academic acquaintance network 416
action orientation contagion (AOC) 304
activation of 308
bi-stability in 307–8
mechanism of 308–9
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 320
Stephan's protocol for 321
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
autopoiesis 532
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

Eve Mitleton-Kelly, Alexandros Paraskevas and Christopher Day - 9781785364426
Downloaded from Elgar Online at 09/01/2019 02:29:29PM
via free access
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
sistematicity 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
bootstrapped 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
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
phemonena 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 expatation 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
 exapation in 484–9
 formation of 11
 ‘Machiavellian’ versions of 42
 major directions of inquiry in 9–12
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
tool theory of 199

compulsive anxiety 586
computational emergence 510, 513–14
Concordat for Engaging the Public with Research (2010) 114
crystalline 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
experiential 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
Cúenot, 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
Index 595

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
Delta7 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 ascendency 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
emerging infectious diseases (EIDs)
antiviral optimization, on simple networks 344–5
   basic reproduction number (R0), 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
coevolving 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)
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 radical 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
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 financial crisis 6
global systems, multiscale analysis of 14
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
grouptink 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
topological metrics for 182
network science 178, 360–61, 381, 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 visualization 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
exploratory novelty 551
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
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
of see infrastructures modeling, social
complexity in
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 see 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
socio-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 change 147, 166
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
sui 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 605

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
uncomputability
radical novelty as 513–15
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
viability, notions of 524
transformation, theory of 529
visual representations 133, 142, 153, 155
visual representations
features of 86
five 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