

What are complex systems evaluations?

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Today I want to move on from giving 'systems evaluation' a hard sell.

Instead I'd like to think more about **what a systems evaluation is**

Based largely on what I and colleagues learned developing Guidance and reviewing existing public health systems evaluations.



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“Consideration of the ways in which processes and outcomes at all points within a system drive change.” (Rutter et al., Lancet 2017)

A recent Lancet article has provided a rallying for public health researchers to think more about systems.

Why?

- Systems approaches can help us understand a complex reality.
- “Traditional evaluations” have limitations when it comes to understanding that reality?

What is a complex system?

Complex system

“a set of things – people, cells, molecules or whatever – interconnected in such a way that they produce their own pattern of behaviour overtime” (Meadows 2008, p.2)

Key attributes of a **complex** system

- ‘produce their own pattern of behaviour’ – i.e. a system is more than the sum of its parts – new patterns can **emerge** from it.
- Self-organising rather than centrally organised.
- ‘over time’ – the system is **dynamic** and time sensitive.
 - The overall system may look stable because changes in one part may be ‘stabilised’ by responses elsewhere.
 - The overall system may transition because changes escalate.
- So complexity is **more than just a tangled set of relationships**. Its about a system that behaves in a certain way.

Note: Although the Foresight map doesn’t directly illustrate all these aspects of complexity, it is still possible to think of a complex, adaptive ‘obesity system.’

Examples of complex systems

Stable system

- Eco-systems (before we ruined them)?
- A hierarchical organisation?
- Socially conservative communities?

Systems in transition

- Eco-systems undergoing climate crisis
- A peaceful protest that turns nasty and becomes a riot.
- Jurassic Park (after it all goes wrong)

Task

Have a go at identifying examples of....

1. A stable complex system
2. A complex system in transition.

Tips

- Don't try and draw a Foresight type diagram.
- Lots of things relevant to health and social policy can be imagined as 'systems': e.g. food system, housing system, poverty system, policy system, etc. Can you think of a system relevant to your work?

Intervening in a complex system

A WELL KNOWN FRAMEWORK FOR LOOKING AT INTERVENTIONS

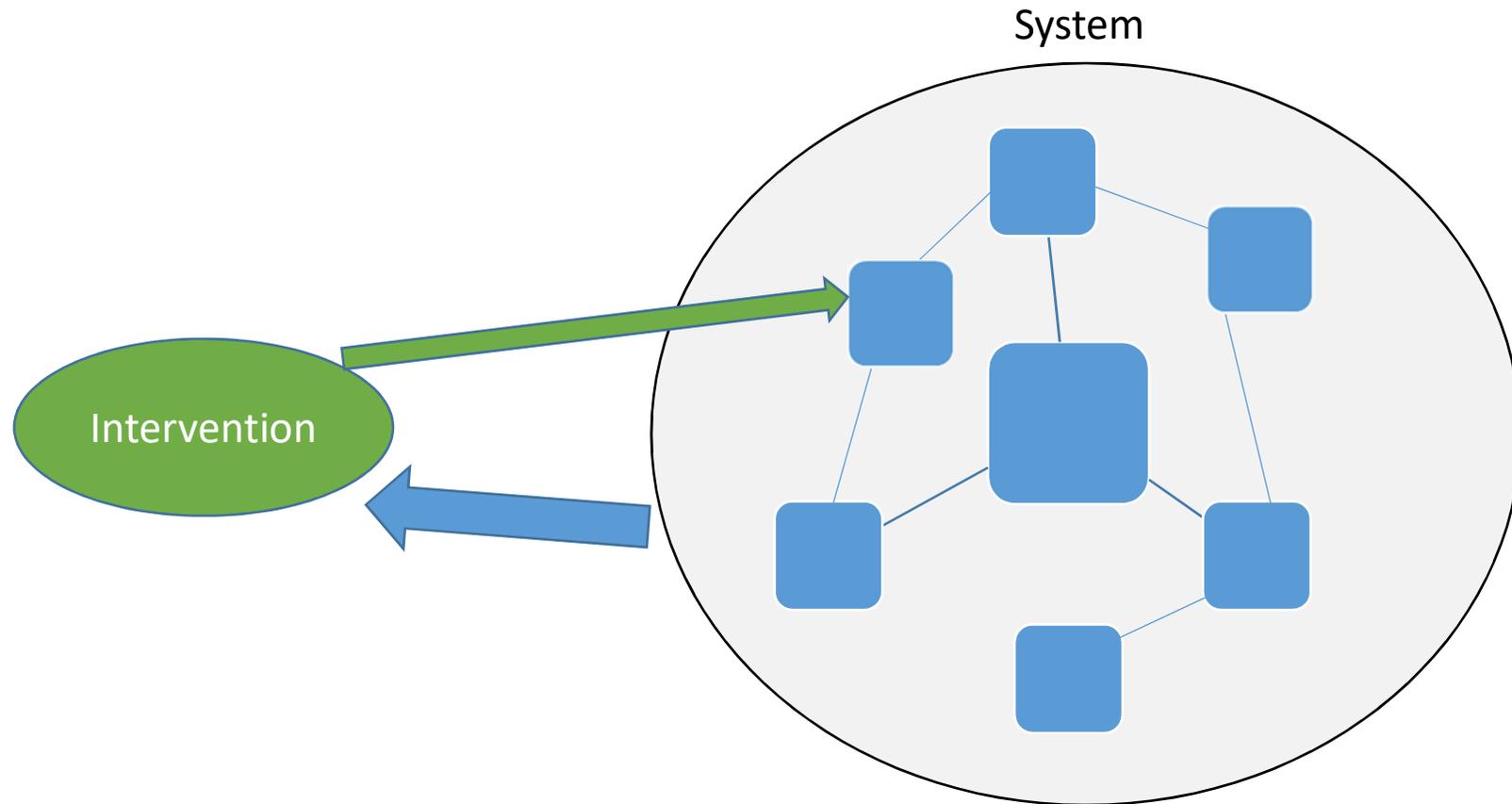
- Simple = baking a cake (easy to follow and replicable recipes).
- Complicated = technological device (hard to do, needs experts, but once mastered can be replicated exactly).
- Complex = raising a child (hard to do, can't be replicated, unpredictable; expertise, luck, personality, context may all play important parts).

But what if we consider complexity as a feature of the system instead of (or as well as) a feature of the intervention?

See Refs on slide 27, especially
-Glouberman & Zimmerman
- Hawe et al.

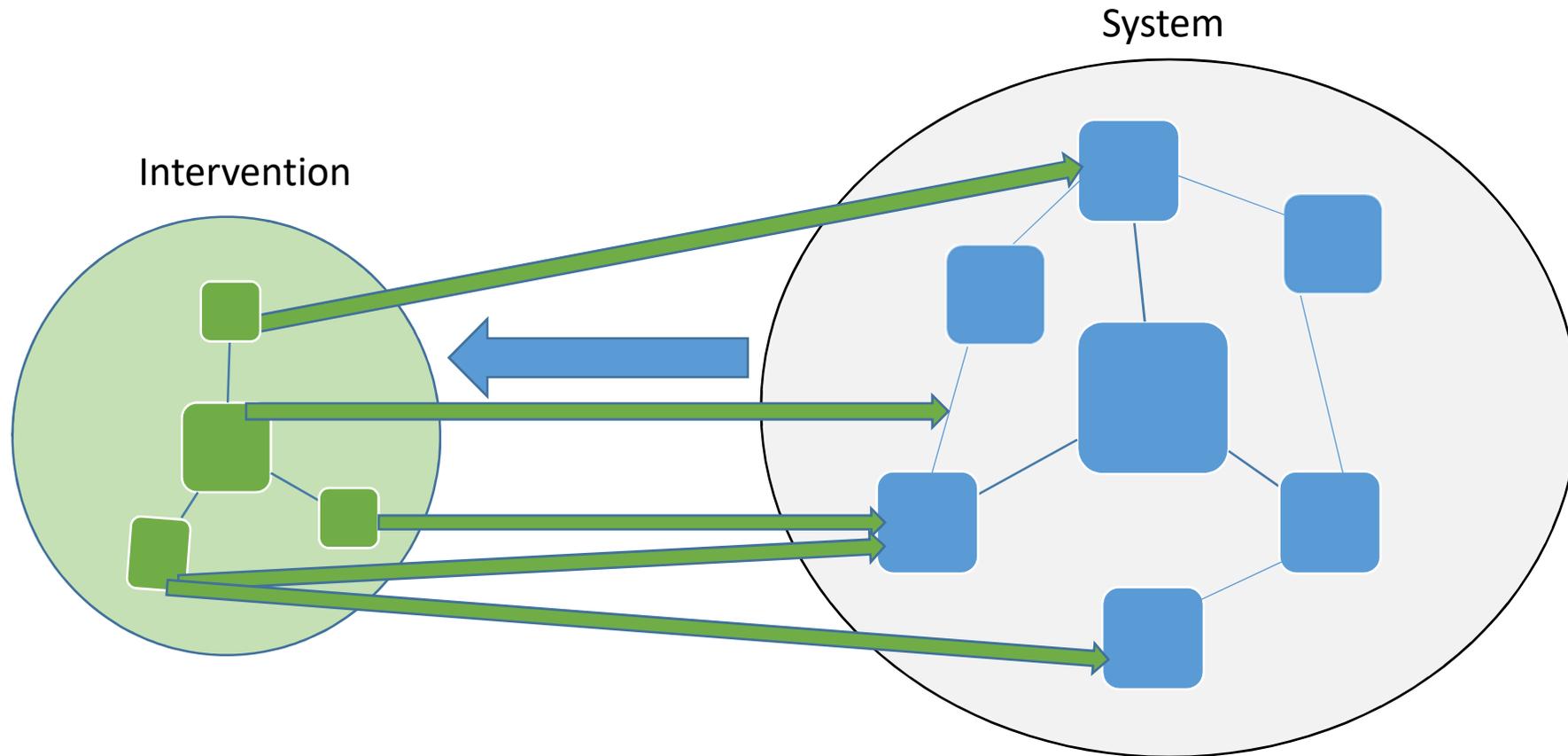
Intervening in a complex system

(Simple intervention)



Intervening in a complex system

(Complex intervention)



What have we learned so far?

- Complex interventions are more than just a tangled set of related factors (though they may be that too)
- Self-organising, dynamic, the whole is more than the sum of its parts.
- Systems may tend towards stability or transition.
- We are used to thinking about simple or complex interventions.
- Complex systems thinking emphasises complexity as a property of the system.
- As such, even simple interventions may have complex consequences.

Street light example



Many towns are dimming their street lamps at nights to save money and energy.

On the face of it, this is a simple intervention. The lights get dimmer.

A simple evaluation might assess impacts on costs and energy use.

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On the face of it, this is a simple intervention. The lights get dimmer.

A simple evaluation might assess impacts on costs and energy use.

Your task is to re-frame this as an intervention in a complex system.

1. Spend 10 minutes thinking about the bigger picture: who and what is affected by street lighting AND/OR might influence street lighting policy.

SIMPLE INTERVENTION

Dimming the lights affects one 'thing' (the lights) in one way (they get dimmer).

COMPLICATED INTERVENTION

The technical challenge of dimming the lights – you can't just turn a dial down.

SIMPLE INTERVENTION WITH COMPLEX CONSEQUENCES

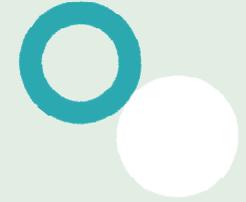
Is it politically acceptable? How do the media and public react? Does it have unintended consequences – traffic and pedestrian injury; feelings of being unsafe, isolation? Increased awareness of environmental issues? Saves money that can be spent elsewhere.

COMPLEX INTERVENTION WITHIN A COMPLEX SYSTEM

Aligning the interests of diverse stakeholders (environmentalists, austerity supporters, media, public) as well as private sector (energy companies) and technical expertise. Mitigating risks, evaluating impacts, seeing how people respond and – perhaps – encouraging other areas to adopt.



Green and colleagues have evaluated street lighting interventions – e.g. see reference on slide 27

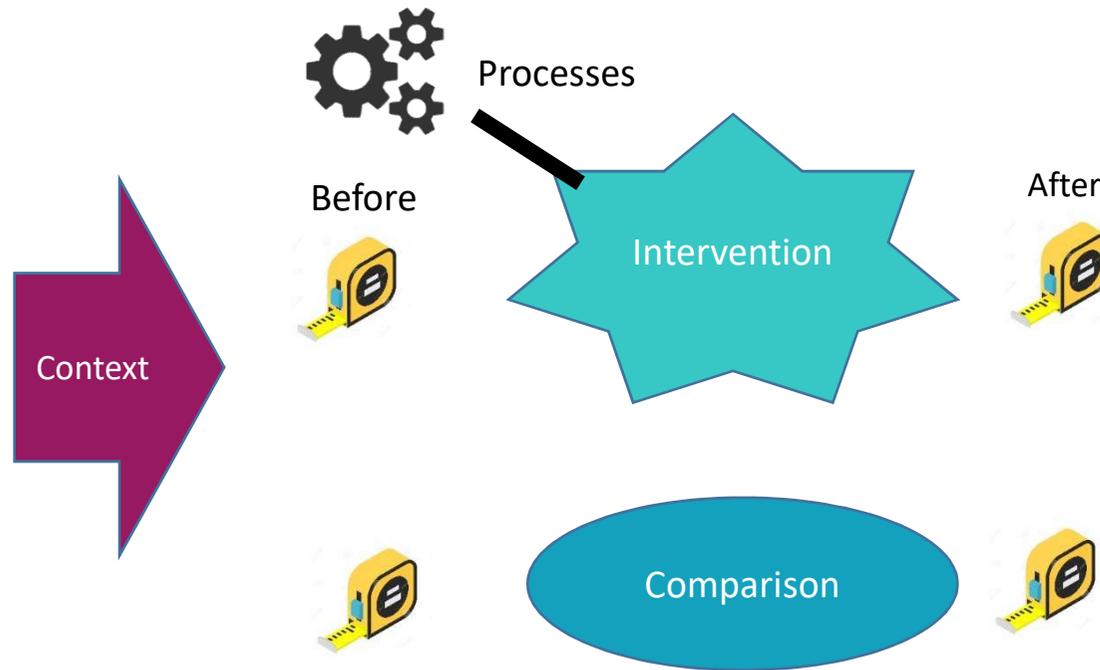


How do you evaluate changes to a
complex system?





Evaluation

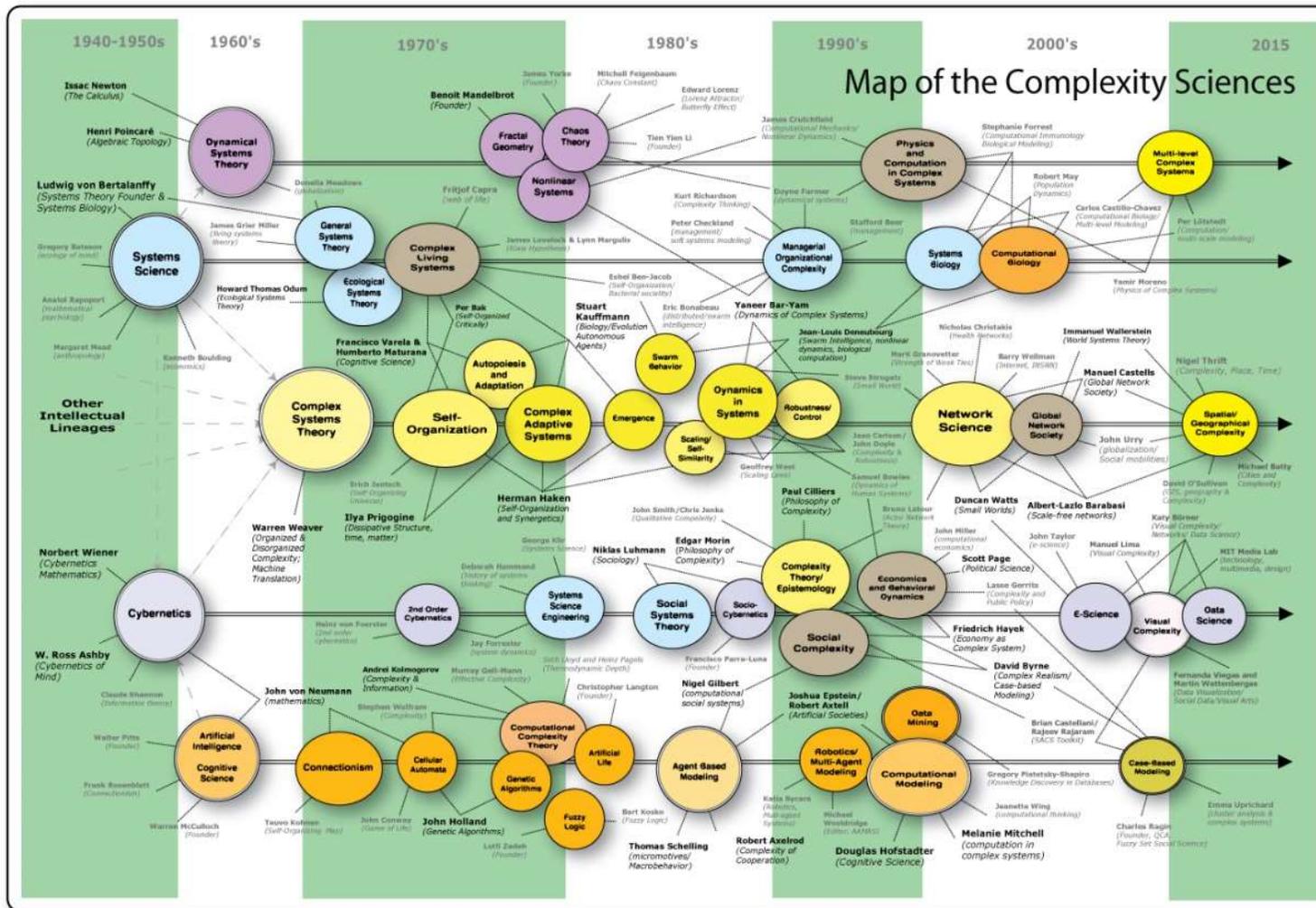


QUESTION	WHEN CAN A TRADITIONAL EVALUATION BE PROBLEMATIC?
What are interventions and are they the norm?	When your intervention has no clear start or end date; or can't easily be disentangled from everything else.
Should we always have primary outcomes?	If you lack compelling reasons for picking a particular outcome as being the most important. (not statistical convenience or funding bodies). Eg. The needs of decision makers or a theory of change.
Do we confuse important with measurable?	When attempts to evaluate bigger, messier public health activities risk being over-simplified or abandoned because evaluators struggle to design robust, affordable evaluations using traditional approaches.
Why place such emphasis on measuring non-replicable 'outcomes'?	Theories about how the intervention has interacted with the wider system *may* lead to findings that are more transferable across contexts.
Do we have to report findings after they have happened?	If an intervention's delivery or its impacts could take years to occur. If the intervention and impacts are hard to reverse once in place and affect many people. Modelling studies can be conducted before or during an intervention.



What research approaches are used
to look at complex systems?





https://www.art-sciencefactory.com/complexity-map_feb09.html

Complex systems: 2 traditions

See: Gates, EF (2016) Making sense of the emerging conversation in evaluation about systems thinking and complexity science. Evaluation and Planning.

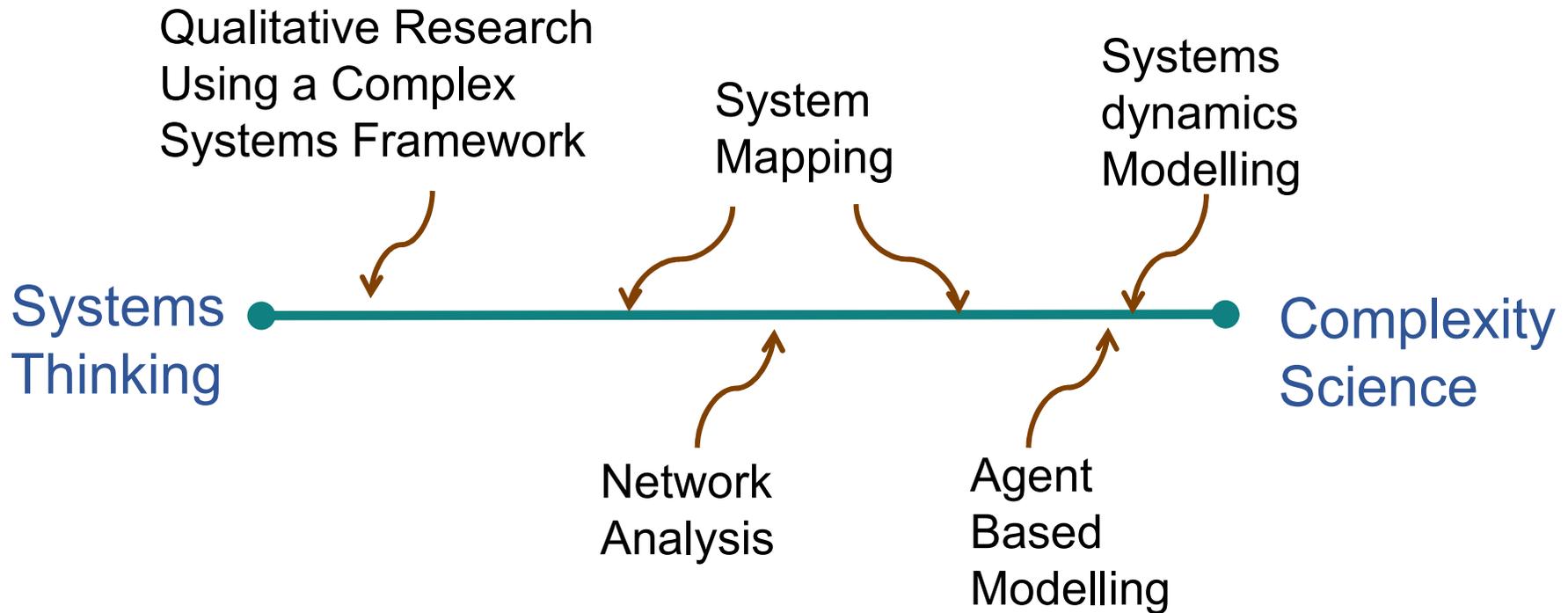
Systems thinking

- Has much longer roots going back to Ancient philosophy: Aristotle, Heraclitus and Lao Tsu
- A collection of theories associated with different disciplines
- Including more qualitative approaches.

Complexity Science

- Developed in the twentieth century
- Strongly influenced by mathematics and uses computational modelling
- Applied to lots of other disciplines like engineering, biological science, economics, social sciences.

We reviewed public health systems evaluations and found 44 studies



1. Starting point often the intervention
2. Sampling wider group of stakeholders
3. Could involve mapping the system
4. Analysis may refer to specific systems theories and frameworks –e.g. Westhorp, Meadows, Finegood etc.
5. Or more adhoc: e.g. micro, local, and national; identifying feedback loops.
6. Compare stakeholder perspectives
7. Focus on events over time
8. Adapt the evaluation over time

Often a hypothetical intervention

Systems dynamics

Systems Thinking

Often an actual intervention

Network Analysis

1. Starting point often an initial definition of the system and its boundaries
2. Formally structured mapping process – e.g. Group Model Building
3. System map made up of variables and causal relationships (e.g. stock and flow diagram).
4. Model the map. Use assumptions or data to give values to each part.
5. Run the model. Try varying specific values to simulate the effect of an intervention or a change in context.

NIHR SPHR SYSTEMS GUIDANCE FOR PRACTITIONERS

- Take a look!

Part 1

https://www.sheffield.ac.uk/polopoly_fs/1.837854!/file/NIHR-SPHR-SYSTEM-GUIDANCE-PART-1-FINAL_SBnavy.pdf

Part 2

<https://sphr.nihr.ac.uk/wp-content/uploads/2018/08/NIHR-SPHR-SYSTEM-GUIDANCE-PART-2-v2-FINALSBnavy.pdf>

- **This Guidance is influenced by the work of many different systems thinkers, and by a review we conducted of previously published systems evaluations. Website links were correct at the time of writing (March 2019). Note some journal articles are open access whilst others require a subscription.**
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 - Whole System Obesity Toolkit (forthcoming). <https://publichealthmatters.blog.gov.uk/2018/07/11/implementing-the-whole-systems-approach-to-obesity/>
 - MRC/CSO SPHSU Updated Guidance on Complex Intervention Evaluation (forthcoming). <https://www.gla.ac.uk/researchinstitutes/healthwellbeing/research/mrccsosocialandpublichealthsciencesunit/programmes/complextivity/complexinterventions/complexint/>
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- Online resources
 - The Centre for the Evaluation of Complexity Across the Nexus (CECAN). *Briefs on methodologies, case studies, and recorded webinars. <https://www.cecan.ac.uk/>
 - Better Evaluation. <https://www.betterevaluation.org/>
 - Scriptapedia <https://en.wikibooks.org/wiki/Category:Book:Scriptapedia> (includes guidance on group model building and causal loop diagram workshops).
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- Free online courses
 - Open University. Systems thinking. <https://www.open.edu/openlearn/science-maths-technology/engineering-technology/systems-thinking-free-courses>
 - John Hopkins University (Coursera). Systems thinking in Public Health. <https://www.coursera.org/learn/systems-thinking>
 - Santa Fe Institute. Complexity Explorer (Known for the study of Complex Adaptive System (CAS). Offer a variety of free and paid courses (including advanced courses)) <https://www.complexityexplorer.org/>
 - Mapping software (Includes a mixture of free, free trial period, and priced software. Our sub-headings are only indicative, based on our impressions, and some software can be used for more than one purpose).