## 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
Contents

Barriers to Practicing Transdisciplinary Science 58
Competencies for Transdisciplinary Research 63
5 The Importance of a Long-Term Perspective
   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
   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
   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
   Introduction 121
   Human Information Processing Is at the Core 122
# Table of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The Biological Evolution of the Human Brain</td>
<td>125</td>
</tr>
<tr>
<td>2</td>
<td>The Innovation Explosion: Mastering Matter and Learning</td>
<td>132</td>
</tr>
<tr>
<td>3</td>
<td>How to Put the Brain to Use</td>
<td>135</td>
</tr>
<tr>
<td>4</td>
<td>The First Villages, Agriculture and Herding</td>
<td>137</td>
</tr>
<tr>
<td>5</td>
<td>The First Towns</td>
<td>139</td>
</tr>
<tr>
<td>6</td>
<td>The First Empires</td>
<td>139</td>
</tr>
<tr>
<td>7</td>
<td>The Roman Republic and Empire</td>
<td>142</td>
</tr>
<tr>
<td>8</td>
<td>Conclusion</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Social Systems as Self-Organizing, Dissipative Information-Flow Structures</td>
<td>144</td>
</tr>
<tr>
<td>10</td>
<td>Solutions Always Cause Problems</td>
<td>157</td>
</tr>
<tr>
<td>11</td>
<td>Transitions in the Organization of Human Societies</td>
<td>180</td>
</tr>
<tr>
<td>12</td>
<td>Novelty, Invention, Change</td>
<td>213</td>
</tr>
</tbody>
</table>

**Contents ix**
Contents

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
Crisis 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 “Crisis” 331
Accumulation of Unexpected Consequences 333
## Table of Contents

### 17 Not an Ordinary Tipping Point

- 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

- 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?

- 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”?

- Introduction 410
- Steady-State Economics 411
## Contents

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

Bibliography  464
Index  493