A Reflexive Theory for the Study of Socio-Technical Systems

Working Paper

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Abstract

Introduction

The structural misunderstandings between Social Sciences and Humanities on one side, and so-called Exact Sciences on the other side, far from being a generality, seems to have however a significant impact on the structure of scientific knowledge [Hidalgo, 2015]. In particular, the place of theory (and indeed the signification of this term itself) in the elaboration of knowledge has a totally different place, partly because of the different *perceived complexities*[1] of studied objects : for example, mathematical constructions and by extent theoretical physics are *simple* in the sense that they are mostly entierely analytically solvable, whereas Social Science subjects such as humans or society (to give a *cliché* exemple) are *complex* in the sense of complex systems[2], thus a stronger need of a constructed theoretical (generally empirically based) framework to identify and define the objects of research that are necessarily more arbitrary in the framing of their boundaries, relations and processes. These differences in backgrounds are naturally desirable in the caleidogram of science, but things can get nasty when playing on "common" terrains, typically complex systems problematics as already detailed, as the exemple of geographical urban systems has recently shown [Dupuy and Benguigui, 2015]. Complex System Science[3] is seen by some as

Objectives

Construction of the theory

Perspectives and Ontologies

The starting point of the theory construction is a perspectivist epistemological approach on systems [Giere, 2010]. To sum up, it interprets any scientific approach as a perspective, in which someone pursues some objective and uses what is called *a model* to reach it. The model is nothing more than a scientific medium. Varenne developped [Varenne, 2010] model typologies that can be interpreted as a refinment of this theory. Let for now relax this possible precision and use perspectives as proxies of the undefined objects and concepts.

[1] We used the term *perceived* as most of systems studied by physics might be described as simple whereas they are intrinsically complex and indeed not well understood [Laughlin, 2006].

[2] for which no unified definition exists but of which fields of application range broadly from neuroscience to quantitative finance, incuding e.g. quantitative sociology, quantitative geography, integrative biology, etc. [Newman, 2011], and for which study various complementary approaches may be applied, such as Dynamical Systems, Agent-based Modeling, Random Matrix Theory

[3] that we deliberately call that way

Indeed, different views on the same object (being complementary or diverging) have the property to share at least the object in itself, thus the proposition to define objects (and more generally systems) from a set of perspectives on them, that verify some properties that we formalize in the following.

A perspective is defined in our case as a dataflow machine M in the sense of [Golden et al., 2012], to which is associated an ontology O in the sense of [Livet et al., 2010]

Definition 1.

Application : co-evolution of subsystems

Discussion

Conclusion

References

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