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Analyzing Visualized Complexity

Gulden, Tore

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Within the field of systems oriented design (SOD) students and practitioners visualize their data by GIGA maps (Sevaldson, 2013), Synthesis maps (Jones & Bowes, 2017), or in general terms, maps where exceedingly complex systems and structures are visualized, a praxis which I in this article have called Visualizing complexity. Visualizing complexity praxis's have contributed for designers to work with and utilize for processes to expand the complexity of wicked problems and to handle and intervene in these contexts, as the process involves the synthesizing of all empirical data as a whole. Although the visualizing complexity praxis is a paramount method for working throughout a holistic perspective for designers, the processes so far is lacking methods for analyzing the empirical data synthesized in the maps to develop a fundament for the succeeding design. Students and practitioners often visualize necessary amount of empirical data with sufficient quality in their maps. However, the analysis and designing of products or services based on these maps originates about the romantic belief of the designers gut feeling as tool for data analysis and creation. Unfortunately this often leads to the designing of parts separately rather than designing the interaction between parts, that is the designing of systems (Russell L. Ackoff, 1974) which in turn may lead to malfunctioning products, services, and missing potentials for functioning concepts. This article describes ongoing research that contributes with perspectives and methods for analyzing the visualized complexity that the maps contain to increase the quality of the systems oriented design process. The work is inspired and based on the empirical data that various systems oriented design processes performed by student and practitioners comprise, since I developed the course Visualizing complexity in 2010 at Oslo Metropolitan University on masters level at the Department of product design. The role of the empirical data in this article however has solely been to recognize the problem with the method and as examples that support a theoretical conversation. That is, the main contribution of this research is based on a theoretical conversation originated in systems theory and cybernetics (Krippendorff, 2019). This conversation has brought forth the two perspectives for map analysis that have been incorporated in the course Visualizing complexity. Firstly, that act of dividing structure and systems as a method for system analysis and secondly, analysis by *theoretical overlay*.

The problem

The field of systems oriented design is growing and students and designers around the world utilizes the process of visualizing complexity as a design method to work within complex contexts. However, this coupling of theory and design practice often function on the basis of an epistemological paradox:

- by that the designer uses its own gut feeling to identify areas of interest, improvement, and change in the contexts that the visualized complexity in the maps portray, and further

- that the choices and characteristics of the design methods are not influenced by the identified complexity in the project
- nor are these methods developed to function or aid the designer to design in and for complexity, rather the design methods often convey design philosophies developed to concentrate the designing of entities separated from systems that leads to products and services that malfunction and nonetheless
- convey a wrong representation of the final designs as they seem well argued and solid within a complexity frame, that is,
- when developing a cross- design practice/theoretical method for mapping, designers also needs methods for analyzing the map as part of a creative design process

Dividing between systems and structures

As a response to these above assertions, I will converse about theory that I have presented to design students as design methods. Systems oriented designers and researchers often recognize structures as systems. Accordingly, they are left out on a rich world of data and methods to analyze them. One method that I have tested out with students is exactly the praxis of dividing systems and structures in the contexts visualized in maps to be able to learn more from the collected data.

Division between structures and systems is a recognized process to gain understanding thoroughly described in systems theory (See for example: Russel L. Ackoff, 1999; Luhmann, 1995, 2012; Maturana & Varela, 1987; Varela, Maturana, & Uribe, 1974) and cybernetics (See for example: G. Bateson, 2000/1972; M. C. Bateson, 2005; Bunnell, 2015; Krippendorff, 2019; D. H. Meadows & Wright, 2009). Most of these researchers recognize systems as communication, interaction, and thus influencing, disruptive, and sustaining, dimensions. Systems emerge out of and exists within an enclosed structure, thus creating its own reality and forming the basis for sustenance, behavior, decisions, and selections of information, among many processes. This activity influences the structure that makes the basis for the system, and the structure influences the activity. As a result, the structure is "self-organizing, in the sense that [it is] produced by the systems' own operation" (Luhmann, 2002/2012, p. 70). Any operating self-organized structure "serves as the point of departure for many further operations" (Luhmann, 2002/2012, p. 70) and structures. Accordingly, a system may emerge and function because of a structure while it concurrently influences or reproduces the structure. As an example, people may create a game (structure) and start to play (self-produced system) because of a sudden awareness of a round object and a flat ground (structures), and the play (functioning system) ultimately may influence the structure by, for instance, the decision to add baskets to catch the ball, which again may stimulate the emergence of rules (structure) that will change the original structure (e.g., by adding lines on the ground). The structure served as the origin for new systems to emerge (autopoiesis) and the reorganizing of the subsequent systems result from experiences of play and self-organization (Luhmann, 2002/2012, p. 72). Structures are temporal in that they exist only when they are part of a functioning system. Accordingly, a set of rules, a field, or a board game does not represent a functional structure unless it influences interaction or play (e.g., the use of the game or talking about the game). Furthermore, physical constructions (i.e., buildings, goals, fields, smart phones, computers, game systems) and physical characteristics (e.g., players, locations on the field, field quality, ball velocity) form part of a structure only if they contribute to the system. Hence, if a seagull should fly just above the grass of a football field during a match without influencing the play in any sense, the game structure is not affected; the bird is neither part of the structure nor the system. Typically, design practitioners often include unnecessary or perturbating factors in their visualizing such as the bird in the above example and may be given the role of similar importance as the game or play systems, as part of mapping different praxes.

My experience witnessing master students introduced to the praxis of performing the division between structures and systems during the course Visualizing complexity is that they acquire a broadened and focused understanding of what systems are. Hence, they manage to describe systems, and systems and structures apart. This praxis enables thus the mapping of various structures as opposed to one, and similarly for the disclosure of systems, they recognize an increased number of existing systems and possible new ones as a result of ideas of systems intervention or invention. Accordingly, when being able to isolate and recognize numerous structures and systems apart and describing these in detail, the students acknowledge that it is possible to design and intervene on a systemic level and not only on a structural. These design qualities are functional as methods in a SOD process. After such analytic division of systems and structures, the designers have the potential to analyze additional and more precise dimensions, yet more methods are necessary to proceed in the analysis of systems, structures, and their mutual influence and self-organization that *serves as the point of departure for many further operations.*

Theoretical overlay

After performing the above method of division, the designers have acquired a potential to describe systems and structures apart that makes make an enriched and more focused potential for where to analyze and intervene in these systems and structures with analysis. The subsequent question is then; how to do this?

A method that my students and I have tried out is the act of filtering the visualized data through different theories and perspectives, which I have called theoretical overlay.

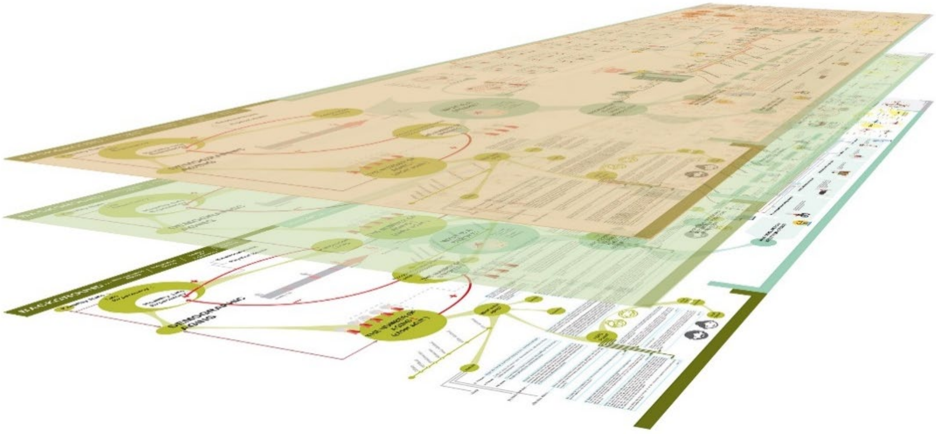

Illustration of theoretical overlay where one analyze the date through different theories

Theoretical overlay involves the identification of several ways of functioning, dynamics, praxes, interactive operations between systems and structures, in the maps by analyzing the data through various angles and theories from systems theory serving as layers of analysis, to see through. Such layers make complex considerations, yet such filtering have aided the students to disclose several new dimensions and systems existing in their data illustrated in the maps. The identification of systems of course demands knowledge of systems theory, as opposed to gut feelings. My students have, to mention a few, tried out utilizing theory that to identify and describes:

- circuits of behavior and praxis (G. Bateson, 2000/1972)
- strengthening and balancing feedback loops (D. H. Meadows & Wright, 2015)
- leverage points for design interventions (D. Meadows, 1999)
- cybernetic analysis of describing other ends of functioning and thus dynamics of tension (G. Bateson, 2000/1972)
- double bind dynamics (G. Bateson, 2000/1972; M. C. Bateson, 2005)
- concepts of flexibility (G. Bateson, 2000/1972; Eriksen, 2005; Steier, 2005)
- double expectations (Gulden, 2018)
- game mechanics (Gulden, 2015, 2016, 2018)
- gamification (Gulden, 2014, 2018; Sjøvoll & Gulden, 2017; V. Sjøvoll & Gulden, 2016)
- but also any other theory to assess the empirical data visualized in the map.

Theoretical overlay seems promising as method for analysis and origins for design in and for complexity. The methods that have emerged throughout my research on systems theory and cybernetics as facets of design, seems to enable students in identifying and describing systems and systems functioning vital for the creation and implementation phase of SOD. In addition, the knowledge and design based on these methods may function as a well-founded origin to analyze the possible effect and functioning the new systems designed, when it is coupled with the existing systems in society.

The continuation of this work will involve a thorough description of the processes, of division of structure and systems, and theoretical overlay as analytic and creative processes for system oriented design praxis. Cases from a decade of maps created in the course Visualizing complexity will serve as empirical data for the research.

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