Index

academic acquaintance network 416
action orientation contagion (AOC) 304
activation of 304
bi-stability in 307–8
mechanism of 308–9
action vectors
categorical representations of 290
in phase space 289–90
active feedback loops 99
actor coalitions, in policy issue networks 209–12
Actor Opinions survey 463–4, 473
adaptation
first-order 579
process of 11
second-order 579
adapted and mis-aligned practice, pathologies of 430
adaptive algorithms 568, 579
adaptive capacity 436, 438, 580, 581–2, 587
adaptive cycle, in natural ecosystems 533
adaptive–exaptive model, of innovation 487–8
adaptive landscapes 481, 573–80
adaptive rank/frequency distributions 235–6
adaptive tension 229–31
Advocacy Coalition Framework (ACF) 200, 205, 209–10
Africa Climate Change Resilience Alliance (ACCRA) 450
agent-based computational models (ABMs)
222, 224, 247, 530, 534
agent-based modeling (ABM) 531–2, 560
applications of 312, 317–21
caregivers for persons with Alzheimer's disease 317–19
housing patterns of persons with disabilities 319–21
appropriateness framework to 443–4
benefits and limitations of 321–3
computational methodology of 313
for creating predictive simulations 323
Patton's utilisation-focused evaluation 322
agent-based simulations (ABS) 135, 200, 202
A-landscapes, in psychopathology 568, 574–5, 580
changing of 583–4
dynamics of attractors in 577
interpenetrating therapist–patient 581
mapping of 583
topology of the patient's 576
analogic reasoning 496
analysis of variance (ANOVA) 529
and generalized synchronization (GS) 394
antisocial behaviour (ASB) 58, 100, 105, 109
Aristotle 496
idea of 'five senses' 254
notion of change 510
artefact, definition of 497–8
assortative mixing 416–19, 469
Astronomia Nova (Kepler) 497
Atkin, R.H. 376
attractor basins 134, 183–4, 186, 191, 302, 575, 577, 584
attractor narrative analysis 75, 83–5, 87, 91, 93
autocatalysis 480, 532, 538
autocorrelation (AC) method 261–2, 320, 396
autogenesis 532
Automap (network text analysis tool) 135, 204–5
advantages of using 204
application of 205, 206–12
protocol for 216
steps in analysis using 216–19
tools available in 205
validity and reliability of 216
autonomous agents and multi-agent systems (AAMAS) 443–4
real-world readiness of 445
Average Mutual Information (AMI) 390, 396
Aynsley, David 109
backcloth structure 376–7
bankruptcy 27, 530
Basalla, George 490, 496, 501
Batty, Michael 456
BCS theory of superconductivity 519–20
Beacon Project 57, 96–7
Beacon Community Regeneration Partnership 97
complexity theory of 97–8
Beacons for Public Engagement (BPE) 114
aims of 115
independent review of 115
bed-blocking problem 381, 385

591
Benard cells 516
benchmarking 268
bifurcation 236, 360, 395–6, 473, 495, 500, 569, 579
big-data 268
Big Picture 145, 153, 154 see also pictures and visual metaphors
binning, of measurement series 258
biochemical networks 5, 12–13
biological evolution 484
Campbellian epistemological approach for 499
high-order predicates of 499
systematicity principle of 499
variation in 499
biological networks 189, 416
biomedical systems, multiscale analysis of 13
Boh, David 152
Boolean networks 179–88, 198
characteristic of 186
Cilliers’s observation 183
dynamic structure 186–8
modularization of 186
network of interest 183
network structure 181–6
power graphs analysis of 189–91
rule and set of incoming connections 181
rule table for node 10 181
‘Small World’ network 134, 180, 182
bootstrap maximum likelihood estimation (MLE) 222, 228
application of 239–46
for linking complexity-science concepts to empirical samples 238–9, 244–5
method of 237
results and interpretations of 239–44
for testing for mechanisms that drive PLDs 245–6
Bortoft, H. 517–18
bottom-up emergence 230, 231, 232
boundary conditions 499
boundary-spanning 116
Boyle, Richard 512
brain–mind divide 567–8, 572
Britannia Bridge 490, 494
butterfly effect 79, 140, 221, 224, 235, 485, 570
Byrne, David 270
Campbell, Donald T. 562
capacity building 112, 153, 450
capitalist economy 489
care provision, psychobiological model of 572
Cariani, Peter 521–2
Carley, Kathleen 204
Cartesian gap, between ‘material brain’ and ‘immaterial mind’ 570
case-based complexity 223, 270
CAS model, as meta-framework for psychiatry 568–70
individual behavior of 575–6
self-organization in 579
category theoretic representational framework 293–4, 309
causality
complex systems science in 46–7
definition of 45
G-causality 46
information theoretic measures of 47–50
Mutual Information value 47–8
Wiener-Granger framework of 45–6, 52
causality measures, types of 3, 45, 47–50, 52
causations
Granger causations 48
TE causation 48
‘cause–effect’ mapping 449
cause–effect relationships 573
cellular automata 513, 530–31
Center for International Earth Science Information Network (CIESIN), Columbia University 388, 392
chaos sciences 77
chaos theory 313, 394, 526, 534, 536
chaotic attractors 25, 396–7, 399, 577
climate change adaptation in Africa (2014) 449–50
criteria for assessing 451
clinical commissioning group (CCG) 100, 363
clustering, of a graph 415–16
co-creation, dynamics of 71
coevolution
dynamics of 61
notion of 117, 231
of trust 98
cognitive science 6, 223, 259–61, 260
cognitive systems
evolutionary complex models of 21
gender studies using 259–61
multiscale analysis of 13–14
coherent conversations 75, 82–3
characteristics of 83
contribution to vorticity 87
narrative data generation in 86–7
co-learning 104–5
programme for 102
transferable 117
collective thinking, idea of 151, 152
communal group social interactions 574
communicable diseases, spread of 328–9
communication system
communication gap 143
 corporate communication 149
different languages 143–5
one-way communication 143
communicative connectedness
phenomena of 78
quality of 78
Community Advisory Group 118, 121
community detection algorithm 469
community development
  asset-based approaches to 115–16
  community-building and 115
community engagement 58–9, 91, 99, 104, 111, 114, 116–17, 121, 128, 131
community-led partnerships 116, 128
community of practice 115, 116
Community Regeneration Evaluating
Sustainable Transfer report 98
community–university research partnerships
  59, 115–16, 121
  conceptual framework of 116–17
  research projects involving 117
complete synchronization (CS) 360, 389, 394
complex adaptive systems (CAS) 224, 313, 481, 530, 567
agent-based modelling of see agent-based modelling (ABM)
categories of change in 579
components of 313, 315–17
  adaptation 316
  agent-based 315–16
  attraction and self-organisation 316
  boundaries 316
  emergent behaviour 316–17
  feedback 316
  heterogeneity 316
complex analogy
  advantage of founding 496
  Astronomia Nova (Kepler) 497
  attributes and relations in 498–9
  background of 496
  concept of 484
  empirical support to 500–501
  evolution and systematicity in 499–500
  Gentner’s theory of 496–7, 498, 499
  inherent relational structure of 497
  modular expation and 496–501
  complex governance networks 199, 200–202, 206, 209
  methods of conceptualization of 202
complexity informed social research
  application of 85–92
  data analysis and synthesis 87–91
  human experiential space 85
  inquiry into community enabling 85
  narrative data generation 86–7
  in vortical postmodern ethnography 86
  vorticity 87
  attractor functions 79
  communicative connectedness and 78
  dynamism of 77
  edge of chaos 79
  emergence of 77
  fitness landscape 79
  fractal geometry 79
  initial conditions of 75–6
  macro-phenomena of 77
  micro-phenomena of 77
  paradigmatic orientation of 77–80
  and qualitative research 77–8
  self-organization of 77
  sensitive dependence, on initial conditions 79
  complexity profile 10
  complexity science 32, 74, 139, 227, 237, 313, 525–6
  American school of 534
  boundaries of 538
  catastrophe theory in 526–7
  characteristics of 314
  computational and mathematical models of 533–4
  dissipative structures theory of 532
  European school of 534
  intersectionality in 256
  linking with empirical samples 238–9
  methodologies of 526–33
  narrative and multi-method studies in 536–7
  natural sciences and ideographic analogies of 534–6
  phases in development of 229–31
  philosophical and paradigmatic interests in 551–2
  research studies of emergence across 527–8
  for social programme evaluation 313–14
  complexity theory 116–17, 121, 179, 201
  in business context 139–40
  complex living systems 77
  complex networks (CN) 359, 389
  centrality of 419–21
  data protocol and data processing in 392–3
  formation of 391
  synchronization of see synchronization, of complex network
types of 391
  complex systems 2, 3, 5, 510
  definition of 46
  expation in 484–9
  formation of 11
  ‘Machiavellian’ versions of 42
  major directions of inquiry in 9–12
Handbook of research methods in complexity science

- choices and anticipated effects 11–12
- description and representation 10–11
- design of systems 9–10
- evolutionary dynamics 11
- games and agents 11–12
- generic architectures 12
- pattern formation 9–10
- self-organization 9–10
- micro–macro relationships in 202
- multi-agent 42
- nonlinear 65
- science of 46–7
- theory of 199
- compulsive anxiety 586
- computational emergence 510, 513–14

Concordat for Engaging the Public with Research (2010) 114
concrete ideas, concept of 151
Connecting Communities (C2) programme approach of 99–100
challenges encountered by 110–12
on effects of poverty on behaviour change 111–12
health creation model 110
NHS bio-medical models of health 110
organizational resistance to change 110–11
‘power crazed’ residents and service providers 111
clinical commissioning group (CCG) 100
code of conduct 111
co-learning programme 102
community impact outcomes of 107–10
Beacon Project 107
Greenfingers Project 108
Operation Goodnight 109
Redruth Enabling Active Community Health (REACH) 108
TR14ers Community Dance Team 109–10
Community Regeneration Evaluating Sustainable Transfer report 98
complexity principles of 100–107
connecting workshop for 102
consolidating relationships and ongoing co-learning 104–5
delivery support team 100
development of 98
‘dynarod’ group 101
exchange visits 104
experiment learning programme 99, 104
‘immersion’ and team-building course 104
Introductory Learning Programme 98
listening and feedback event 103, 105
listening event 98
and listening together to the community 102–3
long-term sustainability 106
neighbourhood hub 104
partnership meetings 105
Partnership Steering Group (PSG) 98, 101–2
people and services partnership 103–4
People & Provider Partnership 100
principles of 99–100
residents, as co-producers of services 105–6
seven-step framework of 98–100
Strategic Steering Group (SSG) 98, 100, 102
training opportunities 105
consciousness
- adaptive strategy for predicting and sharing 574
dualistic view of 572
epiphenomenalism of 571
paradox of 571
Container/Difference/Exchange (CDE) model 186
Cooper pairing 519
corporate tax policy 241
corporate values 150
corruption 56, 70
cost containment versus revenue growth 291, 296
coupling force 362, 472
coupling scale 472, 473
coupling strength 389, 463, 472, 473
creation of new order 227, 247
creative destruction, idea of 32, 43, 489
cross recurrence plot (CRP) 404
Cuénot, Lucien 485
cusp catastrophe model 286, 298, 299, 529
Cusp of Change model 286–7, 288, 307–8
potential function for 298–9
cyber-bullying 569
cybernetics 313, 479–80, 508, 516, 529
cyber security 268, 271
cyberspace 447
CyOog plugin for Cytoscape 189
Darley, Vince 513–14
Darwin, Charles 483, 485, 492
Darwinian algorithms 574, 575
Darwinists 29
data analysis 556
techniques for 559–60
data collection
- challenges in 557–8
- strategies to address 558
methods for 556–7
data collection periods (DCPs) 537  
decision-making 314, 363, 376, 444, 530, 535  
nested system of 382  
Deep Water Horizon Oil Rig Disaster (2004) 431, 450–52  
degrees of freedom 223, 287–8, 291, 295, 297, 302, 304, 449  
Delta 7 strategic narrative Big Picture 146  
de Mesquita, Bueno 472  
dendograms (hierarchical clustering diagrams) 210  
Descartes, Rene 567, 572  
dualism of brain/mind 571  
‘descent with modification,’ theory of 483  
deterministic chaos theory 9, 526, 534, 536  
deterministic threshold (DT) model, of social contagion 307  
developmental adaptations 569  
dialogues  
benefits of 153  
Kantor’s four dialogical positions 152  
meaning of 151–3  
Dimitrov, Vladimir 77  
dissipative structures theory 532  
doctor–patient relationship 568, 570  
*Doctrine of Signatures* (Stone’s hypothesis) 486  
Dodds and Watts general model 305–6, 309  
dynamical systems therapy (DST) 481, 567  
bifurcations in 584–5  
biopsychosocial orientation of 587  
case formulation algorithm 582  
categorical diagnoses and 580–81  
definition of 578  
fractal dynamics of 581–2  
generic treatment algorithms in 580–81  
map of the mind 587  
patient–provider interaction 579  
patient’s experience with 580–81  
PL-type I and II treatment 578  
for psychiatric treatment 580  
psychobiological perspective of 587  
self-awareness and relational dynamics in 580  
systemic psychobiology view of psychopathology 573–80  
trans-theoretical model 567  
dynamic network analysis (DNA) 134, 178  
dynamic robustness (DR) 184, 191  
Earth Observing System Data and Information System (EOSDIS), NASA 360, 388, 392  
ecological ascendancy 533  
economic development, theory of 489  
ecosystems theory 313  
edge of chaos 79, 81, 117, 128, 130, 221, 230, 231, 535, 569  
edge of order 221, 229, 230, 231  
EEG, of musicians and audience 50–52  
eigenvector equation 419  
electric grid, complexity of 271–83  
Electric Power Industry 271  
electronic tracking technology 349  
emergence  
capacity for 510  
Cohen and Stewart’s existence theorem for 513  
complexification process of 518  
computational 513  
computational and mathematical models 533–4  
definition of 509–10  
epistemological versus ontological 511  
explanatory gap and radical novelty in 509–12  
logics of 508  
models of 507–9  
natural sciences and ideographic analogies 534–6  
principle of 58, 117  
radical 511  
real-time visualization of 537  
self-organization with 508–9, 536  
visual time series analysis of 538  
weak versus strong 511  
emergent behaviour 2, 21, 30, 117, 221, 224, 314, 316–17, 321, 322  
energing infectious diseases (EIDs)  
antiviral optimization, on simple networks 344–5  
basic reproduction number (*R*0), estimation of 339  
in real time 339–41  
case study for 348–9  
communicable diseases 328  
compartmental models for studying 328  
branching process 330  
dyad models 330  
individual-based 330  
Reed–Frost chain-binomial models 330  
SEIR model 329–30  
stochastic 330  
contact network epidemiology of 331–3  
Ebola outbreaks 327  
H1N1 influenza pandemic (2009) 333  
as hospital acquired infection 348–9  
hospital contact networks, mapping of 349–50  
influenza vaccination campaigns and 342
intervention strategies, assessment of 342–4
mathematical modeling of 329–31
modes of transmission of 337–9
multi-type networks 345–8
physical contact network 338
preparedness plans against 351
real-time management of 327
respiratory-borne pathogens 328
Severe Acute Respiratory Syndrome (SARS) 327, 333
super-spreaders 350
transmission contact network 338
transmission dynamics of 333–6
Zika virus outbreak (2015–2016) 327, 331
Emk complexity methodology
challenges associated with 70–71
co-evolving clusters 67
Enabling Environment (EE)
co-creation of 71
preparing for 69, 71–2
workshop 65, 66–8
essentials for success 72
examples of 72
Indonesia case 68–9
for multidimensional problem space 64
preparatory analysis of 64-6
problem space
analysis of 65, 66-8
identification of 68
Reflect Back Workshop 65
two fundamentals of 62-3
UN case 61-2
emotional homeostasis 568
Enablers’ fractal narrative 89–91
Enabling Environment (EE)
co-creation of 71
preparing for 69, 71–2
workshop 65, 66–8
engagement cycle 59, 121, 128–9, 130, 131
England’s National Health Service (NHS) 348, 359
Environments of Evolutionary Adaptedness (EEA) 575
Eoyang, Glenda 186
equilibrium 455
equivalence class, notion of 291, 511
ethnographic inquiry 81
evolutionary biology–technological evolution analogy 489, 491
evolutionary complex models 21–3
evolutionary drive, theory of 25, 32
evolutionary dynamics 11, 56, 586
exaptation, in complex systems see also modular exaptation
concept of 484–5
function, functional modules, and modular 489–96
meaning of 485–6
as modular functional shift 500
natural sciences and ideographic analogies 534–6
perspective on R&D and inventions 488–9
as rational innovation 487–8
as source of selectable variation in the technosphere 486–7
strategy and entrepreneurship in 488
exaptive–adaptive cycle 487
exaptive bootstrapping 488
Experiential Learning Programme (ELP) 99, 103–4
fractional dimensions (FD) 469, 471
Fairbairn, William 494
False Nearest Neighborhood (FNN) 390, 396
far-from-equilibrium 429, 508, 515, 532, 578–80
feedback 316, 321
negative 529
positive 529
fitness landscape, notion of 78–9, 159, 292, 485, 574, 577
fixed-point attractors 577
Food web model 396
Formal System Model (FSM) 359, 379–86
fractal narrative analysis 75, 83–4
findings of 87–91
fractals 529
adaptive processes 233
diagnosis of interactions across scales 258–9
fractal geometry 79, 233
fractality, principles of 79–80
multifractal paths forward 258
and power laws 233–5
predator/prey dynamics 233
free will 579
fuel protests, in UK (2000) 453–4
functional shift, process of 483, 485, 489, 491, 493, 500–501
function in technology, etiological concept of 491–4
Galen of Pergamon 517
game theory 11–12
Ganeri, Jonardan 517
Gaussian distributions 24, 410
of homogeneous agents 224
G-causality 46–8
generalization of 48
gender dynamics, hierarchical patterns in 254
gender-related topics, exploration of 261–3
gender theory 254, 256
gene expression networks 409
generalized synchronization (GS) 360, 389, 405
General Practitioner (GP) system 365
action-flow description of 366
as part–whole cone 366
generative mechanisms 222, 228, 245–7, 535,
538
generic architectures 12
genetic algorithms 530, 531
genetic coding, consequence of 260
Gentner, D.
complex analogy, theory of 496–7, 498, 499
structure-mapping theory 496
Gestalt psychology 202
Global Systems Science 385
Gödel’s Incompleteness Theorem 360, 449
Granger causations 48
Granger, Clive 46
graph theory 178, 203, 409
Greenfingers Project 58, 108
Grint, Keith 148
Gross Domestic Product (GDP) 359, 388, 393
country-level 410
socio-economic networks of
characterization of 410–21
complex system of 409–10
group influence force 361, 472
groupthink effects 463
Guide Neighbourhoods (GNs) 104
H1N1 influenza pandemic (2009) 333, 342
vaccination campaigns against 333, 342
Haken, Hermann 508
enslaving principle 231
Hartman–Grobman theorem 395
health and welfare system 385
healthcare workers (HCWs) 224, 342, 347, 349,
350–51
health inequalities 58, 95, 108–9, 112
Heisenberg cut 571
higher education institutes
involvement in community partnerships 115
public engagement in 114
historicity 429
holism, notion of 571
Holland, John 11, 509
homeostasis 508, 515, 516, 574, 578, 586
homogeneous networks 410
homophily 416, 469
Homo sapiens phylogeny 574
‘homo-spatial’ stimuli 522
Hook’s Law 378
Hopf bifurcation 395
Horizontal Genetic Transfer (HGT) 503
hospital-acquired infections (HAI) 348–9
hospital contact networks, mapping of
349–50
human brain/mind 567
human experiential space 78, 84, 85, 92
human interaction dynamics (HID) 223, 286,
303, 306–9
action vectors in
categorical representations of 290
phase space 289–90
categorical representations of
action vectors 290
organizing systems 290–91
cognitive benefits to organizing 287
contagion in 286
Cusp of Change model of 286–7, 288
informational influence on 289–93
integrated analytical framework of 293
order and degrees of freedom 287–8
order parameters of 291
informational influence and 292–3
phase transitions in 286, 288
and stability in organizing systems 292
human-machine teaming 443
human systems, modelling of 26–34
emergent market structure 26–9
emergent supply chain performance 34
organizational evolution 32–4
three meta-strategies for 29–32
Humphries, Paul 514
Huygens, Christiaan 393–4
ideographic
analogy 481
mapping 535, 539
imitators 29
inclusion mapping 291, 294
infectious diseases, modeling of 224, 305, 327,
329–31, 348
Influence Network survey 463
information closure 377–8
information-exchange 141
information-sharing 138–9
infrared (IR) technology 349
infrastructures modeling, social complexity in
267–8
analytic procedure of 273–83
challenges of
organizational modeling 272
regulatory influences 273
smaller and larger social factors 272
time and change 271–2
electric grid 271–83
grounded theory and snowballing of 274–5
reliability and resiliency 268–70
as smart territories 268
study on 270–71
initial condition 10, 75–6
inner complexity 133, 162
inner skills
concept of 157–8
different kinds of 158–9
dimensions of 160
divergent 159
and operational management versus strategic change 166
patterns across management levels 170
innovation 176
intentional agents 568, 570, 579, 587
interactions
accumulation of 513
process of 517
inter-actor influence relationships 459, 469
inter-actor network 460
inter-connectivity 429
Internal Controls and Management Practices (ICMP) 271
International Institute for Applied Systems Analysis (IIASA) 392
International Organization for Standardization (ISO) 268
intersectionality, in the sciences 256
intra-brain networks 51
Iran influence network
analyst survey of 463
case study of 460–63
community structures of 470
Guardian Council 475
integrated issue-network analysis metrics 471
KHAM’s initial natural preference 475
nuclear decision-making 476
nuclear weapons and economic reform 467, 471
nuclear weapons issue simulation 474
P5+1 perspective on 476
Strong Restrictions zone 475, 476
structural analysis of 463–71
Weapons Capability policy 473, 475
Isaacs, William 151
issue positions 361–2, 463–4, 470, 472, 476–7
joint recurrence plot (JRP) 390, 404–8
Journal for Mixed Methods Research 547, 564
Kandel, Eric 570
Kantor, David 151
four dialogical positions 152
Kaplan, Abraham 507
Kauffman Firm Survey (KFS) 238
Kepler, Johannes 497
knowledge creation, networks of 525
Kohonen Self Organizing Map 280
Kolmogorov–Smirnov test (K-S) 239, 241, 252
lag synchronization (LS) 394
‘laissez faire’ approach 19, 59
Landscape of the Mind (LoM) 157, 159–61
in action 165–75
application of 168–75
basic first level globe 160
behavioural choices 165
case studies on 168–75
colour key globe 161
depth profiling 162–5
first level 162
inner skills patterns 170
operational management versus strategic change 166
operational sample versus improvers sample 167
profiling process of 161–5
rank ordered preferences in 169, 173, 175
serendipitous research findings 175
three first level profiles 163
and three levels of leadership 172
and working with the less-than-thrilled 170–74
large-scale networks 413
latitude of acceptance 472–3, 475
law of requisite variety 303, 455
leader–follower relationships, in complex systems 51
leadership
distributed 62, 72
’swallowtail’ model of 529
three levels of 172
leadership networks
analyst survey of 463
Iranian leadership case study 460–63
modeling of 459
structural analysis of 463–71
issue analysis 464–9
network analysis 469–71
learners 29
learning
by doing 101, 161, 436
quality of 143
lever-point phenomena 232
Levinthal, D. 487
Likert scales 239
linear aggregation 377
linear innovation model 493
linearity 74
linear modeling 254, 255–6
line of identity (LOI) 390, 399
line of sight 145, 150
link analysis (LA) 178
living systems 41, 77, 231, 235, 569
local operational activity 101
locked-in behaviours 101
locus of change 139, 140
Lorenz, Edward 577
Lorenz system 399–400
LSE Complexity Group 73, 107
Lyapunov Exponent (LE) 391, 396
management information systems 323
Mandelbrot Set 529
man–machine interfaces 6
map of the mind 568, 578, 587
MATLAB software 252
mean conditional recurrence (MCR) 359, 389, 390, 405, 421
media, concept of 510
mental illness, development of 568, 573, 574
metabolic pathways 409, 570
meta-network analysis software 204, 206
methodological design, consistency and choice in 552–3
microbial cell, modular tree of 490
micro simulation 378
Middle East Respiratory Syndrome (MERS) 327
Millennium Project 440
Mill, John Stuart 513
Mitleton-Kelly, Eve 97
Mivart, George, St. 483
mixed-method research 271, 547
3Ps framework in 553
aim of 562
availability of funding sources for 555
benefits of 560
case-to-case generalization in 560
components of 553
conferences and invitations 556
data collection for
challenges in 557–8
methods for 556–7
definition of 556
design of see research design
integrated 548
paradigms and 552
philosophical and paradigmatic interests in 551–2
researchers with established track-records 556
scope of 547
signal accomplishments of 551
strategies for
dimensions of 561
techniques for 556–7
alignment of 557
data analysis 559–60
predictive 559
theoretical perspectives of 555
worldviews, design and methods of 554
model of practice
for complex situations 428
review of 428–30
modular exaptation
artefacts of 497–8
and complex analogy 496–501
concept of 480, 484, 494, 495–6, 501
definition of 497–8
functional module of 498
function and behaviour of 498
modular artefact of 498
modularity, concept of 490–91
Monte Carlo bootstrapped distributions 241
Morgan, C.L. 517–18
Mt. Druitt Enablers Program 85, 88–9, 91
multi-agent systems (MAS) 178, 357, 426, 443–4
multidimensional problem space 61, 64, 68
multifractal organization, of presymbolic development 259–61
multi-level influence networks 357, 449
multilevel systems 363
backcloth structure at 376–7
bed-blocking problem 381, 384
classes by intension and extension 369–72
formal model of 379–86
health and social care accountability and funding structure 383
information closure and 377–8
and lowest level of representation 377–8
mathematical theory of 376
motif structure 381
multilevel part–whole social structures 365–8
NACE classification for construction 370, 371
naming elements of 369–72
synthetic micropopulations 378–9
systems thinking, modelling and policy 364–5
taxonomic aggregation see taxonomic aggregation
in traffic disaggregation 378–9
multi-modal networks, for influencing change 448–9
multiscale analysis
applications of 12–14
in biomedical systems 13
in cognitive systems 13–14
in global systems 14
method of 7–9
multitrait-multimethod matrix 548
Mutual Information 47–8
definition of 48
Mutual Information from Mixed Embedding (MIME) 48–9
analysis of EEG of musicians and audience 50–52
partial MIME (PMIME) 49–50, 52
mysteries 435
National not-for-profit organisation 171
National Proficiency Tests Council (NPTC) 108
natural complexity 430, 432, 445, 455
natural novelty 512
natural science
dualistic view of 572
and ideographic analogies 534–6
natural selection, theory of 483, 485, 502
navigating in uncertainty 157
neighbourhood governance 100, 106
nesting safety 288
network modeling
contact 331–3
degree distribution 331
Poisson degree distribution 331
scale-free distribution in 331
steps in 331
network of interest
phase space and state-time diagrams for 185
phase space characteristics of 186
state-time (or space-time) diagram for 184
network science 178, 360–61, 459, 469, 472
network structure 181–6
network text analysis (NTA) 134, 199–200, 202–4
neural Darwinism 577
neural networks 12, 448, 567, 572–4, 581
Newman algorithm 210
Nicolis, Gregoire 229, 515–16
NK landscape models 480, 525, 530, 531, 534, 538
non-governmental organisations (NGOs) 63
nonlinear dynamical systems (NDS) 360, 459, 472, 508–9, 567–8
nonlinear dynamics 254
Nonlinear Social Influence Simulation 361, 472
nuclear weapons issue simulation 474
observational commutativity 378
one-way communication 143
operational management 168
versus strategic change 166
Operation Goodnight 57, 109
ORA software 204–5
application of 206–12
‘Locate Subgroups Report’ option 210
protocol for 216–19
steps in analysis using 218–19
order parameters 291
for organizing system 295
order-phase transitions 223
organisational change 138–9
butterfly effect 140
command and control 143
and gap between employees and leaders 142–3
locus of 140
mutually dependent roles for 141
one-way communication for 143
protected time to make sense of 140–41
shared goals and systemic obstacles 141–2
stable 294
organisational development 156
Visual Dialogue process for 137, 141, 145
organisational flexibility 175
organizational evolution 32–4, 481
organizational learning 530–31
organizing states
access to alternative 302
changing, on a potential surface 295–6
external complexity of 301–3
first control parameter of 301–3
internal complexity of 303
phase transitions between 293–304
potential function, for Cusp of Change 298–9
and relationship among them in organizing systems 293–5
requisite complexity among control parameters 303–4
second control parameter of 303
terminal instance as 294–5
organizing systems
action orientation contagion
dynamics of 304–5
mechanism of 308–9
categorical representations of 290–91
model of contagion in 304–6
Dodds and Watts general model 305–6
dynamics of action orientation contagion 304–5
model of phase transitions in 306–9
first-order phase transition 307–8
Index 601

second-order phase transition 307
order parameters and 295
organizing states and relationship among them in 293–5
outliers 175, 227–8, 236, 242–3, 245, 246, 247, 563

pair-wise interactions 32, 36
pandemic influenza, as a hospital acquired infection 342, 343, 348–9
Panel Study of Entrepreneurial Dynamics II (PSED) 238
paradigm incommensurability, notion of 551
parent–child interactions 258
Pareto R/F distribution 234, 235
Partial Directed Coherence (PDC) 50–51
partial MIME (PMIME) 49–50, 52
part–whole aggregation 363, 372, 374, 386
path-dependence 307, 429
pathological attractors 576, 577, 581, 587
patient’s life experience 581
patient-therapist dyad 575
pattern formation 9–10
Pearson correlation coefficient 45
peer-to-peer interactions 286
perceptual learning 257
performance gaps 488
performance potential 488
periodic attractors 395, 577
Perron–Frobenius theorem 419
personal identity, properties of 574
personal protective equipment (PPE) 337, 347
phase space and phase space reconstruction, concept of 395–8
phase synchronization (PS) 360, 389, 394, 402, 421
phase transitions 236, 305
first-order 294
in human interaction dynamics 286, 288
model of, in organizing systems 306–9
in natural sciences 288
between organizing states 293–304
second-order 294, 307
philosophical stance 549, 553
phrase space, notion of 57, 78, 81, 83, 87
pictures and visual metaphors
benefits of 150–51
as communication tool 147
corporate values 150
to engage staff in turning strategy into action 149–51
as tool for sense-making and meaning-making 147–9
versus verbal language 148
Poisson degree distribution 331
Poisson’s distribution 410
Poisson time series regressions 536
policy issue networks, actor coalitions in 209–12
PORTEND (Political Outcomes Research Tool for Elite Network Dynamics) software 360–61, 459–60, 476
algorithm employed in 469
for intra-community linking 469
Iranian leadership case study see Iran
influence network
methodology overview of 461
network ‘modularity’ in 469
possibility space 101–2, 104
poverty, effects on behaviour change 111–12
Power Graph Analysis (PGA) 134, 188–91, 197
benefits of revisualization using 189
of Boolean networks 189–91
of effective dynamic structures 190
examples of 189
practical relevance of 197
primitives of 188
power grid 273
decomposing misoperations in 269
electric service areas of Ohio 274
power-law distributions (PLDs) 222, 227–8, 232
difference with normal distribution 236–7
model significance of 240
parameter estimates of 240
testing for mechanisms that drive 245–6
power laws (PLs) 221–2, 257–8, 529–30
fractals and 233–5
practice for complex situations 428–30
actors’ intentions and 430–31
appropriate practice over time 445–8
aspects of 431–2
approaches to change 436–8
perceptions of change 432–4
understanding of change 434–6
‘cause–effect’ mapping 449
climate change adaptation in Africa (2014) 449–50
Deep Water Horizon Oil Rig Disaster (2004) 450–52
fuel protests, in UK (2000) 453–4
judging appropriateness for
appropriateness framework 440–42
autonomous agents and multi-agent systems 443–4
practice as synthesis 439–40
real-world readiness of AAMAS 445
multi-modal networks, for influencing change 448–9
phases of engagement 439
principles for effective change in 454–5
six main avenues available for change in 446–8
state of 426–8
ways-of-working 437, 453
in predictable situations 443
preadaptation, notion of 485
prediction, optimal means of 513
presymbolic development, multifractal organization of 259–61
Prigogine, Ilya 55, 221, 229, 508
principal components (PCs) 467
of actor natural preferences 468
principal components analysis (PCA) 361, 467
of actor natural preferences 468
prisoner’s dilemma 12
problem space 56, 61, 62, 64, 66–8, 72, 101, 103
Problem Space Analysis 65, 66–8
programme evaluation 224, 312–16, 318, 322, 323
psychiatric treatment, definition of 571, 580, 586
psychiatry 573, 581
CAS model as a meta-framework for 568–70
practice of 567, 572
psychobiology
fractal landscape of
CAS model 568–70
minimal autonomous agents 569
reciprocal causation and 569
shifting paradigms 570–73
systemic 573
map of the mind 578
psychological experiences
diversity of 256
hierarchies driving 256–8
psychopathology
affective valence in 575
A-landscape model of 568, 574–5, 580
dynamics of attractors in 577
interpenetrating therapist–patient 581
topology of the patient’s 576
attractor basins in 575
attractor/repellor states in 568
component-process function of 580
dancing landscapes of 575, 585–6
dynamical systems therapy (DST) see dynamical systems therapy (DST)
evolution of 569
first-person perspective of 580
language of 567
linear models of 568
maladaptive symptoms in 580
‘mindless brain’ model in 572
multi-level reciprocal adaptation of 574
patient-therapist system in 568
and patterns of behavior 576
repellor peaks in 575
second-person perspective of 580
strange attractors 577
systemic psychobiology view of 573–80
third-person perspective of 580
psychotherapy
lightbulb moments in 580
practice of 481, 572
public engagement, in research
Beacons for Public Engagement (BPE) 114
aims of 115
Independent Review of 115
case studies on 118–20
Community Advisory Group 118
complexity approach to 117
complexity-informed cyclical model of 127–30
Concordat for Engaging the Public with Research (2010) 114
cross-cutting themes for 123–5
mutual benefit 125
staying the distance 124–5
time and rhythm 123–4
cycle of 129, 131
data collection and analysis of 120–21
findings on 122–30
in higher education institutes 114
key principles to 114
‘lead-in’ and ‘follow-on’ periods of 124, 131
methods of 117–22
National Coordinating Centre for 118
negotiated feedback sessions on 121
phases of
follow-on 130, 131
lead-in 128–30, 131
project or delivery 130
project planning and outcomes 126–7
roles (functions) and responsibilities of 127
symposium on 121
systems and structures of 126
public health plans 327
application of complex systems tools in 328–9
public policy
definition of 201
making of 199
public service delivery 199
Public Utility Commission of Ohio (PUCO) 275, 276, 283
puzzles 435
qualitative research 74–8, 80, 85, 90, 93, 264, 548, 551, 559–60, 562
qualitative social research 75, 77–8, 85, 93
quantitative modeling 254, 258, 264
quantitative research 536, 548, 551, 562
quantum physics 571
quantum waves 519
quasi-mixed method 547
radical emergence 511, 571
radical novelty 517
degree of 512
of emergent phenomena 510
explanatory gap and 509–12
identifications of 512
versus ordinary novelty 512
of self-organization 515–17
as uncomputability 513–15
Radio Frequency Identification (RFID) technology 349
Ragin, Charles 270
rank ordered preferences 166, 168, 169, 173
Head of Department's 175
real-world-readiness 445
reciprocal causation 569, 577
reciprocity, principle of 115, 316
recurrence plot (RP) 360, 389, 398–9, 404
recurrence rate (RR) 390, 399
τ – recurrence rate 390
Redruth Enabling Active Community Health (REACH) 57, 108
Redruth North Partnership 108
reductive epiphenomenalism 571, 572
redundancy 10, 514
Reflect Back Workshop 65–6
reflexivity, in social system 41–2
relative novelty, notion of 511
relativity, theory of 571
repellor peaks 575, 577
representation, process of 10–11
Research Councils UK 114
research design 549–51
complementary 549
embedded 549
examples of 550
exploratory 549–50
influences on 553–6
multi-phase 551
other influences on 554
selection of 554–5
transformative 551
triangulation 549
research designs, for complexity science 538
residents, as co-producers of services 105–6
resilience, notion of 532–3
Resource Dependency Theory (RDT) 205
respiratory-borne infections 329
risk management 268, 270, 436, 455
Rothenberg, Albert 522
SACS Toolkit 222–3, 270–71, 283
scalability, theory of 235, 243, 323
scale-free distribution 331
Schumpeter, Joseph 27, 32, 487
economic development, theory of 489
scientific induction–deduction learning loop 18
self-awareness 573, 574, 580
properties of 574
self-bias force 361, 472
self-organization 128
capacity for 84
re-establishing 586
command and control versus 137
of complex living systems 77
concept of 515
definition of 532
of emergence 508–9, 536
emergent order creation by 235
Goethe's work on 516
as homeostasis 516
idea of 509
and need for transformation 517–20
process of 9, 26
radical novelty of 515–17
resident 98
and self-regulation 516
of system 58
self-organized criticality 24, 221, 222, 228,
232–3, 238, 243–6, 509
self-regulation, patterns of 508, 515–16, 578
self-transcending construction (STC) 510–12,
514, 520
semantic network analysis 135, 203–5
sense-making 137–8, 140, 143, 147–8, 151–2,
154–5
sensitive dependence, on initial conditions 78–9
Severe Acute Respiratory Syndrome (SARS) 327, 333
sexually-transmitted infections 329
Shannon Entropy (SE) 134
for each node operating within each
attractor basin 194
effective dynamic layers based on 192
future work 198
as measure of activity 191–7
node state sequence 191
Shannon Entropy Signatures (SESs) 192–7
for four attractors 196
signature of various networks 198
Shannon's information theory 10
shared story 133, 145, 150, 154–5
Handbook of research methods in complexity science

Simon, Herbert 331, 388, 491
skewed distributions, basic causes of adaptive rank/frequency distributions 235–6
adaptive tension 229–31
bottom-up emergence 231
fractals and power laws 233–5
self-organized criticality and adaptive variability 232–3
skills acquisition, benefits of 563
sloppy metaphors 480, 496
small and medium-sized enterprises (SMEs) 63
small-world properties 360, 391, 410, 413, 416, 421, 423
‘smart’ complex systems 268
smart territory/grid 268
Smith, Adam 26
social capital, theories of 116, 206
social complexity in infrastructures, modeling
social entrepreneurs 105–6, 523
social influence simulation
nonlinear model of 472–3
nuclear weapons issue simulation 474
results of 473–6
social learning 285
social network analysis (SNA) 134–5, 178, 179, 199–200, 202–4, 219, 441
history of 202
softwares for conducting 204–5
social networks 39, 206, 409, 416
analysis of social network analysis (SNA) composition of 203
method of collecting data on 203
social programme evaluators 224, 313, 322
social research 74, 77, 81, 85–92, 93, 199, 522, 545
social science methodology, reflections on
55–43
social simulation 178
social systems 18
boundary of 21
dynamics of 23–4
evolutionary complex models of 21–3
interpretive frameworks of 19–26
reflexivity in 41–2
solutions of dynamical system 25–6
social work orientation 314
soo-economic data, complexity analysis of
by complex coupling 393–408
joint recurrence plot (JRP) 404–8
phase synchronization (PS) 400–404
recurrence plot (RP) 399
by complex network 408–21
Soros, George 19, 41, 43
South West Ambulance Service 108
space of possibilities, exploration of 5, 9–10, 103, 426, 429, 431, 432
space-time diagrams 184
Special Report on Emissions Scenarios (SRES)
360, 388, 392, 410
speciation, concept of 487
Spencer, Percy 492
Stace, W.T. 511
State Children’s Health Insurance Program (SCHIP) policy 209–10
state of practice, review of 426–8
state-time diagrams 183–4, 186
statistical and probability theory 203
Stewart, Ian 513
Stone, Reverend 486
strange attractors 79, 292, 577
Strategic Steering Group (SSG) 98, 100
strawson, Galen 508
structural attractors 32, 34, 37, 191
Structural Equation modeling 529
structure mapping, concept of 484, 502
successive assumptions/simplifications, process of 20–26
su generis novelty, of emergent phenomena 512, 517–18, 523
summary statistic, concept of 246
super-spreaders 350
supply chain organization of 530
performance of 34
surveys 203
‘swallowtail’ model, of leadership emergence 529
symptom-reduction treatment algorithms 581
synaptic network complexity 574
synchronization, of complex network
and generalized synchronization (GS) 394
complete synchronization (CS) 389
definition of 389, 394
generalized synchronization (GS) 389
lag synchronization (LS) 394
phase synchronization (PS) 389
synchronized coupled chaotic system, classification of 394
system dynamics 25, 200, 202, 307, 317, 521, 523, 530
systemic psychobiology 570–73, 587
systems thinking 26, 55, 313, 363, 364–5, 386
Takens Model 360
taxonomic aggregation 368–9
grounding and transitivity in 372–3
heterogeneous grounded 375
Index

homogeneous grounded 375
interleaved multilevel part–whole and 373–5
versus structural aggregation 374
team development 165
technological artefact, modular tree of 490
technological-biological evolutionary analogy 484
technological change 483–4, 487, 489, 492–3, 501
evolutionary theory of 489
technological innovation 483–4, 493, 502
tension
autonomy/integration 307
notion of 229
opportunity/risk 307
theoretical stances 553, 556
therapist–patient A-landscapes, graphic representation of 581
thinking together, process of 152
time domain waveforms 280–81
time series analysis 45, 47–8, 52, 390–91, 395, 526, 536
tiny initiating events 230, 232
tipping point 97, 238, 241, 244, 307, 309, 584
TR14ers Community Dance Team 109–10
transferable co-learning, phenomena of 58, 117
Transfer Entropy (TE) 48
causation estimates of 48
transformative capability, notion of 487
transformative regeneration 128
TRANSIMS systems 378
transitivity, of a graph 415–16
trauma-based disorders 577
traumatic experience, definition of 568, 578
τ – recurrence rate 390
phase synchronization (PS) by 400–404
Turing, Alan 514

UCINET network analysis software 204
UK Funding Councils 114
Ultra Wide Band (UWB) 349

uncomputability
radical novelty as 513–15
theorem on 514
unintended consequences 173, 329, 364, 387
United Nations (UN) 392
Common Statistics Database (UNSTATS) 392
Security Council 462
universal language 151
unspokens 151
urban governance network 135, 206–9

variation-retention-selection epistemology 486, 499–500
vector quantization technique 275, 277
verbal languages
limitations of 150
versus visual images 148

viable system model, Beer’s work on 529
viral transmission, modes of 337–9
Visual Dialogue process 133, 137–9, 141, 145, 153–4
case study 154–5
key elements of 145
use of 145
visual representations 133, 142, 153, 155
vortical postmodern ethnography 75, 80–82
features of 86
tfive aspects of 81–2
research methodology of 86

Weick, Karl 294
Wellcome Trust 114
weltanschauung (worldview), notion of 78
Whitehead, Alfred North 1
wicked problems, idea of 110, 138, 148
Wiener–Granger framework, of causality 45–6, 52
World Health Organization 327, 351
World Wide Web 12, 267, 409, 419

Zika virus outbreak (2015–2016) 327, 331