Co-producing complex systems interventions for public health

Mapping the state of the art

Brian Castellani

HEALTH CASCADE

Overview

- This two-day workshop will explore the value of integrating complexity science and co-production for developing effective, evidence-based tools for addressing complex public health problems.

BACKGROUND

- A complex systems approach has been proposed as a powerful toolkit for addressing complex public health problems, including the important role of place.
- In turn, co-creation has gained traction for addressing the complexities of public health policy, practice, and promotion, particularly around issues of inequality and inequity.
- While both approaches offer vital strategies for addressing complexity in public health, researchers are only beginning to explore their integration.
- Hence the purpose of this workshop.

Overview

Day 1

- **Our first goal is to provide a framework for thinking about complexity in public health.**
- To develop this framework, we will begin with an introduction to the complexity sciences, including a map of its present-day trajectories.
- From there we will examine the current challenges the field faces.
- We will focus on the failure of most complexity science approaches – particularly in terms of computational modelling – to effectively engage stakeholders in the model building process, as well as the development or evaluation of public health policies and practices.
- Given our public health focus, the COVID-19 pandemic will be used as our case study.
- We will end the day highlighting some examples where progress has been made in integrating complexity science and co-production, particularly participatory systems mapping – which attendees will get a chance to explore.

Overview

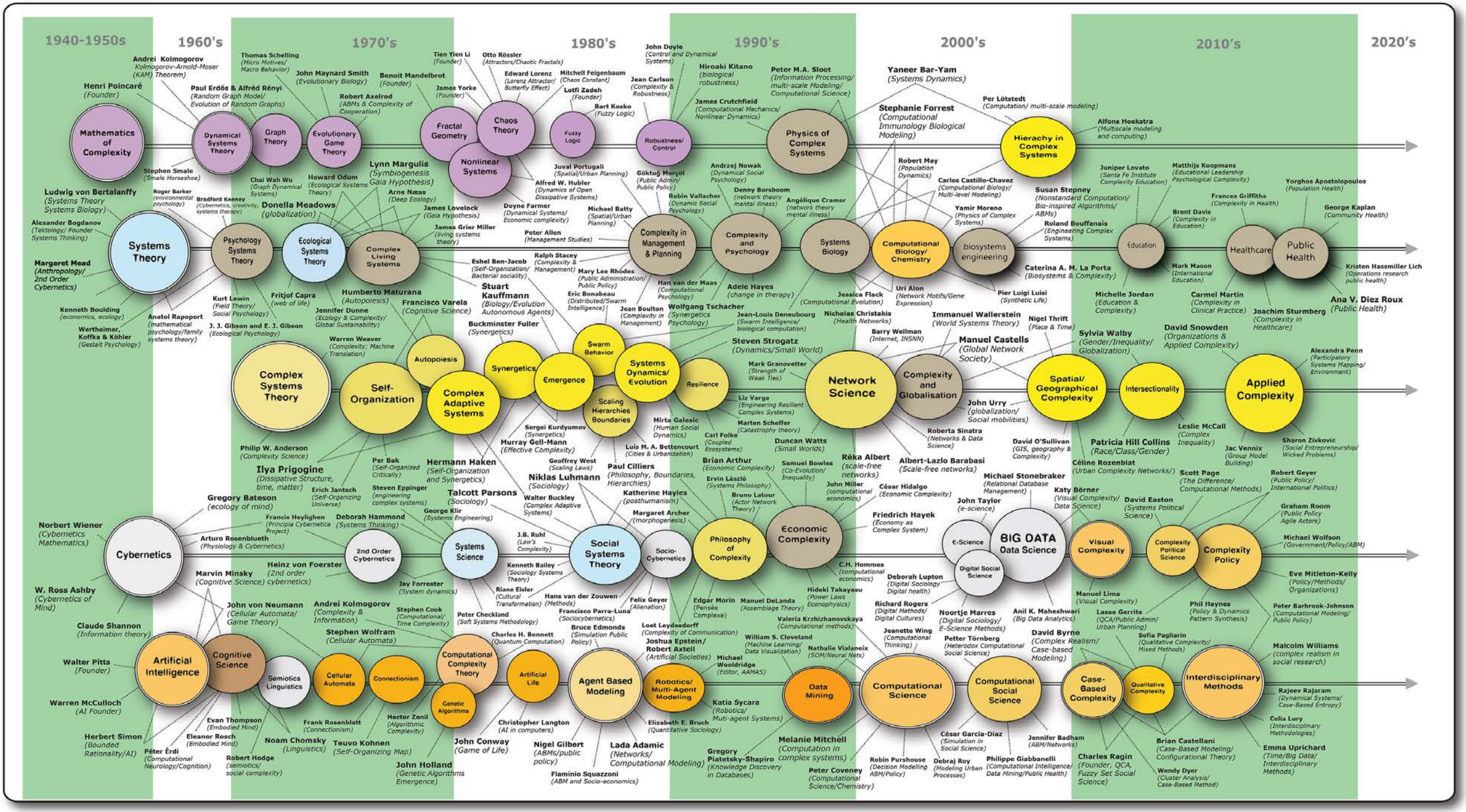
Day 2

- Day 2 will involve a series of break-out, small-group discussions.
- **The first session** will explore, from both an epistemological and practical level, which approaches to co-creation and complexity science might work best together (or not), or critically inform or challenge one the other, including different methods and tactics.
- **The second session** will explore what sorts of research projects or case studies participants could develop to advance the integration of these two approaches to address complex public health problems.

Mapping the complexity sciences

What is the study of complexity in health and social science?

- Complexity in health and social science concerns the application of theories, concepts and methods of *complex systems* to social inquiry – from sociology and public health to psychology and clinical practice to neuroscience and systems biology.
- Complexity in health and social science is not the strict domain of any one discipline, including instead scholars from across the academy as well as from those places where these ideas are applied in practice, including public health and health and social services.


1940-1950s
1960's
1970's
1980's
1990's
2000's
2010's
2020's
Mathematics of Complexity
Dynamical Systems Theory
Graph Theory
Evolutionary Game Theory
Fractal Geometry
Chaos Theory
Nonlinear Systems
Fuzzy Logic
Robustness/ Control
Physics of Complex Systems
Hierarchy in Complex Systems
Systems Theory
Psychology Systems Theory
Ecological Systems Theory
Complex Living Systems
Complexity in Management & Planning
Complexity and Psychology
Systems Biology
Computational Biology/ Chemistry
biosystems engineering
Education
Healthcare
Public Health
Complex Systems Theory
Self-Organization
Autopoiesis
Complex Adaptive Systems
Synergetics
Emergence
Swarm Behavior
Systems Dynamics/ Evolution
Resilience
Network Science
Complexity and Globalisation
Spatial/ Geographical Complexity
Intersectionality
Applied Complexity
Cybernetics
2nd Order Cybernetics
Systems Science
Social Systems Theory
Socio-Cybernetics
Philosophy of Complexity
Economic Complexity
E-Science
Digital Social Science
BIG DATA Data Science
Visual Complexity
Complexity Political Science
Complexity Policy
Artificial Intelligence
Cognitive Science
Semiotics Linguistics
Cellular Automata
Connectionism
Computational Complexity Theory
Genetic Algorithms
Artificial Life
Agent Based Modeling
Robotics/ Multi-Agent Modeling
Data Mining
Computational Science
Computational Social Science
Case-Based Complexity
Qualitative Complexity
Interdisciplinary Methods
Ludwig von Bertalanffy (Systems Theory Systems Biology)
Henri Poincaré (Founder)
Andrei Kolmogorov Kolmogorov-Arnold-Moser (KAM) Theorem)
Paul Erdős & Alfréd Rényi (Random Graph Model/ Evolution of Random Graphs)
Thomas Schelling (Micro Motives/ Macro Behavior)
John Maynard Smith (Evolutionary Biology)
Benoit Mandelbrot (Founder)
Robert Axelrod (ABMs & Complexity of Cooperation)
James Yorke (Founder)
Tien Yien Li (Founder)
Otto Rössler (Attractors/Chaotic Fractals)
Edward Lorenz (Lorenz Attractor/ Butterfly Effect)
Mitchell Feigenbaum (Chaos Constant)
Lotfi Zadeh (Founder)
Bart Kosko (Fuzzy Logic)
John Doyle (Control and Dynamical Systems)
Jean Carlson (Complexity & Robustness)
Hiroaki Kitano (biological robustness)
James Crutchfield (Computational Mechanics/ Nonlinear Dynamics)
Peter M.A. Sloot (Information Processing/ multi-scale Modeling/ Computational Science)
Yaneer Bar-Yam (Systems Dynamics)
Stephanie Forrest (Computational Immunology Biological Modeling)
Per Lötstedt (Computation/ multi-scale modeling)
Alfons Hoekstra (Multiscale modeling and computing)
Stephen Smale (Smale Horseshoe)
Chai Wah Wu (Graph Dynamical Systems)
Howard Odum (Ecological Systems Theory)
Lynn Margulis (Symbiogenesis Gaia Hypothesis)
Arne Næss (Deep Ecology)
Alfred W. Hubler (Dynamics of Open Dissipative Systems)
Juval Portugali (Spatial/Urban Planning)
Göktuğ Morçöl (Public Admin/ Public Policy)
Andrzej Nowak (Dynamical Social Psychology)
Denny Borsboom (network theory mental illness)
Robert May (Population Dynamics)
Carlos Castillo-Chavez (Computational Biology/ Multi-level Modeling)
Yamir Moreno (Physics of Complex Systems)
Susan Stepney (Nonstandard Computation/ Bio-inspired Algorithms/ ABMs)
Roland Bouffanais (Engineering Complex Systems)
Juniper Lovato (Santa Fe Institute Complexity Education)
Matthijs Koopmans (Educational Leadership Psychological Complexity)
Frances Griffiths (Complexity in Health)
Brent Davis (Complexity in Education)
Yorghos Apostolopoulos (Population Health)
George Kaplan (Community Health)
Roger Barker (environmental psychology)
Bradford Keeney (Cybernetics, creativity, systems therapy)
Donella Meadows (globalization)
James Lovelock (Gaia Hypothesis)
James Grier Miller (living systems theory)
Peter Allen (Management Studies)
Doyne Farmer (Dynamical Systems/ Economic complexity)
Michael Batty (Spatial/Urban Planning)
Robin Vallacher (Dynamic Social Psychology)
Angélique Cramer (network theory mental illness)
Alexander Bogdanov (Tektology/ Founder Systems Thinking)
Margaret Mead (Anthropology/ 2nd Order Cybernetics)
Kenneth Boulding (economics, ecology)
Wertheimer, Koffka & Köhler (Gestalt Psychology)
Anatol Rapoport (mathematical psychology/family systems theory)
Kurt Lewin (Field Theory/ Social Psychology)
J. J. Gibson and E. J. Gibson (Ecological Psychology)
Fritjof Capra (web of life)
Jennifer Dunne (Ecology & Complexity/ Global Sustainability)
Humberto Maturana (Autopoiesis)
Francisco Varela (Cognitive Science)
Warren Weaver (Complexity; Machine Translation)
Buckminster Fuller (Synergetics)
Stuart Kauffmann (Biology/Evolution Autonomous Agents)
Eshel Ben-Jacob (Self-Organization/ Bacterial sociality)
Ralph Stacey (Complexity & Management)
Mary Lee Rhodes (Public Administration/ Public Policy)
Eric Bonabeau (Distributed/Swarm Intelligence)
Jean Boulton (Complexity in Management)
Wolfgang Tschacher (Synergetics Psychology)
Han van der Maas (Computational Psychology)
Adele Hayes (change in therapy)
Jessica Flack (Computational Evolution)
Uri Alon (Network Motifs/Gene Expression)
Pier Luigi Luisi (Synthetic Life)
Caterina A. M. La Porta (Biosystems & Complexity)
Michelle Jordan (Education & Complexity)
Mark Mason (International Education)
Carmel Martin (Complexity in Clinical Practice)
Joachim Sturmberg (Complexity in Healthcare)
Kristen Hassmiller Lich (Operations research public health)
Ana V. Diez Roux (Public Health)
Jean-Louis Deneubourg (Swarm Intelligence/ biological computation)
Nicholas Christakis (Health Networks)
Barry Wellman (Internet, INSNN)
Immanuel Wallerstein (World Systems Theory)
Nigel Thrift (Place & Time)
Steven Strogatz (Dynamics/Small World)
Manuel Castells (Global Network Society)
Sylvia Walby (Gender/Inequality/ Globalization)
David Snowden (Organizations & Applied Complexity)
Alexandra Penn (Participatory Systems Mapping/ Environment)
Mark Granovetter (Strength of Weak Ties)
Liz Varga (Engineering Resilient Complex Systems)
Marten Scheffer (Catastrophy theory)
Roberta Sinatra (Networks & Data Science)
John Urry (globalization/ Social mobilities)
David O'Sullivan (GIS, geography & Complexity)
Patricia Hill Collins (Race/Class/Gender)
Leslie McCall (Complex Inequality)
Jac Vennix (Group Model Building)
Sharon Zivkovic (Social Entrepreneurship/ Wicked Problems)
Céline Rozenblat (Urban Complexity Networks/)
Sergei Kurdyumov (Synergetics)
Murray Gell-Mann (Effective Complexity)
Mirta Galesic (Human Social Dynamics)
Carl Folke (Coupled Ecosystems)
Luís M. A. Bettencourt (Cities & Urbanization)
Duncan Watts (Small Worlds)
Réka Albert (scale-free networks)
Albert-Lazlo Barabasi (Scale-free networks)
Philip W. Anderson (Complexity Science)
Ilya Prigogine (Dissipative Structure, time, matter)
Per Bak (Self-Organized Criticality)
Hermann Haken (Self-Organization and Synergetics)
Erich Jantsch (Self-Organizing Universe)
Steven Eppinger (engineering complex systems)
Talcott Parsons (Sociology)
George Klir (Systems Engineering)
Niklas Luhmann (Sociology)
Walter Buckley (Complex Adaptive Systems)
Geoffrey West (Scaling Laws)
Paul Cilliers (Philosophy, Boundaries, Hierarchies)
Katherine Hayles (posthumanism)
Margaret Archer (morphogenesis)
Brian Arthur (Economic Complexity)
Ervin László (Systems Philosophy)
Bruno Latour (Actor Network Theory)
Samuel Bowles (Co-Evolution/ Inequality)
John Miller (computational economics)
César Hidalgo (Economic Complexity)
Friedrich Hayek (Economy as Complex System)
Michael Stonebraker (Relational Database Management)
John Taylor (e-science)
Katy Börner (Visual Complexity/ Data Science)
David Easton (Systems Political Science)
Scott Page (The Difference/ Computational Methods)
Robert Geyer (Public Policy/ International Politics)
Graham Room (Public Policy Agile Actors)
Michael Wolfson (Government/Policy/ABM)
Eve Mitleton-Kelly (Policy/Methods/ Organizations)
Peter Barbrook-Johnson (Computational Modeling/ Public Policy)
Malcolm Williams (complex realism in social research)
Rajeev Rajaram (Dynamical Systems/ Case-Based Entropy)
Celia Lury (Interdisciplinary Methodologies)
Emma Uprichard (Time/Big Data/ Interdisciplinary Methods)
Norbert Wiener (Cybernetics Mathematics)
W. Ross Ashby (Cybernetics of Mind)
Claude Shannon (Information theory)
Gregory Bateson (ecology of mind)
Francis Heylighen (Principia Cybernetica Project)
Arturo Rosenblueth (Physiology & Cybernetics)
Deborah Hammond (Systems Thinking)
Heinz von Foerster (2nd order cybernetics)
Marvin Minsky (Cognitive Science)
John von Neumann (Cellular Automata/ Game Theory)
Andrei Kolmogorov (Complexity & Information)
Stephen Wolfram (Cellular Automata)
Stephen Cook (Computational/ Time Complexity)
Peter Checkland (Soft Systems Methodology)
Charles H. Bennett (Quantum Computation)
Bruce Edmonds (Simulation Public Policy)
Jay Forrester (System dynamics)
J.B. Ruhl (Law's Complexity)
Kenneth Bailey (Sociology Systems Theory)
Riane Eisler (Cultural Transformation)
Hans van der Zouwen (Methods)
Francisco Parra-Luna (Sociocybernetics)
Felix Geyer (Alienation)
Edgar Morin (Pensée Complexe)
Manuel DeLanda (Assemblage Theory)
Loet Leydesdorff (Complexity of Communication)
Joshua Epstein/ Robert Axtell (Artificial Societies)
Michael Wooldridge (Editor, AAMAS)
Valeria Krzhizhanovskaya (Computational methods)
William S. Cleveland (Machine Learning/ Data Visualization)
Nathalie Vialaneix (SOM/Neural Nets)
Hideki Takayasu (Power Laws Econophysics)
C.H. Hommes (computational economics)
Deborah Lupton (Digital Sociology Digital health)
Richard Rogers (Digital Methods/ Digital Cultures)
Noortje Marres (Digital Sociology/ E-Science Methods)
Petter Törnberg (Heterodox Computational Social Science)
Jeanette Wing (Computational Thinking)
Anil K. Maheshwari (Big Data Analytics)
David Byrne (Complex Realism/ Case-based Modeling)
Manuel Lima (Visual Complexity)
Lasse Gerrits (QCA/Public Admin/ Urban Planning)
Sofia Pagliarin (Qualitative Complexity/ Mixed Methods)
Phil Haynes (Policy & Dynamics Pattern Synthesis)
Brian Castellani (Case-Based Modeling/ Configurational Theory)
Wendy Dyer (Cluster Analysis/ Case-Based Method)
Charles Ragin (Founder, QCA, Fuzzy Set Social Science)
Walter Pitts (Founder)
Warren McCulloch (AI Founder)
Herbert Simon (Bounded Rationality/AI)
Péter Érdi (Computational Neurology/Cognition)
Evan Thompson (Embodied Mind)
Eleanor Rosch (Embodied Mind)
Robert Hodge (semiotics/ social complexity)
Noam Chomsky (Linguistics)
Frank Rosenblatt (Connectionism)
Teuvo Kohonen (Self-Organizing Map)
Hector Zenil (Algorithmic Complexity)
John Holland (Genetic Algorithms Emergence)
John Conway (Game of Life)
Christopher Langton (AI in computers)
Nigel Gilbert (ABMs/public policy)
Flaminio Squazzoni (ABM and Socio-economics)
Lada Adamic (Networks/ Computational Modeling)
Elizabeth E. Bruch (Quantitative Sociology)
Katia Sycara (Robotics/ Muti-agent Systems)
Gregory Piatetsky-Shapiro (Knowledge Discovery in Databases)
Melanie Mitchell (Computation in complex systems)
Peter Coveney (Computational Science/Chemistry)
Robin Purshouse (Decision Modelling ABM/Policy)
César García-Díaz (Simulation in Social Science)
Debraj Roy (Modeling Urban Processes)
Philippe Giabbanelli (Computational Intelligence/ Data Mining/Public Health)
Jennifer Badham (ABM/Networks)

Setting the context

- Study of complexity in health and social science has become an advanced and highly interdisciplinary field
- As it matures, twelve challenges emerge.
- The combination of the field's rapid growth and the challenges present us with a conundrum.

JASSS
THE JOURNAL OF ARTIFICIAL SOCIETIES AND SOCIAL SIMULATION

Justified Stories with Agent-Based Modelling for Local COVID-19 Planning

Jennifer Badham[1], Pete Barbrook-Johnson[2,4], Camila Caiado[3], Brian Castellani[1]

[1]*Department of Sociology, Durham University, 29-32 Old Elvet, Durham DH1 3HN, United Kingdom*
[2]*Centre for Research in Social Simulation, Department of Sociology, University of Surrey, Guildford GU2 7XH, United Kingdom*
[3]*Department of Mathematical Sciences, Durham University, Upper Mountjoy Campus, Stockton Road, Durham DH1 3LE, United Kingdom*
[4]*Institute for New Economic Thinking, University of Oxford, Manor Road, Oxford, OX1 3UQ, United Kingdom*
Correspondence should be addressed to *research@criticalconnections.com.au*

Journal of Artificial Societies and Social Simulation 24(1) 8, 2021
Doi: 10.18564/jasss.4532 Url: http://jasss.soc.surrey.ac.uk/24/1/8.html

Received: 22-09-2020 Accepted: 22-01-2021 Published: 31-01-2021

Twelve challenges: 1

- There is no real philosophy of complexity. Therefore, there is no firm rooting of methods or findings. Epistemology and ontology are commonly untouched, particularly amongst scholars from the natural sciences, mathematics and computer science.
- This is problematic given that the complexity sciences emerged, in part, as a challenge to reductionist, modernist science.

Twelve challenges: 2

- A combination of scientific overreach and the use of complicated language give rise to a mysticism that suggests that the complexity sciences are not just interesting tools but somehow give access to the deepest, most fundamental questions about social life in general.
- This is problematic because such bravado rarely (never) delivers, as such fuelling criticism from other scientists.

Twelve challenges: 3

- Given the dominance of the natural sciences in the study of social complexity there is a tendency to reinvent the wheel in the face of 150 years of social sciences
- This is problematic because it results in the re-creation of established social science. Examples include the uptake of social contagion theory with little acknowledgement that the theory has existed for at least several decades.

Twelve challenges: 4

- The jargon of complexity science often leads to confusion when transferred to the social sciences, leading the question whether a complexity concept tells something that could not be told by another concept, i.e. old words vs. new words.
- This is problematic because it often creates jargon-heavy texts, and conflicting definitions of the same terms. Examples include fitness landscapes and self-organization that are understood in many different ways.

Twelve challenges: 5

- Given the widespread enthusiasm regarding computational modelling and big data, there has been a strong move toward devaluing social theory and theory-driven inquiry: technique in the absence of theory
- This is problematic because social theory is crucial to making sense of data. A recent example was the proliferation of of COVID-19 models that did not utilize or have expertise in the theories on infectious diseases, epidemiology, or human behaviour.

Twelve challenges: 6

- Since social theory is largely absent from the complexity sciences, a majority of scholars are preoccupied with finetuning of methods while forgetting the bigger picture: the dire sound of technicalities
- This is problematic because minute technical refinements threaten to replace grand ideas. Many concepts from the complexity canon are two or more decades old.

HERE IS WHERE CO-PRODUCTION AND PARTICIPATORY RESEARCH ENTER THE PICTURE

Twelve challenges: 7

- Complexity sciences are powerful means to learn about global problems. However, many scholars feel the pressure to predict and control systems instead of learning how to manage them: learning tools vs. predictive machines.
- This is problematic because it constitutes a relapse to old ways of predicting notoriously complex social dynamics and prevents learning from those dynamics

Twelve challenges: 8

- The complexity sciences appear to ignore the qualitative methods for the study of social complexity, despite the fact there is much going on.
- This is problematic as it devalues an important type of social inquiry, particularly around issues of voice and agency and representation and understanding the nuances of people's lives.

Twelve challenges: 9

- There is so much knowledge in the social sciences not presently part of the formal study of social complexity that there are big gaps in understanding social science and health.
- This is problematic because the complexity sciences claim to offer holistic answers to all matters social.
- Examples of the gaps include proper theories of power, inequality and agency.

Twelve challenges: 10

- Complaints that policy makers, politicians, managers of any kind ‘don’t get complexity’ and fail to follow-up on complexity’s findings signal that some scientists are being tone-deaf about the real world
- This is problematic because the real world of policy and management is as complex as the systems studied. Examples include policy recommendations that link intricate analytical statements to rather simplistic recommendations.

Twelve challenges: 11

- While scientists may be tone-deaf about the real world, practitioners are equally likely to misunderstand concepts and theories in practice.
- This is problematic because it could discredit ideas by a wider audience and give the impression of complexity as a fad. Examples include the misuse of complex systems thinking in public policy, managerial science, healthcare and public health.

Twelve challenges: 12

- Social sciences have yet to fully engage with big data and computational modelling techniques. Some fields are therefore methodologically outdated relative to the globalised data worlds in which we now all live: the methodological closing of the social scientific mind.
- This is problematic because it allows social science to be ignored by complexity theorists

Examples of progress

Health & Place 73 (2022) 102735

Contents lists available at ScienceDirect

Health and Place

journal homepage: www.elsevier.com/locate/healthplace

Factors influencing usage of urban blue spaces: A systems-based approach to identify leverage points

Niamh Smith [a,*], Michail Georgiou [a], Abby C. King [b], Zoë Tieges [c,d], Sebastien Chastin [a,e]

[a] School of Health and Life Sciences, Glasgow Caledonian University, Glasgow, Scotland, UK
[b] Departments of Epidemiology & Population Health and Medicine (Stanford Prevention Research Centre), Stanford University School of Medicine, Stanford, CA, USA
[c] Geriatric Medicine, Usher Institute, University of Edinburgh, Edinburgh, Scotland, UK
[d] School of Computing, Engineering and Built Environment, Glasgow Caledonian University, Glasgow, Scotland, UK
[e] Department of Movement and Sports Sciences, Ghent University, Belgium

The Centre for the Evaluation of Complexity Across the Nexus

COMPLEX-IT

Exploring complex data from a case-based perspective

Build the Model

1. Build Database and Import Cases
2. Cluster Cases

Test the Model

3. The Computer's turn
4. Compare and Visualise Results

Extend the Model

5. Simulate Interventions
6. Predict New Cases

Export Results

7. Generate Report

beta version
release 2019

COMPLEX-IT is a web-based and downloadable software tool designed to increase your access to the tools of computational social science (i.e., artificial intelligence, micro-simulation, predictive analytics). It does this through a user friendly interface, with quick access to introductions on concepts and methods; and with directions to richer detail and information for those who want it.

The result is a seamless and visually intuitive learning environment for exploring your complex data -- from data classification and visualisation to exploring simulated interventions and policy changes to data forecasting.

You don't need any technical expertise to start using COMPLEX-IT, all that is required is a data set you want to explore, and a curious mind!

COMPLEX-IT

DOWNLOAD VERSION

COMPLEX-IT

WEB VERSION

USER RESOURCES

Video Tutorials
Step-by-step User Guide
Additional Readings

Meet the team

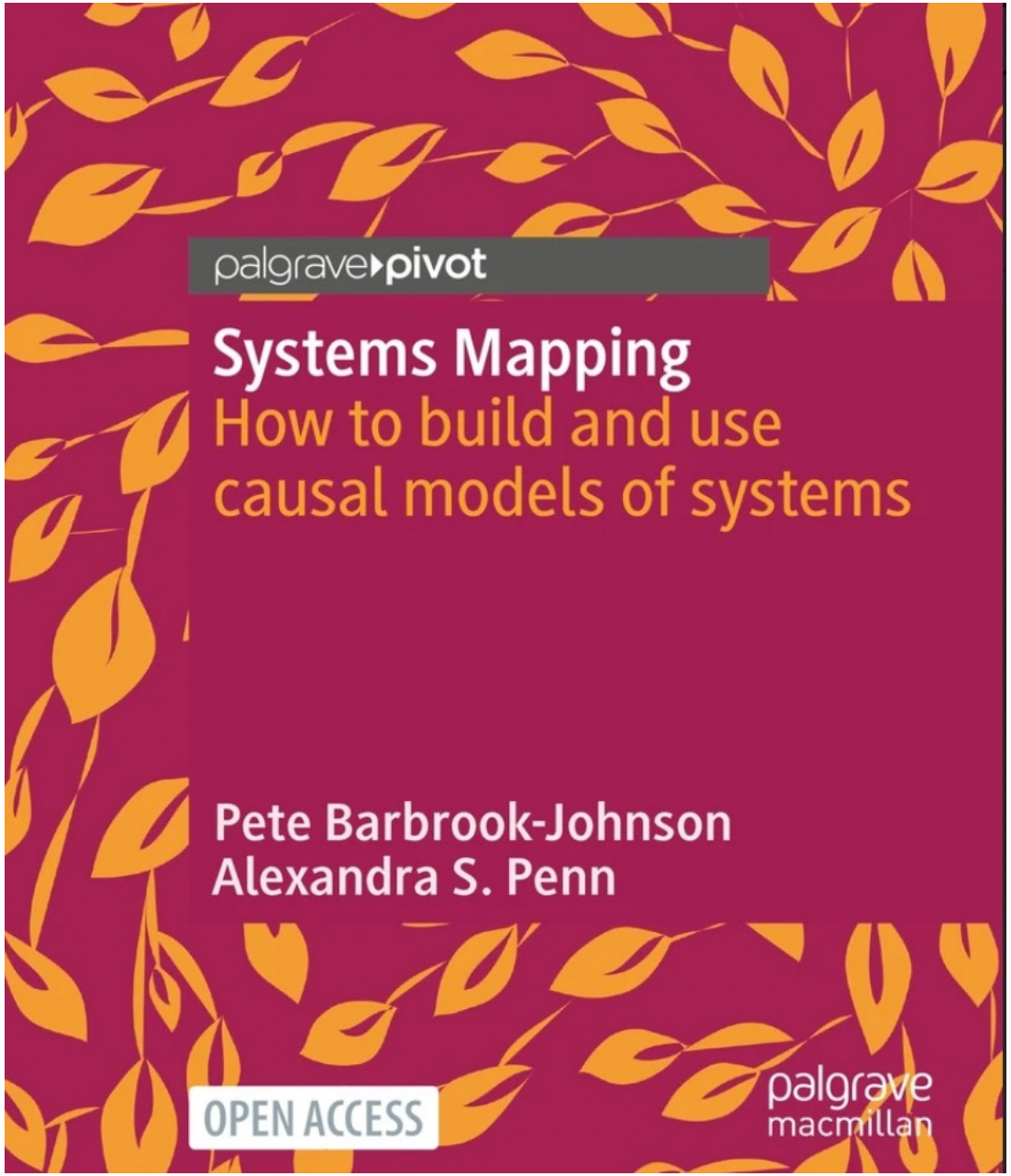
University of Oxford

University at Buffalo
The State University of New York

Durham University

cecan
Centre for the Evaluation of Complexity Across the Nexus

Kent State University
Ashtabula



CHAPTER 5

Participatory Systems Mapping

Abstract This chapter introduces Participatory Systems Mapping, a method for building and analysing causal system models in groups, developed by us. The method uses tools from network analysis and focuses on chains of causal connections to develop meaningful and actionable insights with stakeholders. This chapter describes in detail what it is and how to use it, considers what it is good and bad at, as well as describes some of the history of its development. We also point to resources and tips for getting started with the method yourself.

Keywords Participatory Systems Mapping • Complexity • Policy • Stakeholders • Network analysis

https://link.springer.com/chapter/10.1007/978-3-031-01919-7_5


PRSM
The Participatory System Mapper (PRSM) is a free, open-source
and secure tool for mind-mapping and system visualisation

ELSEVIER

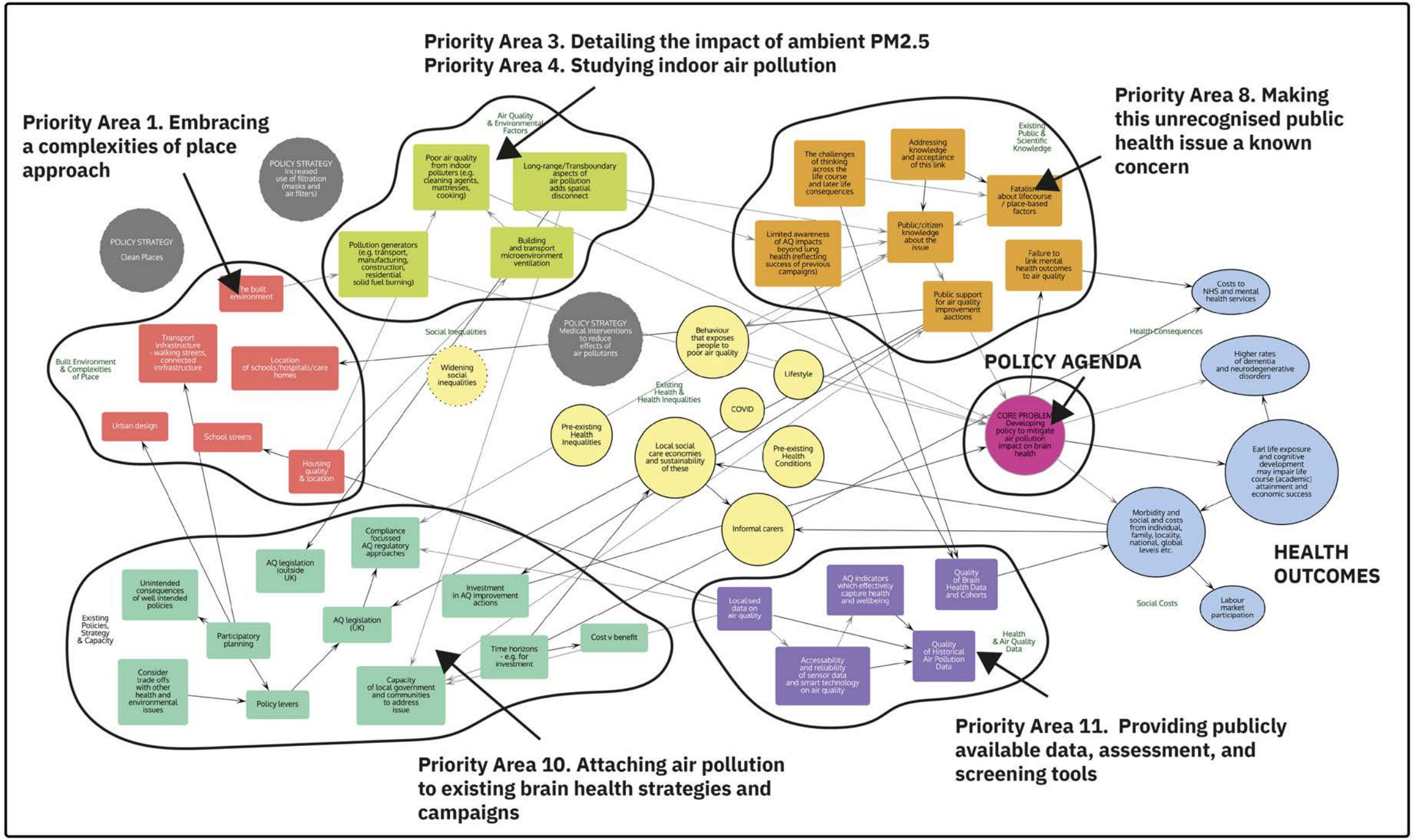
Environmental Research

Volume 215, Part 2, December 2022, 114362

Review article

Mitigating the impact of air pollution on dementia and brain health: Setting the policy agenda

Brian Castellani [a, b, c, e], Suzanne Bartington [d], Jonathan Wistow [e, c], Neil Heckels [f], Amanda Ellison [c, g], Martie Van Tongeren [h], Steve R. Arnold [i], Pete Barbrook-Johnson [j, b], Martha Bicket [b], Francis D. Pope [k], Tom C. Russ [l, m], Charlotte L. Clarke [e, n], Monica Pirani [o], Matthias Schwannauer [n], Massimo Vieno [p], Rachel Turnbull [q], Nigel Gilbert [b], Stefan Reis [p, r, s]


Priority Area 3. Detailing the impact of ambient PM2.5
Priority Area 4. Studying indoor air pollution
Priority Area 1. Embracing a complexities of place approach
Priority Area 8. Making this unrecognised public health issue a known concern
POLICY STRATEGY Increased use of filtration (masks and air filters)
POLICY STRATEGY Clean Places
Air Quality & Environmental Factors
Poor air quality from indoor polluters (e.g. cleaning agents, mattresses, cooking)
Long-range/Transboundary aspects of air pollution adds spatial disconnect
Pollution generators (e.g. transport, manufacturing, construction, residential solid fuel burning)
Building and transport microenvironment ventilation
The built environment
Built Environment & Complexities of Place
Transport infrastructure - walking streets, connected infrastructure
Location of schools/hospitals/care homes
Urban design
School streets
Housing quality & location
Social Inequalities
Widening social inequalities
POLICY STRATEGY Medical interventions to reduce effects of air pollutants
Behaviour that exposes people to poor air quality
Existing Health & Health Inequalities
Pre-existing Health Inequalities
Lifestyle
COVID
Pre-existing Health Conditions
Local social care economies and sustainability of these
Informal carers
Existing Public & Scientific Knowledge
The challenges of thinking across the life course and later life consequences
Addressing knowledge and acceptance of this link
Fatalism about lifecourse / place-based factors
Limited awareness of AQ impacts beyond lung health (reflecting success of previous campaigns)
Public/citizen knowledge about the issue
Failure to link mental health outcomes to air quality
Public support for air quality improvement aactions
POLICY AGENDA
CORE PROBLEM Developing policy to mitigate air pollution impact on brain health
Health Consequences
Costs to NHS and mental health services
Higher rates of dementia and neurodegenerative disorders
Earl life exposure and cognitive development may impair life course (academic) attainment and economic success
Morbidity and social and costs from individual, family, locality, national, global levels etc.
Social Costs
Labour market participation
HEALTH OUTCOMES
Existing Policies, Strategy & Capacity
Unintended consequences of well intended policies
Participatory planning
Consider trade offs with other health and environmental issues
Policy levers
AQ legislation (outside UK)
Compliance focussed AQ regulatory approaches
AQ legislation (UK)
Investment in AQ improvement actions
Time horizons - e.g. for investment
Cost v benefit
Capacity of local government and communities to address issue
Localised data on air quality
AQ indicators which effectively capture health and wellbeing
Quality of Brain Health Data and Cohorts
Accessability and reliability of sensor data and smart technology on air quality
Quality of Historical Air Pollution Data
Health & Air Quality Data
Priority Area 10. Attaching air pollution to existing brain health strategies and campaigns
Priority Area 11. Providing publicly available data, assessment, and screening tools

Overview

Day 2

- Day 2 will involve a series of break-out, small-group discussions.
- **The first session** will explore, from both an epistemological and practical level, which approaches to co-creation and complexity science might work best together (or not), or critically inform or challenge one the other, including different methods and tactics.
- **The second session** will explore what sorts of research projects or case studies participants could develop to advance the integration of these two approaches to address complex public health problems.


PRSM
The Participatory System Mapper (PRSM) is a free, open-source
and secure tool for mind-mapping and system visualisation

Part 1: Things to consider

- Which approaches to co-creation and complexity science might work best together?
  - Can you articulate what those approaches are?
  - Can you articulate why they work?
- Does the Health CASCADE approach work with systems thinking?
  - If so, how or why?
  - If not, how or why not?
- Which approaches do you think do not work together? And why?
- How can co-creation inform systems thinking?
- How can complexity thinking inform co-production?

Co-creation emerged of late in response to the limitations of science and policy and practice. Those same limitations are often found in the complexity sciences.

How can co-creation address those similar limitations in the complexity sciences?

Given its focus on collective decision making, co-creation struggles with complexity and systems thinking. How can the tools of complexity science help? Be it systems mapping, computational modelling, or network analysis?

Part 1: Things to consider

Co-creation emerged of late in response to the limitations of science and policy and practice.

Many of those same limitations are often found in the complexity sciences and its various approaches, particularly in computational modelling

How can co-creation address those similar limitations in the complexity sciences?

Given its focus on collective decision making, co-creation struggles with complexity and systems thinking. How can the tools of complexity science help? Be it systems mapping, computational modelling, or network analysis?

Part 2: Thinking about your research . . .

- What sorts of research projects or case studies could advance the integration of co-production and complex systems thinking?
- What sorts of health CASCADE research or case studies could be engaged to advance this integration?
- How would these ideas work with different stakeholders?
- What would be the barriers to doing this sort of work?
  - How would you address those barriers?
- What sorts of methods or colleagues would you need to work with?