to change the basic consumerist system, commitment makers do include British Petroleum-AMOCO (10% by 2010), Shell (10% by 2002), Dupont (50% by 2000) and United Technologies (25% by 2007). Earthbeat, ABC Radio National, March 6, 1999.

sensitive business by international companies such as The Body Shop, Interface, McDonalds (Sweden), DuPont and Dow, especially since Kyoto⁶⁶ (Hawken et al 1999: 17, 139-41, 80, 258).⁶⁷

David Korten, whose life experience straddles both business and global scale NGOs, believes Adam Smith would be appalled at the theories ascribed to him by neoclassical economists.

Table 132: ES: Adam Smith's Ten Rules for Mindful Markets lists and explains his economic vision, based on Market Economics, which in his book, follows an analysis of where he believes Corporatism has erred and misinterpreted Adam Smith, Old economics/New Economics (Waldrop):

Given the frequency of popular references to Adam Smith's "theory of the invisible hand", one might assume it is a central theme of *The Wealth of Nations*. There is in fact only one passing mention of the invisible hand in the entire nine-hundred-page text. Smith says that the business owner "intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention". ... Nowhere does he suggest that those who knowingly harm others in the pursuit of their own personal gain also benefit society. As I read his work, Smith likely assumed that those whose commerce benefits society are the same sorts of people who would make good neighbours ... I'm confident that the kind of healthy market economy we seek would have pleased the whole Adam Smith, the one who wrote both *The Theory of Moral Sentiment* and *The Wealth of Nations*. I thus dedicate my ten rules for mindful markets – necessary conditions for healthful function of a post-corporate market economy – to his name (Korten 1999: 154).

Many large organisations have apparently recognised the inevitability of change, and are seeking to retain their dominant positioning in a more environmentally aware world, by grabbing niches and not a little 'greenwashing'.⁶⁸ The "*World Resources 2000-2001*" Report written by UNDP, UNEP, World Bank and WRI, identified an 'ecosystem approach' and the means to apply it, starting with a global scale ecosystem audit (the "*Millennium Ecosystem Assessment*", under way since 1998), and a commitment to prioritising ecosystem function in human activities at all scales.⁶⁹ Personal and system change will still be necessary to act on better feedback.

Serres and his colleagues have proposed that to ensure Ecological Justice, Nature be accorded identity as a person in law, as companies are. He points out the progression over recent centuries and decades from a world where only men had rights (not women, children, foreigners, lower classes and so on). There is now a comprehensive list of internationally

⁶⁶ This signalled to business that carbon reduction had real potential for improving the 'bottom line' (Hawken et al 1999: 258).

⁶⁷ Advanced TNS Training.

⁶⁸ Corporate Watch Earth Day *Greenwash Sweepstakes* Winners 2000: <http://www.corpwatch.org/climate/sweepstakes.html>:

Grand Prize: FORD MOTOR COMPANY for its massive new green image campaign: costing as much as a new line of automobile.

1st Runner Up: THE WORLD BANK, for selling its bonds as "socially responsible investments".

2nd Runner Up: MONSANTO & THE COUNCIL FOR BIOTECHNOLOGY INFORMATION, for launching a \$250 million multi-year PR campaign.

3rd Runner Up: ROYAL DUTCH SHELL, for its "*Profits and Principles*" advertising series.

4th Runners Up: CHEVRON and UNOCAL. Chevron, for the longevity of its "*People Do*" campaign, and Unocal for grotesque innovation in the Human Rights equivalent of greenwash.

The Booby Prize: EXXON-MOBIL, for not even bothering to cover up its role in global warming.

recognised rights, and Nature needs similar protection (Serres, MacArthur & Paulson 1995).⁷⁰ The recent move in Australia to reserve a portion of river flow 'for the environment' is a parallel concept.

Adams states that it would be typically human to remove some societies: for the strong societies to stand by, assimilating scarce resources for themselves while the weaker are destroyed (Adams 1988: 47). This process has actually been apparent since the industrial revolution when the rate of plunder by colonising countries and their carrying capacity increased. Excess population, social problems (criminals), polluting industries and incompatible colonial cultures were exported to the economically weaker third world, building the wealth of the 'West': an option not open to LDCs as they struggle with 'free trade', carrying capacity deficit, structural readjustment, corruption, debt, disease and war over scarce resources. It is exemplified by the catastrophic behaviours of forces of oppression in Eastern, Europe, Africa and Asia as the 20th Century closed. It continues through the generation and maintenance of third world debt, the exponential compound interest system, the selective benefits of Market Libertarianism for the wealthy, and the resurgence of support for capital punishment and mandatory sentencing.

Adams, like many others, recommends a low dissipation society as the preferred path. The Club of Rome, Tainter (Tainter 1988: 123) and others say a new energy source is the only way out. To that end, many EPPs are working on renewables,⁵ but Newman and colleagues have taken an interest in hydrogen for the long term, as its main competitor, nuclear, has cost, political and intergenerational disadvantages. They conclude:

Australia is better endowed than most countries in the world with both renewable energy supply, and technical expertise to find cheaper and more efficient ways of exploiting the supply. Should a path of producing hydrogen from fossil fuels be followed, the economic and environmental costs are likely to rise over the next few decades, as regulations involving CO₂, SO₂ and NO_x emissions become increasingly strict. The obvious solution is then to produce hydrogen from renewable energy and to store, process and transport it using what we have called the "clean path"⁷¹ (Reed *et al* 1992: 38).
Link Thermodynamics.

Trainer strongly argues the Limits to Growth position, and demands that we set up a 'conserving society', modelling this in his own lifestyle, which he uses as a basis for public education⁵ (Trainer 1985; Trainer 1991). The ecological approach is the means by which Urban Ecology practitioners are attempting to demonstrate how this may be done, and argue that this, too, is a form of evolution: 'progress' is an arrogant, egocentric concept that implies a perfect destination towards which all is evolving through 'development', with 'man' as the 'most advanced' life form

⁶⁹ Full report on Internet. Source Rebuild Network: rebuild-l@vicnet.net.au/.

⁷⁰ Interview with Serres, 6/5/00, 5RN, ABC Radio National.

⁷¹ Clean path production: not carbon based (cf carbon based, from coal); clean path transport: neat H₂ by pipes, road, rail, ship (not dissolved in toluene/cyclohexane) (Reed, Stocker & Newman 1992: 3). Costing comparisons must be done over long term, as startup phase of any system uses large quantities of fossil fuels.

guiding it all, and the benefits of economic growth trickling down to the less fortunate. This type of argument is dealt with in *"Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future"* by Norgaard, who asserts that our responses must recognise our coevolutionary position (Norgaard 1994).

Buckley suggests that the adaptive ability of groups and nations is the key: that social evolution has enabled either destructive revolution or constructive evolution, but that brute strength will have less survival value than organised foresight and flexibility of restructuring as the environment changes. The balance in institutional structure between processes which engender stability and those that allow change and adaptation ('social morphostasis' and 'social morphogenesis') are determined by the particular politico-economic order. Based on non-equilibrium Evolution Theory, Buckley sees (1970s but still relevant) most societies as poorly prepared in the following areas (thus suggesting strategies for improvement and an informal baseline for comparison of present progress):

- poor self regulation
 - poorly controlled for adaptation to environmental change
 - poorly designed or almost inoperative goal seeking feedback & feedforward systems (cybernetic reasoning)
 - conflicting national goals, poorly defined & operationalised
 - gaps & inappropriate filters in information feedback loops
 - gaps & inappropriate filters in communication loops
 - institutional feedback & communication loops rudimentary
 - error range in comparators much too broad
 - system lags dangerously long compared with crisis frequency
 - imbalance towards morphostatic institutional structure (favours revolution over evolution)(sunrise & sunset legislation have adaptive advantage)
- (Buckley 1977: 252-3, 256).

Holling identifies resilience of ecosystems as the key issue. Survival strategies for him consist in alignment with the natural ecosystem rhythms of increasing organisation and stasis, creative destruction, reorganisation and renewal. Human technology increases fragility by impacts on ecosystem patterns through:

- Temporal restriction
- Overriding slower ecosystem rhythms (masks rising fragility & inhibits adaptive responses)
- Spatial homogenisation
- Changed internal biophysical relations
- Increased incidence of crises (Surprises generated internally)
- Climate change (generates global stress on top of local)
- Increased global connectivity affecting global phenomena.

He thus recommends deprioritising prediction and focusing on monitoring, anticipation and design of resilient systems, especially in eco-social linkages where Economics, Technology and Resource Management in interface with ecosystems (Holling 1986: 313-4). Proponents of Permaculture, which above all seeks to align itself with nature's rhythms, would agree with him,

but also actively attempt to change human behaviour and teach Ethics by example and by pedagogy (Mollison 1988; Mollison & Slay 1991, Permafest 1999).⁷²

Introducing another work with Gunderson and Light, Holling provides some advice derived from investigating why management of renewable resources tends inexorably to render ecosystems and societies more fragile and dependent and their institutions more rigid (Holling 1995: 32). By analogy with the Homeostasis Metaphor for organisms, variability is controlled at the expense of resilience, but regulatory response must be flexible and robust, and remain in opportunistic relationship with the exterior, "releasing the opportunity" for probing and creativity:

This is at the heart of Sustainable Development – the release of human opportunity. It requires flexible, diverse, and redundant regulation; monitoring that leads to corrective responses, and experimental probing of the continually changing reality of the external world ...

... Sustainable Development is neither an ecological problem, a social problem, nor an economic problem ... [it is] ... an integrated combination of all three ... [effective investment in it needs simultaneously to] ... retain and encourage the adaptive capabilities of people, business enterprises and nature ... [these] depend on the processes that permit renewal ... for nature it is biosphere structure; for businesses and people it is useable knowledge; and for society as a whole it is trust.

(Holling 1995: 32,33) [*Emphasis added*].

Timmerman identifies Mythology as the area for reform. As mentioned above, he suggests that the Myth of Resilience is risky but best suited to survival, as it embraces Surprise (preferably epiphany without catastrophe) as a teacher, and enables long-term understanding of system operation at the expense of short-term control. He invents a new discipline, Stress Ecology, and assumes better information will enable better management by those espousing the proper Myth. Information-seeking strategies suggested include Surprise-pre-emptive management techniques, Historical Eco-social Surprise Studies, small-scale Surprise Studies, space & time Surprise Scale Analysis, management to avoid monocultures and avoid causing collapse by inappropriate connectivity (self-simplification, instability) (Timmerman 1986: 449-50).

Peet (hardly uniquely) insists that crucial survival strategies include a new morality of total system stewardship, acceptance that the economy is within the biosphere and not vice versa, steady state material and energetic parsimony with proper planning, new social structures and adult education. The ANU FQ Programme produced a treatise on values for sustainability and the necessity to adopt a new spiritual relationship based on a recognition of our ultimate support base, a position also argued persuasively by Spretnak (Cock 1991b; Spretnak 1986).

Forrester and his colleagues recommend K1-12 training for school children in systems thinking (Forrester 1994).

⁷² Attendance.⁵

Costanza *et al* point out the importance of the direct linkage of Ecology and Economics in the necessary transition to more sustainable behaviour patterns in the human population. They use the case of Evolutionary Game Theory to illustrate the useful cross-fertilisation of the two fields which has evolved to date (Costanza *et al* 1993: 546, 552-3). They question the nature of external influences necessary for optimal evolutionary adaptation. A number of other questions arise, including whether FFE and CDS Theory could be used to model Ecological Economics, and what the selection criteria (for example quantitative criteria for fitness) should be. Survival strategies are seen (also quoting Berker & Folke, *in press*) to rely on model building in order to predict, respond and manage feedbacks to avoid catastrophe (Costanza *et al* 1993: 551).

The Australia Institute,⁷³ particularly its Executive Director, Dr Clive Hamilton, has in the past advocated ecological tax reform, and most recently, the supplementation of the GDP indicator index with GPI, the Genuine Progress Indicator (Hamilton 1998; Hamilton & Denniss 2000; Hamilton *et al* 1997).

Allen and Hoekstra above have called for an understanding of relative disconnection and the use of Hierarchy Theory (Scale consciousness). Others call for the redesign of institutions or the invention of new ones to match the needs of the present (Folke *et al* 1998; Young 1998).

These positions overlap with those relating to a complex ecological view of sustainability, and most of these authors have been iterating a similar position at least since the 1970s. That failure of civil society to listen and come to terms with sustainability issues inevitably returns to risk perception, prioritisation, politics, media cynicism and the personal and collective self interest of powerful groups. The pain and difficulty of this is apparent to anyone attempting to do the 'right thing'. This returns the discussion to the realm of the 'ego to eco' aspect of the title of this dissertation. All necessary knowledge to deal with the most damaging Australian climate change emissions has been well known for many years, and could be funded by a 0.5% carbon tax if there were any will to act (Hamilton *et al* 1997). Of total world military expenditure (\$US1 trillion, 1991), 25% would cover all programmes to reach sustainability goals for soil erosion; clean, safe energy, energy efficiency; retire LDC debt; safe, clean water; starvation and malnutrition; health care; shelter; acid rain; global warming; deforestation; ozone depletion; population; illiteracy (Henderson 1991: 230). Much could be achieved by a 'Tobin Tax' on international financial transactions. It probably will not, and Adams may well be correct.

⁷³ Probably best described as an ecological Economics think tank which "... promotes a more just, sustainable and peaceful society through research, publication and vigorous participation in public debate".

And from the length of this dissertation, voices have been calling for integrated action at multiple scales: global, bioregional, local, personal. Most seem to understand that this is a spiritual problem, not a physical or ignorance one. EPPs know have a dangerous and inappropriate Attractor in place.

Self-interest must be understood as a characteristic common to all beings, who must therefore accommodate to each other. Therefore, standing back from all this, I would argue for listening to Maturana, and for Theobald, for behaving as if such a world were in train:

We have only the world that we create with others whether like them or not ... love is the act of seeing another person and ... opening up for him [*sic*] room for existence beside us ... the acceptance of the other person beside us in our daily living (Maturana & Varela 1988: 24-7, 245-7).

I believe that we all have a responsibility to converse with each other, based on a belief in the power of conversation and trusting where it will take us. And I have the feeling, deeply, that Robert Theobald was 'onto something' when he said that 'talk, talk' was the means to bring about a change to a more caring and compassionate and cooperative society. *It is not much of a shift to talk about coming together to converse rather than debate - or is it?* (Stewart 2000)

Whatever the situation about after-lives, we already have a presence of both 'heaven' and 'hell' on Earth. But while we wait for integration of the big picture, I would also argue for Conversation at all scales, Bioregionalism, and at larger scales, the concentrated eco-education of America, of business and industry, and of consumers, through the Arts, multi-media, Green Capitalism and dramatically improved (indicator) feedback systems. These groups appear to have the power required for the rapid action we need.

Siebenhüner recommends the graduation of the concept of humans (presently *Homo economicus*) to an ecological economically defined entity *Homo sustinens*. This implies the development of a sustaining set of characteristics:

- Caring and respectful action towards Nature based on "a certain emotional relationship" (:21)
- Protective and cherishing feelings towards Nature and other humans
- Open-access communication and cooperation
- Learning and creativity: new kinds of knowledge and learning, new kinds of thinking (systems thinking), complex, multi-variable problem solving, new modes of perception, new heuristics, emotional intelligence (Steiner's 'emotional literacy'), emotional learning, enhanced creativity
- Moral responsibility and intrinsic motivation: values changes around consumption and lifestyle, collective environmental action, taking care of others, self-actualisation (Maslow: personal growth without egoism), respect future generations
- Sustainability as a social learning process balancing the personal and the collective (Siebenhüner 2000: 21,19-23).

For appropriate response then, society needs to trust complex processes, revisit its Metaphors and run on mutual good will; to delight in life and creativity, to educate for resilience, mastery of multiple literacies, and believe in what it is doing - and to know what it is doing through solutions emergent from Conversational processes; to set up new, appropriate institutions, integrated across the Scales; to develop human settlements friendly to people and Nature

together, and especially inclusive of children, adolescents and old people; to set up appropriate indicators that are designed to lead to action. It needs to act in concert globally and bioregionally, from an informed position that shares knowledge, coordinating, educating and allowing consistent access to information and decision-making; it needs to be permissive, flexible, supportive and curious about Human Settlement Ecology experiments, and learn from them, taking collective responsibility for divergent problems.

Consumerism must be dematerialised and diverted into service, and the material resource loops must be drastically reduced and the circuits connected. But there must be some constantly revised but rigidly enforced limits set by agreement but informed by our best Science, respected no matter how wealthy or virtuous the transgressor: a universal, non-negotiable, updatable boundary set around ecological structure (and thus, function), with active (whole of life) education and training in conserving and restoring what we have left, ecological and cultural, and constraints built into global market functions that enable and insist on, decent third world incomes, social justice and ecological and environmental protection. And a matching set at bioregional Scale. We need to recognise, set up and manage, both the runaway positive feedbacks and the Constraints, nudging our systems back into the Sustainability Space we need for our own survival.

From a Complexity Theory position, our human system moves on an economic, anthropocentric Attractor. This is apparently in runaway positive feedback. As we fail to Constrain it, and as the perception of scarcity on which Competition is based, is itself in positive feedback, we are starting to see the re-emergence of extremist views (shift to far right, Nationalism, Militarism), as usual located amongst those in pain with nothing to lose, and those with relative gains to protect. EPPs would have us move on a biocentric or ecocentric Attractor: that is our best guess at a solution compatible with planetary health, and thus our own. If we stay on the amoral economic hub and take our chances, there will be many human and biotic extinctions, and they will be ruthless: we run the risk of major crisis, where only an enlightened Dictatorship can manage the few remaining choices, probably too little, too late, and any action will be based on and perpetuate the fear. If we are to Constrain the economic system so that the eco- and the social- are forced into pricing and onto decision-makers, seeking a rightful place for Ecological Economics; we need enlightened consumers and Green Capitalists, but this does little about the looming resources crisis: it just extends the deadline: if we go on behaving as if the LDCs (China, India) can reach our standard of consumption without rethinking our own, an unplanned, material Constraint is inevitable. If we shift onto a new Attractor (a new Global Parent), more

appropriate to the planetary conditions we find ourselves in, such as that emerging into consciousness through attuned Planetists. It is apparent that the necessary constraints, policies and priorities would flow more readily from a co-aligned humanity than from an unknown 'they' trying to force a reluctant. A transient phase of Green Capitalism may allow us space to review the situation with more openness (less intellectual and emotional discounting). Humans are only at their best under conditions of security, love and mutual trust.

As Holling says, we have systems problems with nonlinear causes, and the scales are increasing and connecting up; the whole thing is evolving, so we are obliged to keep adapting (Holling 1995:34). We are in Bohm's Rheomode, whether we like it or not. *Velopment* and *volution* are upon us, and we must choose the prefixes.

The first message is that there is disorder. Physicists and mathematicians want to discover regularities. People say, what use is disorder. But people have to know about disorder if they are going to deal with it (Gleick 1987: 68, quoting Yorke).

The rules of the game: learn everything, read everything, inquire into everything ... When two texts, or two assertions, or perhaps two ideas, are in contradiction, be ready to reconcile them rather than cancel one with the other; regard them as two different facets, or two successive stages, of the same reality ... (Casti 1994: 278, quoting Yourcenar uncited).

If you want something short-term done, ask a businessman: that's what they're good at. If you want something long-term, large-scale, to contact the deeper, slower things, go to Art: that's its role ... the timing could not be more exquisite: the eco thing is with us right now. We only have the next five years to do something about it ... that's what I'm here for (Peter Sellars, Director, *Adelaide Festival of Arts*, 2001).

Having a view is a world away from having a vision.

It is in relation to the environment that the need and the opportunity exist to extend the range of employment opportunity. Today, the impact of people's ostensibly productive activity is, almost without exception, destructive ... [*We could recover and restore salt rivers, polluted coastlines, mining and urban wastes*] ... We could ... create ... a context within which all, however poor in money terms, could find scope to live in health and dignity. The ways to do this are known; we have idle hands desperate for worthwhile work to do. Only the political will is lacking ... We are not inescapably dependent on this flood of commodities which our economic system is designed to produce. There are conceivable lifestyles more modest in their material demands, less destructive of the physical environment - lifestyles which are simpler, whose excitements are found primarily in the human relationships they provide scope for. The search for those lifestyles is the essential task of the rising generation. Upon their success in that search will depend the future of humankind (Dr H.C. 'Nugget' Coombs 1990: 164-5).

The death of the God of theism, therefore, has removed from our world the traditional basis of ethics ... It is frightening for many when they grasp the fact that we live in a morally neutral universe ... a panicked pursuit of pleasure ... escape .. into the world of alcoholism and drugs ... depression ... suicide ... becoming hysterically religious ... are but signs that a loss of meaning has engulfed our world ... To build a new basis for ethics, we must learn to look in a different place ... not outside of life for some external and objective authenticating authority, but rather, at the very centre and core of our humanity ... by asking a totally different set of questions ... not God questions, but human questions ... What gives us life? What lifts us up into wholeness? What enhances our being? What introduces us to transcendence? What calls us beyond our limits? What do we ultimately value? (Bishop John Shelby Spong 1998: 159, 160).

12 CONCLUSION

“Walk to the highest place and the lowest place, and let the land speak to you.”

12.1 REVIEW OF PATH

The dissertation maps two Journeys. An exploration into action that turned out to be premature and a little disappointing, in the sense that the outcomes of so much enthusiasm were derailed, debilitated or took longer to implement than anticipated. And a journey of intellectual synthesis, into what turned out not to be Ecology itself, but the complexity that underlies it. Thus the focus changed, from cases to iteration of an ecological model, and a first iteration of a discipline I have termed 'Human Settlement Ecology'. Along the way, the ambience of an EPP position has been explored through concept and quotation, along with its intellectual and cosmological roots. I have described and extended, but do not claim to have invented, the Unified Ecology core of this conceptual model, which now appears to be emerging (self-organising) with increasing clarity, 'channelling' it, if you will. I argue that such concepts must be presented with urgency in non-mathematical form, to the attention of the development community and civil society, along with its justification in elementary scientific terms, as required by the dominant paradigm: meeting first at the 'client's' model of the world. This is a heart matter that must be nurtured in a world that pretends its decisions come from the head.

The conceptual Tools emerging from this work may be used with a minimum of scientific knowledge, but not without a general framework model and a repertoire of strategies. The practice of Human Settlement Ecology requires both an organising structure and a repertoire of strategic content. Confronted with a development project, one starts with the givens, especially the optimal function of the land, and all innovations must be tailored to local conditions with higher scale issues in mind. The best solution for the situation will emerge, but there are no absolute rights and wrongs. Should Scientific knowledge be available, that is good, but much is intuitive and awaits experiment.

A major difficulty in writing a work like this is to know at what level to write, especially when several disciplines are used as resources. Most urban ecologists would be familiar with most of what I have written, except for the Scientific aspects. Yet most of what I have written would be far beyond the brown realm, into a far-too-green place to please most Local Government engineers, and developers more so, who sadly have probably not heard of Green or Natural Capitalism, or Green Development. Academics will have a problem with the fact that this is not a small, focussed, reductionist study, but 'theory development' is a recognised type of

Dissertation. As explained elsewhere, I believe this is half the Planet's problem: we need to start bridge-building, synergising our specialist knowledge and teaming up at tertiary education level. This is actually happening in project teams, but there are few skilled generalists. Specialists pick this up as they go along. We could be training them at university, even if we only revamped our existing multi-disciplinary faculties (for instance Geography, Ecology and Environmental Studies by adding business skills). It may be that the Biosphere is about to be seen to deserve its own serious course - akin to Medicine.

12.2 ANSWERING THE RESEARCH QUESTIONS

This work set out to answer a number of questions, which can now be re-addressed. The principle question, *'What could an ecological approach to human settlements be?'* is answered through the original investigation of the ecological concepts, strategies and projects of Ecological Paradigm Proponents, and the subsequent journey into the linkages between their practical world and the array of structures and processes studied by disciplines like Ecology, Landscape Ecology, Architecture and Human Settlement Ecology, and their intangible underpinnings in Philosophy, Subatomic Physics, Thermodynamics and Systems Theory. Thus the whole work is a response to this question, and the generic answer is: An ecological approach is one that acts on an understanding of the core definition of humans and their settlements as participants in Nature, where Nature is identified as a complex, dynamic, self-organising, multi-scalar, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*.

This speaks to the conundrum *'What is Nature like, that we might align with it?'* but is far from providing the 'how' of it. It does, however take some preliminary steps, through the descriptions of Complexity, and through the collated strategies for alignment, the various reports, quotations, the 20-Step Design Process, and the OCW project process and outcomes. It also provides, through the Unified Human Settlement Ecology framework, a generic way to approach the design and development of projects of any scale, but especially the large ones, from an ecological perspective.

The subsidiary questions are also taken up through this structure. *'How have people attempted to apply ecological principles to human settlement development?'* is answered in part by the collated strategy lists, but also by consideration of philosophical approaches such as Semiotics, Metaphor, Metaphysics, Subatomic Physics and Cosmology, as applied to EPP thought and Urban Ecology projects, and by the examples given to illustrate the different perspectives of the Criteria

of Observation for Human Settlements, each of which constitutes a partial answer to an ecological question.

'If linear thinking has let us down, what do we have instead?' is answered in short, by 'Complexity Theory', which is described in some detail, answering at the same time *'What are the New Sciences of Complexity and how do they relate to the Philosophy and Science of an ecological approach?'*

With linear approaches we have 'facts' claiming objectivity; structures divorced from meaning; relativity devoid of complexity and data bereft of context; causes operating singly in oversimplification and a culture of scapegoating and blaming; black-and-white Probabilities that exclude the grey; an 'either/or', competitive reality built of blocks whose atomistic sum equals the whole; closed, 'predictable' machine-systems run by machine humans; delusions of control with 'externalities' and 'outliers' that shock and Surprise our best pre-emptions; and Metaphors of people, buildings and cities to match: machinery. But linear approaches are excellent for dealing with linear things, and with machines without context. We see learning as 'training' for specific objectives, ascribe rightness and wrongness to information, believe that multiple choice examinations are appropriate confirmation of the success of education, and that ecological and social entities are substitutable commodities. In many ways our ecological problem IS the dissolution of context.

With Complexity Theory we have entities emerging from complex fields of facts and values; the Complementary shadowing of structures and entities by interpretations and purposes; causal associations rather than proximals; a creative, wholistic, deterministic chaotic interpretation of reality that extends the interface between Being and Becoming from cosmic to subatomic; a 'both/and' inclusive reality that sees people as simultaneously particle and wave; a Conceptual Pluralism that runs on an Organic or Ecological Metaphor and treats reality like a garden to be cultivated and learned from, embraces Surprises as learning opportunities; we warm to Possibilities rather than Probabilities and to Mathematiques that include the grey. We take our first steps towards understanding Hyperspace, look for approaches that work by giving up control, and become very interested in co-creativity, patterns, synthesis, emergence, Constraints and learning systems: learning how to learn, how to keep learning, to change, adapt, manage information and remain flexible but well-grounded. The most direct value of Complexity Theory is that it explains the operation of larger pictures: why markets, ecosystems and social processes operate the way they do, and what sorts of interventions are likely to stabilise or disrupt a dynamic equilibrium.

The new Sciences tell us is that corporatist Market Libertarianism is a siren, probably a mistaken path, or more likely, a mis-Darwinian shrug in a world of diminishing resources. It is a powerful Attractor that acts to dissolve the Constraints that keep Nature and Society relatively stable, exponentially expanding the system, with more and more energy dissipation, more and more variables, less and less predictable outcomes. It overconnects everyone to everything, putting us all at risk from shocks and Surprises. If there is to be a Market, it must have the right signals, and self-centred greed is not a right signal. A market rampant removes redundancy in the name of efficiency, denying us diversity's stability and resilience. Ecology values 'functional redundancy'. Marketism demands loyalty to its legally-binding, Competitive Ideology ('Competition Policy'), so making system function increasingly brittle, insensitive to environmental change, indifferent to the casualties and the massive waste as businesses collapse and banks are rescued. It demands that only profitable enterprises be viable, and measures in short timescales, so Basic Science, the Arts and Public Education lose support, weakening society's creative engines. What is creative is bought and hidden as patented, commercial-in-confidence: all the better to exploit us with, and worse, exploit Nature with.

Biospheric and social distress remain invisible unless they make us uncomfortable, can be commodified or they start to infect or poison us, cost money or reduce profits. Powerful people still argue that the Accelerated Greenhouse Effect is a wicked greenie plot, or that it will be good for us. Not enough of us are yet uncomfortable enough to see beyond our astounding luxury, continuing to expect ever higher standards of living, even at the expense of the global have-nots, even as our life support founders. NeoClassicism underwrites the artificial scarcity of Economics, focussing both successful and unsuccessful participants onto powerful but misdirected drives to survival, making people rigid, competitive, mean, dishonest and frightened to change or challenge the system. They are too tired and they don't have time. It creates a climate where power, control and certainty are highly valued for the winners, and submission and 'flexibility' are required for those below. The much-espoused 'trickle down' rarely in fact trickles down, and then, not far. Plans and decisions rely on experts, so the grass roots, in the best position to detect and reflect change, are disconnected from the 'thinkers'.

Where the expert advice fails, and personal resources dwindle, litigiousness comes quickly to mind. A continuous-learning, experimentally based society becomes less and less possible with these dynamics. It rewards short-term thinking, which feeds into setting up Social Traps, and discounts the needs of future generations. This sets up a Social Darwinist scene characterised by

the 'Success to the Successful' Archetype, an increasing gap between rich and poor, and decreasing support of the poor.

Many systems are in positive feedback, expanding exponentially. When a big one crashes, we all crash. Ecological Hierarchy Theory would predict that this situation will eventually run up against a set of higher level constraints, which can be expected to be large scale unless lower scale constraints are applied artificially, to re-balance the system. We must start to re-confine our processes, but to demand that, we must understand why we should, implying Systems Education, and urgently.

*'Is this different from "Sustainable Development"?' is spelt out in the differentiation between 'ESD' and 'ECD': there is no ecological approach to a development project without the substantial inclusion and ownership of a Community. Ecologically Sustainable Development (standard RED) has its core in Resource Economics and environmental, not ecological concepts. EcoCommunity Development is based around respect for and the sustaining of the Community of humans in Nature, in the ecosystems in which they are explicitly embedded: it is Biocentric. Further, there is no 'sustainability' as such. Sustainability is a convenient but contested term with initially false premises ecologically. It can only be meaningful if 'development' does not mean 'growth'. Indefinite expansion and growth of consumption are clearly impossible. That idea was based on an economic world view, and has lost credibility with EPPs. The Fuzzy Sustainability Space, the Ecologically Supportive Backcloth for our human settlements, the Ecological Metaphor and a self concept as *Homo sustinens* are suggested guidelines.*

But there is still the question: *'Who or what are we trying to sustain?'* Yes, we want to sustain "the ecological systems on which all life depends", but that is similar to saying we just want to stay alive. We do know we want a particular quality of life. But do we really want to sustain life as it is now, exponentially stressed and in tatters all around us? We must actually weave (ecological and our own!) health and healing into our activities and decisions, not just pretend to, and celebrate life. But we can only relate to such goals if we see and understand the tatters for what they are, and take responsibility for them. This dissertation both frames that understanding and provides a working model for action, without inappropriate prescription.

Finally, *'How can all this be applied as a non-linear approach to human settlement Policy, Assessment, Design and Development?'* has been demonstrated theoretically as the UHSE framework, and to some extent practically, through the OCW Project and given examples. The

collated strategies demonstrate clearly that hundreds of strategies for action have been known for at least two decades. Maybe we just need to be terrified or impoverished by extreme climatic events into taking their proponents seriously.

Revisiting the elements considered to be required of an ecological model ([Link: Models & Mindscapes: Concepts & Questions](#)), the aspects judged to satisfy these requirements are reviewed in **Table 133: CM: Elements of Ecological Model Contributed by UHSE Approach**. The Unified Human Settlement Ecology framework should be distinguished from the theoretical synthesis underlying it. The framework merely provides a tool set and an Epistemology for approaching the complex nature of our world through an Ecological Metaphor.

We were palpably approaching this position 20-30 years ago. This ship could not be turned around in 5-10 years. Those working at 'saving the planet' since the 1970s, have needed patience and persistence. Enormous changes towards consciousness and appropriate action are visible, even as we appear to be in reverse. Some of us have run workshops on visioning,² despair or recommitment for burnt-out Planetists.³ The ship does seem to be turning. Big business is belatedly bringing its creativity to the problem, reeling from hitting various eco-social 'walls' (Nike, Shell, Electrolux; see TNS funnel). While still not challenging the consumer society, green entrepreneurial activity may provide a stepping stone to a new level of awareness, perhaps a new era of consumer activism. The catchy term "*Natural Capitalism*" may be truly catalytic: a Metaphor at last that entrepreneur and politician can hear. But to survive 'free' trade, we need eco-social and material Constraints: too many still yearn for a 'world without limits'.

12.3 EMERGENT UNDERSTANDING

A level of general understanding has emerged from the twin journeys undertaken to reach this staging post. Most of my learnings from this process have been system-related, rather than the nuts and bolts of resource conservation, which was my chief awareness at the outset, and which, with community building, is still the main strategy available to EPPs, developers, designers and those not able to influence policy directly.

¹ I could have written this dissertation at the scale of the human being, demonstrating a set of health problems with similar antecedents.

² Wendy Sarkissian (social Planner) assisted me in Adelaide 1991, to run a Visionary Planning Workshop (Rounsefell 1991a: 95-101). The Process Work network frequently runs such activities in Australia, often involving Native Australians.

Firstly, I have come to understand that the same types of Principles seem to underlie all forms of complex systems with living elements, from organism to biosphere. This gives us a key to understanding and action. Secondly, the importance of Landscape Ecology to human habitat development is very clear. Thirdly, throughout this writing, I have asked myself 'why don't they...?' on issues of potential policy development: awareness of a systems approach and the concept of a *Supportive Backcloth* confronts one with the importance of this, and the potential, with goodwill towards our planet and each other, to make rapid and effective changes in the directions we must go, through creative and responsive policy.

When governments claim to be so worried about employment levels, why then do they tax payrolls? When we have a review of the whole tax system, and the environment is dying around us, why are ecological taxes and subsidies not considered? Why do we have adversarial political and legal systems and Competition Policy, when we urgently need to work in partnership at every scale, and share resources? Why do we continue on clearly suicidal collective paths, believing a few who discount ecological problems at high level, and ignoring thousands of highly qualified scientists who have been warning us in concert for over two decades? Why do we remove regulator functions, especially from crucial industries such as food supply, forests, agriculture, when it is also clear that self-regulation (unconstrained self-organisation) of the private sector does not work to collective benefit in the presence of an economics-driven selfishness Attractor, and Organising Principles vary with Scale? It never will. Ethical companies themselves say that they appreciate the certainty and fairness of backup regulation. We all know that the answers to these questions usually lie in Ideology and vested interest, which hold sway in the presence of an ignorant, impotent, alienated, divided, media-monopolised or market-entrained public. So we must rapidly educate the public, assist NGOs to access the media, and honour their legitimate role.

Urban (or any) human settlement development is much influenced by larger systems. Those with an ability to influence systems, and particularly able to understand and manipulate them, have considerable advantage over other stakeholders naïve in these matters. Indeed, systems thinking has been known for some two decades to large corporations. Anyone educated or influenced by the Harvard Business School or Massachusetts Institute of Technology, or with access to STELLA or ITHINK software, will be in the former position. Many corporations do strategic planning for 'winning', especially profit-making, coached by management consultants skilled in systems

³ I assisted Wendy Sarkissian in a (Macy) *Council of All Beings* ritual for planners at the RAPI Annual Conference in Canberra in 1992.

thinking. Many of these companies contribute significantly to the sustainability crisis and the unsustainable lifestyles underlying it. This creativity and expertise in systems management could be harnessed in the service of the planet instead of service to self.

Economics too, works with systems, its tragedy being the serious mis-scaling of its focus, which Ecological Economics attempts to redress. NeoClassical Economics has been repeatedly demonstrated to be based on untenable assumptions, yet we are intimidated by formulae whose outputs belie our experience: the public needs to know better and say so. Privatisation of public assets has been shown to be disastrous in many, many cases, and not supported by realistic arithmetic, yet government ideologues still insist that it is good for us. Former Premier of South Australia Don Dunstan, delivering an oration a few months before his death in 2000, traced the ownership of SA's public utilities from public to private and back again over the decades, demonstrating that most of the hopes of the privatisers are not realised, but tend to result in self-serving behaviour, and rarely public benefit. Recent disasters in Australian privatised utilities resulting from economising on maintenance and safety checks, bear witness to a need for enforceable system Constraints. The ecological need for balance between positive and negative feedbacks, the importance of *Frequency Hierarchy*, critical thresholds, hysteresis, the key roles of Constraint, relative disconnection, Social Traps and Surprises, exponentiality, evolution, learning from History (long term views back and forward), the requirements for habitat stability and resilience, and the stability conferred by *relative disconnection*, are concepts we need to take further, in policy, and in human habitat development.

While familiar to ecologists, many professionals are systems-ignorant or have forgotten: Geographers and planners dabbled with systems in the 1960s-70s and moved on, while Chaos Theory was not then well-known. Even those using systems models, have not fully understood actual behaviour of the chaotic aspects of complex, dynamic, far-from-equilibrium, dissipative systems. Ecologically, increasing dissipation and scale appear to be selected for already, thus technological disruption of Constraint can only make the dynamics larger scale, and population pressure confirms the trend. If such runaway positive feedback finds no human Constraint the system is threatened with natural Constraint, collapse, or (probably rapid) large-scale Attractor shift (which may already be under way). Appropriately-scaled, holonic structures (in this case institutions, global and local suffrage and governance, and resource Constraints based on mutuality) may decelerate such instability.

At a recent Conference on Sustainability, Chris Tipler, long-time forest activist and Chairman of the Board of *The Natural Step Australia*, and principal of the Collins Hill Group of companies,

made the point that we must stop awaiting leadership from government. Government is usually the last to provide leadership in these matters, and will only act under public pressure. As Tipler sees it, collective and ongoing learning, individual commitment, persistence and indeed, love, are the key qualities needed for radical change.⁵

This needs more top-down/bottom-up partnership, transparency in decision making, and far more tolerance of mistakes. Instead of seeking someone to blame, we need to learn, trying to understand how the system failed, and to set up a well-designed, open information feedback systems based on subsidised experiment, to keep us tuned in and continuously improving. Change is unlikely without a demonstrably sound, triple-bottom-line economic base.

Dee Hock, the developer of Visa, has recently described the '*Chaordic Organisation*', which operates in the interface between order and chaos. He describes it as the emerging way to build institutions: as networks-with-a-Vision. The *Global EcoVillage Network* is one such organisation. Others include *The Chaordic Alliance*, *Appleseed Foundation*, *North-West Atlantic Marine Alliance*, *Society for Organizational Learning* and *GeoDate Forum Initiative* (Hock 1999: 327-31).

I recently received from New South Wales an email, part of which said:

The BusinessFutures Project represents an attempt to fundamentally change and move beyond the current business model. And we'll do this with a small business focus. [It] will focus on practical outcomes ... and develop, integrate and balance workable models of operation for small business that include social and environmental dimensions. ... the project is comprised of two elements:

1. The sustainable enterprise network ... an enterprising and learning community that:

- Agrees that there are things that we need to learn
- Agrees to share what they do know and to disclose what they don't know
- Agrees to exchange information with each other and to work cooperatively to strengthen our own enterprises and to further the aims of the network.

2 The sustainable enterprise centre ... a small business incubator space where we can come together in a cooperative environment and work towards developing sustainable enterprises. There will be a mix of established businesses from sectors like:

- Environmental management, products & services
- 'Mainstream' business ventures adopting sustainable practices
- Environmental services
- Social ventures

As we move forward we're seeking your support and input (such as two hours' work per week and three-weekly meetings)... <stuart.horrex@workventures.com.au> 03/2001.

Such organisations tend to be those of NGOs: groups and webs of people who cooperate to pick up the pieces and fill the needy gaps that precipitate out from the underside of economic and 'development' processes, or non-profits, communities and government departments that work together towards social justice, environmental and ecological balance and informed and open decision making. These 'triple bottom line' tenets are frequently found in their mission/vision statements.⁵ In an unconstrained, globalising context, emergent formal and informal webs of common interest will be increasingly important in their roles of feedback, constrainer and actor.

What, then, is Nature?

A complex, dynamic, self-organising, multi-scalar, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*.

What is society?

A complex, dynamic, self-organising, multi-scalar, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*.

What is the economy?

A complex, dynamic, self-organising, multi-scalar, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*.

What are development projects?

Complex, dynamic, partly self-organising, multi-scalar, far-from-equilibrium, dissipative systems poised at the *Edge of Chaos*.

What is a human being?

A complex, dynamic, self-organising, multi-scalar, far-from-equilibrium, dissipative system poised at the *Edge of Chaos*.

And the *Edge of Chaos*?

Being ↔ Becoming.

Plate 19: Rainforest

Photograph Nicolas Rounsefell, Darwin 2000; '*Rainforest*' poetry by the late Judith Wright (Wright 1994: 412); composition: Author.



The forest drips and glows with green.
The tree-frog croaks his far-off song.
His voice is stillness, moss and rain
drunk from the forest ages long.
We cannot understand that call
unless we move into his dream,
where all is one and one is all
and frog and python are the same.
We with our quick dividing eyes
measure, distinguish and are gone.
The forest burns, the tree-frog dies,
yet one is all and all are one
("Rainforest", Judith Wright, 1994: 412).