Complex or worse?

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"Complexity" and "Complexity science"

We will focus on society and its interplay with the environment...

But the argument generalizes well to e.g. natural history and ecosystem evolution.

Society is full of "complex problems":

- Climate change
- Geopolitical conflicts
- Development issues
- Equality

How can CAS contribute here?
How can CAS contribute?

The lessons from this lecture:

- **CAS contributes an essentially important tool** to the study of society and its interplay with environment.
- Society and environment has a type of complexity that mainstream CAS is not sufficient **in itself** for addressing.
- CAS must be synthesized with other types of approaches: **this is an interesting transdisciplinary challenge in itself**.
- This also helps us **understand CAS in the context of other approaches**.
- Societies and ecosystems (under innovation/evolution) represent an interesting **class of systems** that we tend to refer to as "complex" in need of more attention.
How are complex societal and environmental problems tackled today?

A number of basic approaches used over the years for understanding and steering what goes on in society.

Let’s divide them into narrative theory, systems-based and analytical models and theories.

Let’s look at what these are good at and what they’re not so good at!
Narrative-based approaches

The hallmark of the humanities, originates in philosophy and is very old: it’s really about **formalized and disciplined reasoning**.

We basically use trained cognitive capabilities as our tool when we do this.

**Histories**: contingent and qualitatively heterogeneous factors spin out a unique history...

Histories are ardously **dug up, organized, retold, analyzed, generalized**...

Consider major sociotechnical transitions: e.g. automobility, electrification, nuclear power, computers... Many examples... **But still a rather limited set!**

Each have only one unique historical instance: generalization from a small number of highly specific histories.
Pros and cons with narrative interpretation

How would we quantify the emergence of automobility? It’s a story... It is a narrative!

But narrative interpretations produce any number of perspectives... How do we validate and choose?

We can take perspectives based on different types of processes and effects: e.g. innovation, economic growth, welfare, power...

We can use different theoretical/ideological lenses: e.g. liberal, Marxist, national, gender and so on.

There is really no way to produce the sort of unique "correct" interpretation that positivist science likes to see as definitional of science!

We are cognitively impaired when it comes to conceptualizing and analyzing mass dynamics: our intuition for the CAS type of systems is very poor!
Systems-based approaches

Stricter way of dealing with systems of heterogenous and functionally powerful entities that must be qualitatively described.

What does a computer component do? Its description is a mix of qualitative and quantitative information that allows us to piece it into wholes.

Engineering – for example – is strongly based on systems thinking: **we put specialized pieces together into an emergent whole.**

Systems science conceptualizes systems like societies and ecosystems **like machines really.**

Allows us to use at least a limited set of **stricter analytical approaches** to the analysis and representation of societal and environmental systems.

Systems science was big in the post-War era of the 20th century! **Social engineering would finally allow us to construct a society based on science and reason!**
Pros and cons with systems approaches

Systems theory deals with dynamics in **ontologically fixed** systems.

Allows us to build really powerful machines and organizations!

But innovation produces cascades of emergent effects... altering the premises of the plan over time...

Systems approaches are **very poorly equipped to deal with innovation**... Which unfortunately **cripples it in relation to societal systems**!

The best-laid plans, by mice and men, often go awry

But Mousie, thou art no thy lane, In proving foresight may be vain: The best-laid schemes o' mice an' men Gang aft agley, An' lea'e us nought but grief an' pain, For promis'd joy!

- Robert Burns, “Tae a mouse” 1785
Analytical/linear quantitative approaches

Allows us to "do science" on society.

- Analytical models, such as in neoclassical economics, micro and macro... Laws of society.
- Statistical analyses (linear regression etc.)

This is typically what we (and policymakers) are presented with...

Produces output in highly accessible and actionable formats.
Pros and cons with **analytical/linear** quantitative approaches

Imposes a strong bias for what we have **measures** for!

Important to develop new ways of quantifying things...
But is this a vain pursuit?

Strictness produces an **illusion of control**

Lacks all provisions for dealing with qualitative change: the future becomes a simple extrapolation.
Complexity Science

Lately – from the 1980’s – we also have complexity science.

But complexity science has not really lived up to its high expectations either either!

To be provocative: Complexity science – in relation to societal systems – is well into the stagnation phase
Pros and cons with CAS

Contributes an essential capability to deal with mass dynamics!

But... it excels at systems with many similar entities and where the emergence that we study is simply patterns in those entities.

CAS is as focused on bottom-up as Systems Science is focused on top-down!

This works splendidly for crowds, disease spread, bird flocks and such...

But for societies... The breakthroughs have not appeared!
So what’s the problem?

The problem seems to be that no single approach has all the answers.

Now we may raise a fuzzy call for everybody to ”work together”!

That’s nice and all – but how do we do it?
Exploring a very basic question

On this background – exploring what type of system humans societies are appears to be timely!

It’s a “complex system” – but this doesn’t appear to be specific enough!

We employ a framework developed by the group over the past years [1]

An abstract question – but a relevant one

- Choice of models?
- Limitations of existing approaches?
- Steering society in socially and environmentally desirable directions?
- Finding out what those directions are?
- What new approaches may we need?
- ...

Why are societal systems so theoretically challenging?

The starting point for this exploration will be: Societies are complex
Human societies are complex systems!

Little more than a truism?
Does it mean anything?
Does it entail anything?
Komplext

Enkelt
Complexity — Large numbers of simultaneously interacting entities giving rise to emergent (often surprising) patterns

Complicatedness — Systems, typically with some function, with an organization that demands lengthy descriptions to specify

We have powerful ways of dealing with both - so in which one of these senses are societies complex?
An emergent combination between complex and complicated different than its components!

So – why ”Wicked”?

Where does it come from?
Why is it important?
Internal critique against systems theoretical research[1][2]

Starvation, climate change, geopolitical conflicts, social disenfranchisement, corruption and so on

Just about all major problems besetting the world

Wicked Systems generate Wicked Problems.

Let’s first map some systems into the Wicked Diagram...
...then approaches

Many similar entities, interacting in parallel.
Organization is directly tied to the dynamics: evaporates if dynamics ceases.

A mixture between complex and complicated
Ephemeral and inert organization blend together

Many different (specialized) entities acting in parallel.
Organization is much more weakly tied to the dynamics of the system.
The "comfort zones" of basic approaches...

- Systems based theories extend from analytical models.
  - Boxes and arrows – dynamics in a system
  - The boxes and arrows do not change run-time.

- The weapon of choice in the humanities
  - Can at least do something here...
  - Systematic reasoning and storytelling

- Relies heavily on computer simulation
- Focuses on emergence (macro) from a single-level dynamics (micro)
- Relies on finding key parameters
  - E.g. Neoclassical economics, rational choice theory...

Simple relationships (analytical/statistical)
- Systems based theories extend from analytical models.

Complexity Science
- Analytical models
- Systems based theories

Narrative theory
- Wicked
- Complicated
- Simple
Transforming problems into zones of comfort

- Emphasizes complexity
- Cuts complicatedness
- Self-organization based steering approaches

- Simple relationships (analytical/statistical)
  - Cuts away both complexity and complicatedness
  - Steering by key parameters – prime movers of society

- Emphasizes complicatedness
- Cuts complexity
- Engineering-like approaches based on prediction and control

Casting systems:

Complex

Wicked

Complexity Science

Analytical models

Systems based theories

Simple

Complicated
But how about a complexity approach without cutting complicatedness?

Adjusting formal theories towards "realism"

Why hasn’t this worked?
Simon’s ”near-decomposability”

We can formally model systems that conform to a certain set of criteria

Simple, complex and complicated systems do – Wicked systems don’t!

...can be understood over ”the short run”

The short run...

...is the time scale over which these ontological assumptions are valid.

There may or may not be a relevant short run.

**Traffic**

**Seconds**
Only the internal environment dynamics moves – the objects of interest do not move in a relevant way

**Hours**
Good “short run” – outer environment remains fixed, and internal environment dynamics can be expressed in terms of behavior of the vehicle

**Years**
The outer environment may change dramatically, and for reasons that are not understandable within the modelled dynamics
Wicked Systems are "Poorly Decomposable Systems"

In general hard to "cut the system" without cutting across important interactions

There are no short runs in the general case
Mixing formal approaches to go Wicked?

Works not because of complicatedness...
Works because a lack of complicatedness

Works not because of complexity...
Works because of a lack of complexity
The genesis of Wicked Systems

Let’s briefly investigate two questions about adaptive systems:

1. How they arise?
2. How they are maintained?

We begin with the more well-behaved complicated systems:

Artifacts and organisms
Complicated Systems

- Entities have a distinct life-cycle
- Assembly/development phase clearly separated out from the use/life phase
- After assembly/development the system remains ontologically inert
Top-level normal functionality

- Ecological niche
- Intended area of use

Components slaved

Entities serve only internal functions relative to the overall function of the system.

- Nuts & bolts, circuits, subroutines, engine parts
- Hearts, liver cells, skeleton
- Accounting department, equipment

To the extent that they have their own agendas – e.g. people in organizations – complicated system becomes unstable, in need of explicit mechanisms for aligning the agendas of parts to that of the overall system:

- Police, legal systems, intelligence services (society in the guise of a top-down state)
- Immune systems vs. cancer
- Anti-virus systems vs. viruses, malware etc.
- Values, goals, themes in organizations
- Line of command, discipline, drill in military organizations
Complicated systems are dominated by symbiotic interactions

The parts have no separate agendas

The system may adapt to be adaptable “in peace”

Near-decomposability is an adaptation for adaptability and ease of construction
Wicked Systems are not adapted for adaptability or transparency

No discernable phases of construction, use, maintenance ...
It’s all tangled up into a single developmental evolutionary process

No top-level functionality
More like arenas for complicated systems

Components not slaved
Entities have their own agendas

Symbiotic relations exist, but also other modes of interaction:
Parasitism, Competition, Commensalism, Amensalism...

Policy: adapting a system that wasn’t designed to be adaptable!

Worse than complex

In a *complex* system we can at least assume the rules of the game to remain stable – we can focus on the states.

In a *wicked* system – the very *rules* of the game change on the same time scale that the states change.

Societal systems are thereby ”worse than complex”

Can we even in principle deal with this?
Policy and science for Wicked Systems?

We tend to understand and steer them as simple, complex, or complicated systems.

Understanding them as Wicked Systems is more easily said than done.

The first task – really – is to build a better understanding of how these systems work.

But some thoughts from our work over the past years...
We should change our expectations on policy and science

Realize that we have no idea even what the objects of our model should be.

Not just an empirical problem! (hard to measure)

**More importantly:** The system *keeps changing* unpredictably as a result of our actions
Constantly *monitor* the unfolding of society

If we can’t *predict*...

...we must constantly *find out*, and

...dynamically *use* what we find out

Chanelling information between the bottom and the top...

Explicitly experiment and evaluate!

"Herding" may be a metaphor for policy in wicked systems
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