Thesis Progress Meeting

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Achieved Work (by projects)

- Biblio [0.2w]
- Meetings/Seminars/Organisation [0.5w]
- Cybergeo Project [1w]
- Synthetic Data/Density Model [0.5w]
- Technical : OpenMole and Genetic Algorithms [0.4w]
- Theory construction [1w]
- Monitorat [2,4w]

Theoretical Framework

Construction of a theoretical framework at a high abstraction level, to try to capture driving questions and intuitions in various projects done until now.

→ **Not yet** a thematic geographical theory or theoretical positioning, but it is supposed to be the direct next step : application of the meta-theory yields theories.

→ Aims to capture structure of *models of socio-technical systems* from an epistemological point of view.

→ Not a theory of systems (like cybernetics, synergetics, systems of systems, etc.) nor a meta-modeling framework for complex systems nor a general epistemology of systems.

Objectives

The theory must explicitly include :

- a precise definition and emphasis on the notion of coupling between subsystems, in particular allowing to qualify or quantify a certain degree of coupling : dependence, interdependence, etc. between components.
- a precise definition of scale
- a precise definition of what is a system.
- the notion of emergence in order to capture multi-scale aspects of systems.
- a central place of ontology in the definition of systems, i.e. of the sense in the real world given to its objects
- heterogeneous aspects of the same system, that could be heterogeneous components but also complementary intersecting views.

Theory Summary

→ Starting from a perspectivist approach to science [Giere, 2010], a system is the superposition of perspectives on it, that are dataflow machines [Golden et al., 2012] with ontologies [Livet et al., 2010].

→ Compatible notions of *emergence*, nominal and weak emergence [Bedau, 2002], yield pre-order relations on ontologies.

→ An ontological graph is constructed by induction.

→ The graph can be mapped to a minimal tree (directed forest), that captures a hierarchical structure of the system regarding emergence. "Strongly coupled" subsystems are encoded within nodes of the tree.

Theory Construction

See Working Paper for detailed construction of the theory

Theory Applications

Direct applications that will be looked at in next steps :

- Positioning regarding classical definitions of geographical systems (e.g. [Dollfus and Dastès, 1975]).
- Simple examples ; clarification and guidelines for application. In particular for our thesis, proposes definition
- Definition of co-evolving subsystems.
- Link with Multi-Modeling framework [Cottineau et al., 2015]

Positioning within our thesis I

1. The perspectivist approach implies a broad understanding of existing perspectives on a system, and of possibility of coupling between them ; thus an emphasis on applied epistemology, i.e. **Algorithmic Systematic Review**, **Disciplines Mapping** and **Datamining for Content Analysis**.

2. At a finer level of particularization, the knowledge of perspectives means **Knowledge of stylized facts**, i.e. empirical analysis of cases studies.

3. The emphasis on coupled subsystems at different scales implies a deep understanding of coupling mechanisms, thus the need of methodological and technical developments : **Methods for Statistical Control**, **Methods for Model Exploration**, **Theoretical Study of Coupling**, **Multi-Modeling**, etc.

Positioning within our thesis II

4. Furthermore, the possibility of hidden elements within the ontology implies the test for causal relations and intermediate processes at the origin of emergence (thus e.g. the exploration of new paradigms such as role of governance).

5. Finally, the idea behind system structure contained within the ontological forest is a large set of coupled models for a given system : it means that a proper system definition (i.e. thematic problematization and exploration) and construction should yield to a structured family of models : parallel branches can be different implementations of the same process or various processes trying to explain the emerging ontology ; therefore the final objective of a family of models tackling the thematic question.

Next steps (until January 2016)

- Develop theory applications and examples [1w]
- Construct the thematic problematization within the theoretical framework [1w]
- Correlated Synthetic Data : exploration of network generation [0.5w]
- Cybergeo [0.5w]
- Monitorat 1w

References I

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Downward causation and the autonomy of weak emergence.
Principia: an international journal of epistemology, 6(1):5–50.

Cottineau, C., Chapron, P., and Reuillon, R. (2015).
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Dollfus, O. and Dastès, F. D. (1975).
Some remarks on the notions of 'structure'and 'system' in geography.
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Giere, R. N. (2010).
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University of Chicago Press.

References II


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Applied Mathematics and Computation, 218(16):8039–8055.


Livet, P., Muller, J.-P., Phan, D., and Sanders, L. (2010).
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