

Contents

Preface *page* xiii

PART I

1	How This Book Came About, What It Is, and What It Is Not	3
	Introduction	3
	Stepping Stones	7
	The Book: What It Is and What It Is Not	9
2	Defining the Challenge	15
	Background	15
	Six Fundamental Points	25
3	Science and Society	30
	Introduction	30
	The Great Wall of Dualism	32
	Rationalism and Empiricism	35
	The Royal Society and the Academies	36
	The Emergence of the Life Sciences and Ecology	38
	The Founding of the Modern Universities and the Emergence of Disciplines	41
	The Instrumentalization of Science	44
	Regaining Trust	48
4	Transdisciplinary For and Against	50
	Introduction	50
	Interdisciplinarity	53
	Multidisciplinarity Results in a Bee's Eye View	54
	Transdisciplinarity, Intellectual Fusion, and Linking Science and Practice	57

Barriers to Practicing Transdisciplinary Science	58
Competencies for Transdisciplinary Research	63
5 The Importance of a Long-Term Perspective	67
Looking Far Back into the Past	67
The Importance of Slow Dynamics	69
We Need to Know the Healthy State of Our Planet	72
The Importance of Second-Order Change	73
The Accumulation of Unintended Consequences	77
Summary	78
6 Looking Forward to the Future	79
Introduction	79
Past Perspectives on the Future	81
Analogue and Evolutionary Approaches to Understanding Past and Future	81
Ex Post vs. Ex Ante Perspectives	83
The Role of Modeling	85
Why Model?	86
Support Models and Process Models	88
Challenges to Integrated Modeling of Socioenvironmental Dynamics	90
Scenario Building	96
7 The Role of the Complex (Adaptive) Systems Approach	100
Introduction	100
Systems Science	100
Complex Systems	102
The Flow Is the Structure	103
Structural Transformation	103
History and Unpredictability	105
Chaotic Dynamics and Emergent Behavior	107
Diversity and Self-Reinforcing Mechanisms	108
Focus on Relations and Networks	109
Deterministic Chaos	110
Attractors	111
Multi-Scalarity	113
Occam's Razor	114
Some Epistemological Implications	115

PART II

8 An Outline of Human Socioenvironmental Coevolution	121
Introduction	121
Human Information Processing Is at the Core	122

The Biological Evolution of the Human Brain	125
The Innovation Explosion: Mastering Matter and Learning	
How to Put the Brain to Use	132
The First Villages, Agriculture and Herding	135
The First Towns	137
The First Empires	139
The Roman Republic and Empire	139
Conclusion	142
9 Social Systems as Self-Organizing, Dissipative	
Information-Flow Structures	144
Introduction	144
Social Systems as Dissipative Structures	145
Perception, Cognition, and Learning	146
Communication: The Spread of Knowledge	149
Social Systems as Open Systems	152
Transitions in Social Systems as Dissipative Structures	152
Conclusion	155
10 Solutions Always Cause Problems	157
Introduction	157
The Pre- and Proto-History of the Rhine Delta	158
The Middle Ages: Keeping the Land Dry Leads to the	
Hoogheemraadschap Rijnland	159
The Early Modern Period: Land Is Turned into Water	162
The “Golden Era”: Water Is Again Transformed into Land	165
Regaining Lost Ground	169
The Aftermath	173
Summary and Conclusion	174
11 Transitions in the Organization of Human Societies	180
Introduction	180
Information Processing and Social Control	181
Phase Transitions in the Organization of Communication	186
Modes of Communication in Early Societies	190
Hierarchical, Distributed, and Heterarchical Systems	193
Information Diffusion in Complex Hierarchical and Distributed	
Systems	195
Conclusion	203
Appendix A	204
12 Novelty, Invention, Change	213
Introduction	213
Technology as “Tools and Ways to Do Things”	214
Objects and Ideas	215

	The Presence and Absence of Change	217
	Perspectives on Invention	218
	Invention in Economics	219
	Open Questions	227
	The Inventor and the Context: Niche Construction	228
	Creation, Perception, Cognition, and Category Identification	232
	How Are Technical Traditions Anchored?	233
	The Locus of Invention	235
13	An Illustration of the Invention Process and Its Implications for Societal Information Processing	237
	Introduction	237
	The Niche in Which the Potter Operates	237
	Challenges Limit Products	247
	Comparing Two Pottery-Making Traditions in This Light	248
	Using the Paddle and Anvil on Negros Oriental, Philippines	249
	Mold-Shaping in Michoacán, Mexico	255
	Some Lessons	257
	The Role of Artifacts and Technology in Society	259
14	Modeling the Dynamics of Socioenvironmental Transitions	263
	Introduction	263
	Second-Order Dynamics	264
	Mobile and Early Sedentary Societies	265
	The Emergence of Hierarchies	266
	The First Bifurcation	267
	The Second Bifurcation	268
	The Third Bifurcation	269
	The Fourth Bifurcation	270
	Summary and Conclusion	271
	Appendix B	272
PART III		
15	The Rise of the West as a Globally Powered Flow Structure	287
	Introduction	287
	The Rise of Western Europe 600–1900	287
	The Changing Roles of Government and Business	297
	Crises of the Twentieth Century	299
	Conclusion	301
16	Are We Reaching a Global Societal “Tipping Point”?	304
	The Present Conundrum	304
	A Complex Adaptive Systems Perspective on “Crises”	331
	Accumulation of Unexpected Consequences	333

17	Not an Ordinary Tipping Point	339
	Introduction	339
	The Acceleration of Invention and Innovation	341
	The Acceleration in Information Processing	342
	The Information Explosion	343
	Changing Relationships between Society and Space	347
	The Impact of ICT on Time and Its Societal Management	349
	Exploding Connectivity among Tools for Thought and Action	350
	Reduction of Control over Information Processing	351
	Blurring the Boundary between Information and Noise	352
	A Society's Value Space Determines Signals and Noise	354
	The Dynamics of Value Spaces	355
	Wealth as the Predominant Global Metric	358
	Our Western Value Space Seems to Be Reaching a Boundary	360
18	Our Fragmenting World	362
	Introduction	362
	The Race of the Red Queen	363
	The Growing Dissolution of Our Global Governance System	364
	The Spectacularization of Experience	367
	Democracy under Pressure	369
	The Deconstruction of Communities	372
	The Transformation of Globalization	375
	The Emergence of the Developing World	376
	Big Data and Individuation	378
	Automation and Artificial Intelligence	380
	From Production to Distribution	382
	Our Perception of the World	383
	How These Trends Are Developing	385
	Conclusion	387
19	Is There a Way Out?	389
	Introduction	389
	Individuals Must Reengage in the Management of Our Society	390
	Designing a Plausible and Desirable Future	391
	The Role of Narratives	395
	Reconstructing Communities	396
	The Future Role and Management of Cities	399
	Dealing with the Acceleration in Information Processing	402
	Our Role as Scientists in the Community	406
20	"Green Growth"?	410
	Introduction	410
	Steady-State Economics	411

Sustainable Development Goals	415
Toward a Mindset Change	419
Pluri-Polarity	422
Possible Future Roles for ICT	423
The New World: How Might the ICT Revolution Impact on Society?	428
Conclusion	440
21 Conclusion	443
What Is the Message Thus Far?	443
What Are the Chances of Success?	454
Breaking the Fundamental Feedback Loop of Coevolution	456
Decentralization, Disruption, and Chaos	462
<i>Bibliography</i>	464
<i>Index</i>	493