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Complex systems studies and predictability of sociopolitical phenomena

Futures of a Complex World
12-13 June 2017, Turku, Finland

ASSUMPTIONS OF THE PRESENTATION

Complex World?
Risk Society?
Radical Uncertainty?
Predictable Surprises?
Imperfect Knowledge Economics?
ASSUMPTIONS OF THE PRESENTATION

“Hidden Order” (Holland 1995)

“Harnessing Complexity”  
(Axelrod and Cohen 1999)

“Order out of Chaos”  
(Prigogine and Stengers 1984)

“Understanding Complex Organizations”  
(repeated in various contexts), etc.

Imagination of readers curious about the causes and consequences of the financial turmoil was mesmerized by such creatures as “Black Swan” (Taleb 2007) or mysterious “Dragon King” (Sornette 2003, 2009)
ASSUMPTIONS OF THE PRESENTATION

Modern social sciences are becoming as intricate as physics, chemistry, etc.

The old divide between „easy” studies of Nature and „difficult” studies of society are well-known but at present it has received new impulses.

A new factor: synthesis of advanced qualitative (verbal studies) with operationalizations including advanced mathematical modeling – econometrics and econophysics.

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ASSUMPTIONS OF THE PRESENTATION

Are we able to predict the future socio-economic phenomena thanks to enhanced epistemological/methodological capabilities?

Can the limitations of prediction of socio-economic phenomena be at present better identified than in the past?

Can we use the identifiable limitations of prediction as a source of improvement of prediction?

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ASSUMPTIONS OF THE PRESENTATION

A middle-of-the-road epistemological level

(Uutilitarian approach)

The aim of the presentation/paper/project is to assess whether ideas depicted as complex systems studies can be helpful in a better understanding of prediction and of its limitations in social sciences.

Novelty of the proposed approach – a deeper understanding of limitations allows for better understanding and improving of prediction.

X“Complexity theory” would be premature
Definitional remarks

Prediction vs. forecasting

„Scientific” prediction vs. „common sense prediction”

Contingent prediction, (conditional prediction) “if, then”

Non-contingent prediction - future events

are depicted in a straightforward manner

Sense of prediction (forecasting)

Mathematical modelling – historic data

Constructivist approaches – reflection about reflection about the future (individual and collective)

Social sciences – synthesis of the two above approaches
Two approaches to prediction with mathematical models

A priori model and search for phenomenological interpretations – physics, chemistry, (theoretical economics?)

Building a “central metaphor” guiding the cognitive process. The metaphor can be decomposed and subsequently, parameters can be operationalized as to enable further research – description, prediction, etc. (Central metaphor results from experiments or theories)

The two above approaches are in fact (almost) similar

Examples of central metaphors: social system as machine/chaotic system/beehive/learning system, etc.

Equilibrium, stability, turbulence

Is the ideal market or axiomatic approach to economy aprioric or based upon external inspiration – physics?

Different central metaphors lead to various interpretations/meaning and to different patterns of control
Prediction can be interpreted as a selection of one world from infinite number of “potential worlds” which can emerge from any given set of circumstances

Prediction as search for regularities

What about causality?

Causality is interpreted as objective when proved with logical or empirical evidence

At the same time causality has also an intersubjective character. Observers (participants) agree that a specific course of events has led to a specific outcome although it is not certain whether both cause and effect are unique and cannot be replaced
Prediction in physics

(quantum mechanics excluded)

1. Identification of system – elements, interactions, borders
2. Identification of representative parameters (characteristics)
3. Patterns of change – micro- … and macro-level and their relationships
4. Search for invariants – can also be dynamic
5. Possibility of „brute force” – number crunching

Prediction of nodal points (patterns of change):

(1) connector points, which interpose one into another type of process;
(2) branch points, foreclosing certain possible lines of development;
(3) jump points, creating a new horizon of possibilities;
(4) saddle points, inducing stasis or even regression;

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Nodal points, cont'd:

(5) break points, actually consisting in or substantively contributing to a rupture of social structures and/or their constellation in a totality;

(6) trigger points, initiating or powerfully augmenting such a transformative process;

(7) predisposing points, securing the satisfaction of the enabling conditions for such a process, e.g. the inception of a (tendentially) auto-subversive tendency.

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Changes, no matter whether positive or negative.

Known and predictable

Known but not predictable

Unknown, sometimes even unthinkable

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Predictions are, essentially, *linguistic artefacts*

**Metaphors**

**Metaphorless ideas, e.g. information, knowledge**

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**Language game (s):**

- Society
- System
- Complexity
Three approaches to social/economic systems:

1. **Objective** – risk, threat, equilibrium, etc.

2. **Subjective (constructivist)** – risk, threat, equilibrium, as an “act of speech” (performative utterance)

3. **Intersubjective** – search for (negotiated) meaning), acceptable, allowing for efficient communication
THE CHALLENGE OF COMPLEXITY

What is complexity – about 45 definitions?

„Hard” complexity

„Soft” complexity

ASSUMPTIONS OF THE PRESENTATION

Complex world – what is new?

New sources of complexity:

- increased amount of information
- increased demand for assignment of meaning – the core feature of modern society
- enhanced technical capabilities to deal with information
- improved methods of prediction
„Hard” complexity - mathematical models:

artificial life, attractors, bifurcations, co-evolution, edge of chaos, spontaneous self-organization, learning, fractals, power law, self-organized criticality, instability, irreducibility, adaptability, far-from-equilibrium-states, scale-free networks

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„Soft” complexity:

analogies and metaphors deriving from mathematical models along with qualitative ideas of complexity, e.g. concepts of Niklas Luhmann

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Social systems are characterized by the presence of all sources and types of complexity

Human systems are

“Complexities of complexities”

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Epistemological barriers of prediction in social sciences

1. Consequences of non-linearity:

- sensitivity to initial conditions (small cause-big effect), the famous “butterfly effect”
- limitations of mathematical modelling – sensitivity of parameters to small errors
- limitations of measurement
- impossibility of decomposition

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Epistemological barriers of prediction in social sciences

1. Consequences of non-linearity, cont’d:

- Identification of non-linearity allows for resigning from searching for regularities
- Search for regularities

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Epistemological barriers of prediction in social sciences

2. Social systems are both cognitive constructs and composition of tangible elements

Taking into account the intangible aspects of social systems any research faces the barriers of self-reference, recurrence, etc., Even assuming a simplification that a social system can be described with relevant parameters, there is always a barrier of their relevance and measurement. Since it is not always possible it can be concluded that prediction is impaired already at the stage of system identification

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Epistemological barriers of prediction in social sciences

3. Inherent limitations of mathematical modeling going to the very foundations of mathematics

Works by Chaitin (2001) (Kolmogorov or Chaitin complexity of the prediction problem – the length of the shortest programme that generates the prediction (taking the program to include the initial data as well as the instructions), and Wolfram (2002) (Computational Irreducibility).

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Epistemological barriers of prediction in social sciences


Taking in a simplified way, by putting stress on subjectivity, intersubjectivity and discourse, post-modernism denies any possibility of prediction – only the discourse on possible worlds.

Future as a cognitive/social construct

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Sociopolitical barriers of prediction in social sciences

1. Increased complexity of modern society (risk society, increased unpredictability of consequences)

2. The “financial crisis” - why the unthinkable is becoming unthinkable due to sociopolitical reasons?

Epistemological barriers of prediction in social sciences

7. Self-delusion – the “boiling-frog parable” (Senge 1990)

8. Limitations of reasoning – bounded rationality, “prospect theory”, “framing” - behavioural economics

9. Ignorance referring to the present and to the future (uncertainty)
Sociopolitical barriers of prediction in social sciences

3. Barriers to innovative thinking - distribution of innovation

4. Political aspects of social discourse – political correctness, dominant trends, conformism

   Politically correct worst case scenario?
   Market for optimistic/pessimistic scenarios?
   Ethical/unethical scenarios?

5. Information asymmetry/uneven knowledge

I is easy to come to the conclusion when reading the works in politics, IR, economics and finance that the so-called empirical basis of research, and alas, theoretical generalizations, are in most cases based upon openly available sources – media, reports, etc.
Sociopolitical barriers of prediction in social sciences

6. Ignorance

A. Ignorance refered the present conditions
B. Ignorance about future (uncertainty)
C. Second level ignorance – concerns methods of description and analysis
D. Complexity as self-awareness of ignorance

Conclusions:

Traditional prediction – physics as a source of better instruments of prediction usually based upon sophisticated models, improved availability of data, enhanced computational capabilities
Conclusions:

A new approach to the use of complex systems in prediction in economics, finance and management

- better understanding of limitations – more accurate predictions - less errors
- deeper epistemological background of prediction
- improved understanding of the discourse in social sciences
- models deriving from physics as a source of knowledge and influence in policy making

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Conclusions:

- better understanding of intersubjective discourse, performative utterances and physics-based reasoning
- heuristic inspiration for predictions – enrichment of vocabulary (Complex Adaptive Systems)

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Further research:

1. Search for "hidden patterns"?
   (a deeper understanding of social systems and of physics/mathematics)

2. Studies of cognitive and social mechanisms influencing predictions and scenarios

Thank you for your attention!