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From Hardware to Hardcore:
Formalizing Systems with Form Theory

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ABSTRACT

The state and relevance of Systems as a field of research and a specific form of scientific inquiry into complex real-world problem situations, can be enhanced significantly by developing and applying more formalized and coherent tools: a new 'hardware' enabling to build a new 'hardcore' for systems science. The basis of this new hardware stems from a line of thought emanating from George Spencer-Brown and the 'Laws of Form', running through the work of Francisco Varela and his calculus for self-reference, being radicalized by Niklas Luhmann and his views on 'Social Systems', and continued by Dirk Baecker with the application of form theory to management and organizations. In this contribution, the author develops an understanding and appreciation of the potentials of a form-theoretical approach to formalizing systems (real-world phenomena) as well as Systems (field of research). Central aspects will be the power of the form-theoretical hardware as regards systems storytelling, systems diagnostics and abductive reasoning.

KEYWORDS

Form Theory, Laws of Form, Second-Order Cybernetics, Systems

1. POINTS OF DEPARTURE

Some years ago at an UK System Society meeting in Oxford, Peter Checkland was arguing that systems theory just about struggles on. Surely, he added, the field of Systems (with a capital S) had been institutionalized within university departments and courses are taught dedicated to systems theory and practice; but in Checkland's view there appeared to be a certain stagnation both within Systems and with its acceptance across disciplines. In listening to his remarks, one could not help but feel a certain resignation in his voice. By remembering Checkland, we did a quick Google Ngram search on the terms 'system' and 'systems' in order to check for any signs of 'peak system' and a potential decline in references in published books. The results are sobering. You do actually notice a peak of both terms at around 1990 and a slow but steady decline afterwards. The term 'systems theory' peaked at around 1980 and remained somewhat on a plateau until the mid-1990s. Since then it fell back in its prominence to mid-1970s levels. For 'soft systems methodology', Checkland's own creation (Checkland, 1999), the peak occurred in the late 1990s followed by continued decline ever since. Quite interestingly, the hard system approach of 'system dynamics' remains on a high plateau as regards references since the 1990s and even shows some increase since the mid-2000s. Needless to say that all of these terms are dwarfed by more common managerial concepts like 'strategy' or 'marketing'. By these admittedly crude and quantitative measures, but substantiated by the observation of one of the most eminent researchers within the Systems community, Systems as a field and its associated notion of systems theory is increasingly looking like a niche product for connoisseur scholars.

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The peaking of concepts and ideas is not the end of the world and a normal process in the evolution of science. However, the initial promise of systems research, providing a unique conceptual lens for addressing complex real-world problems, is probably more in demand in our age than ever before. Messy and intertwined problems like climate change mitigation and adaptation, managing the digital transformation of economy and society, as well as finding a new global governance framework in a time of resurgent nationalism and authoritarianism, defy classical predict-and-control approaches in the fields of economics or political sciences. Systems understood as a post-classical approach i.e. not bound to a single discipline (e.g. economics) and a single rationality (e.g. rational choice), must not be abandoned in the light of these challenges. In this contribution, we will argue for the need for more formalization within systems research and more rigour – yet also for increased playfulness within a formal framework we call the 'hardware' of systems research. We propose a certain tradition of system thought emanating from Francisco Varela's work on a calculus of self-reference (Varela, 1975) that was based on George Spencer-Brown and his 'Laws of Form' (Spencer-Brown, 1969). This tradition continued with Niklas Luhmann in his theory of social systems that he based firmly on the grounds of second-order cybernetics (Luhmann, 1995) and culminated in the form-theoretical reconstruction of management and organization by Dirk Baecker in his 'Form of the Firm' (Baecker, 2006). Some insights from our own work (Reichel, 2011, 2017) will be re-evaluated in the light of what we call an emerging form-theoretical approach to systems storytelling, constituting a new 'hardcore' of systems theory and research.

2. THE ARGUMENT FOR FORMALIZATION OF SYSTEMS

Systems as a field of science apparently knows no singular form, neither in its own name nor in the term 'systems theory'. Actually, we should probably call it systems theories instead when we talk about the conceptual foundations of Systems. For some this plurality within Systems can be seen as both a strength and vital sign for its further development, creating new insights and understanding in the complexity of the phenomenon of systems. Given the notion of peak system above, you could also rightfully argue that plurality might now be a major hindrance to any future development within Systems and to the relevance of the field to the great societal challenges around us. We are not yet ready to argue for turning Systems into a monochromatic discipline, but we do believe that the continuing rise of e.g. system dynamics gives us a hint what to look out for. There can be many criticisms about the method of system dynamics and its rather under-complex conceptualization of systems as first-order feedback systems, but its methodological rigor, its 'hardness' is most likely to blame for its ongoing success (Featherston, Doolan, & others, 2012). We are not proposing to become system dynamicists or trying to apply computer simulation to our own systems theories; rather we follow the insights from Stephan Fuchs that there is no hard distinction between 'hard' and 'soft', between the methods of the natural and the social sciences because there is no *Ding an sich*: "The choice of methods, stances and approaches is… not governed by intrinsic differences between things social and things natural. Rather, 'social' and 'natural' are consequences of processes of attribution that vary from observer to observer, across time and space." (Fuchs, 2001, p. 109) Moreover, Fuchs is arguing that what "makes a [science] culture 'hard' and realist, rather than 'soft' and constructivist, is hardware, among other things." (ibid., p. 306) Hardware means tools, not just physical tools like a telescope but conceptual tools like mathematics and others. System dynamics' success rests on its hardware and the mindset of those who do system dynamics for a living. Again, we neither advocate the hardware nor the mindset of system dynamicists, but the insights we can gain from their particular culture. Without the proper conceptual hardware and an appropriate mindset, the field of Systems cannot progress. The mindset we deem appropriate here is that of formalization, not necessarily quantification: developing and applying formalized languages, tools and descriptions for systemic problems.

This argument is inspired by research originally carried out by Francisco Varela more than 40 years ago in his seminal article on 'A Calculus for Self-Reference' (Varela, 1975). Varela's lifelong