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Systems Intertwined: A Systemic View on the Design Situation

Introduction

Checkland and Poulter describe how we as humans "feel ourselves to be carried along in an onrushing turbulent stream, a flux of happenings, ideas, emotions, actions."[1] From this stream, we extract chunks we view as situations, of which we try to make sense. Designers aiming to initiate change in this world must have a deep understanding of the situations they face. Several design scholars note that a lot of emphasis in design research has been placed on understanding users' situations and experiences, while the situations in which designers find themselves has been paid less attention.[2] In this paper, I explicitly address designers' situation and propose a systemic model of the design situation, which is intended to make designers better prepared for complex design projects. By design situation, I refer to all aspects of the often ill-defined situation we face when approaching a design project, which directly or indirectly influence our design activities.

I start the paper by introducing the concepts of sensemaking and judgment-making. Following the theoretical discussion, I describe the practice context from which the presented work originates and then introduce a systemic model of the design situation. Last, I discuss the proposed model and its implications for design practice.

Sensemaking: A Situated View

The concept of sensemaking has been used in different application contexts and with somewhat different definitions. Generally speaking, however, sensemaking can be described as "how people make sense out of their experience in the world."[3] Many tie sensemaking specifically to an understanding of events,[4] while others relate it to making sense of data.[5] In this paper I use the term *sensemaking* to refer to the continuous process of attempting to gain

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[1] Peter Checkland and John Poulter, *Learning for Action: A Short Definitive Account of Soft Systems Methodology and Its Use for Practitioners, Teachers, and Students* (Chichester, UK: Wiley, 2006), 4–5.

[2] See for example: Ron Wakkary, "Framing Complexity, Design and Experience: A Reflective Analysis," *Digital Creativity* 16, no. 2 (January 1, 2005): 65–78; Elizabeth Goodman, Erik Stolterman, and Ron Wakkary, "Understanding Interaction Design Practices," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, CHI '11 (New York: ACM, 2011), 1061–70, doi:10.1145/1978942.1979100; Peter Dalsgaard, "Pragmatism and Design Thinking," *International Journal of Design [Online]* 8, no. 1 (2014).

[3] Maureen Duffy, "Sensemaking: A Collaborative Inquiry Approach to Doing Learning," *The Qualitative Report* 2, no. 2 (1995): 1–22.

[4] Karl E. Weick, *Sensemaking in Organizations* (Thousand Oaks, California: Sage, 1995); Gary Klein et al., "A Data-Frame Theory of Sensemaking," in *Expertise Out of Context: Proceedings of the 6th International Conference on Naturalistic Decision Making*, ed. Robert R Hoffman (New York: Erlbaum, 2007), 113–54.

[5] George W. Furnas and Daniel M. Russell, "Making Sense of Sensemaking," in *CHI '05 Extended Abstracts on Human Factors in Computing Systems* (Portland, OR, USA: ACM, 2005), 2115–16, doi:10.1145/1056808.1057113.

insight into situations. Sensemaking is important in design because designers must make sense of their design situations to be able to judge what is possible and desirable.

A *situation* is a part of reality that can be seen as a contextual whole. The American philosopher Dewey discussed how situations can be experienced as indeterminate and problematic.[6] By *experience*, Dewey referred to a person's experiencing *and* characteristics of the situation in which the experience takes place.[7] Sensemaking, as used in this paper, and the notion of experience are related. Just as one may say that experience involves sensemaking because people always try to make meaning in their lives,[8] one may also say that sensemaking involves experience because without experiencing something, there is nothing to make sense of.

Dewey referred to the process of transforming an indeterminate situation into one that is determinate (or resolved) as *inquiry*,[9] and Schön, building on Dewey's theories, described how designers' inquiry processes take place "in action."[10] Sensemaking can be seen as the stages of inquiry where one starts asking questions about the situation faced and initiates the process of defining the problem at hand — or in the words of Schön, "frames the situation."[11]

The purpose of sensemaking for design is acquiring knowledge that enables us to develop "adequate designs."[12] The situation of which we need to make sense in a design project, however, is dynamic rather than static, and knowledge of (or knowing in) a situation is always contextual and dependent on experience.[13] Thus, there is no correct sensemaking and we cannot be certain that insight gained at one stage of the process will still hold at a later stage. For this reason, sensemaking in design is an ongoing process. It is hermeneutical[14] and always relies on some sort of pre-existing understanding that is used to make sense of that which is experienced and is updated based on that which is experienced. Many terms are used to refer to such explanatory descriptions of the mind, including *prejudices*,[15] *schemata*,[16] *mental models*,[17] and *frames*.[18] In this paper, I used the term mental model.

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[6] John Dewey, *Logic: The Theory of Inquiry*, Kindle ed. (1938; republished, Saerchinger Press, 2013).
[7] John Dewey, *Experience and Nature*, Kindle ed. (1925; republished, Mccutchen Press, 2013).
[8] John McCarthy and Peter Wright, *Technology as Experience* (Cambridge, Mass: MIT Press, 2004), 105–129.
[9] Dewey, *Logic: The Theory of Inquiry*, 102.
[10] Donald A. Schön, "The Theory of Inquiry: Dewey's Legacy to Education," *Curriculum Inquiry* 22, no. 2 (1992): 119–39.
[11] Donald A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983); Donald A. Schön, "Designing: Rules, Types and Words," *Design Studies* 9, no. 3 (July 1988): 181–90, doi:http://dx.doi.org/10.1016/0142-694X(88)90047-6.
[12] Nelson and Stolterman use the term "adequate design" to refer to the best possible design developed within the time and resources available. Harold Nelson and Erik Stolterman, *The Design Way: Intentional Change in an Unpredictable World*, 2nd ed. (Cambridge, MA: MIT Press, 2012), 99.
[13] Dewey, *Experience and Nature*.
[14] Ron Bontekoe, *Dimensions of the Hermeneutic Circle* (New York: Humanity Books, 2000).
[15] Hans-Georg Gadamer, *Truth and Method*, *Wahrheit Und Methode Grundzüge Einer Philosophischen Hermenutik*, 2nd, rev., Stagbooks (London: Sheed & Ward, 1989).

A focus on humans' sensemaking implies a shift from viewing information as objective, and humans as input-output processors, to an approach in which "information is defined as an outcome of human constructing processes and humans are seen as making 'sense' in response to changing and sometimes elusive conditions."[19] Design is informed by both making sense of that which already exists and by making sense of and judging that which designers create in the design process, as described by Schön through his concept of *seeing-moving-seeing*.[20] As such, sensemaking in design is closely related to making judgments and decisions.

Judgments and the Appreciative System

Vickers' theory on appreciative systems[21] offers a framework and a vocabulary that are valuable in discussing judgment-making and decision-making in design. An appreciative system, according to Vickers, includes *appreciative judgments* and *action judgments*.[22] These judgments depend on our *appreciative setting*, which builds on our experiences and include our standards of value and what we consider an "ideal norm." Our appreciative setting is our "readinesses to see, to value and to respond to situations in familiar ways which, while they last, exclude the power to see other possibilities."[23] Appreciative settings are not universal, yet can be shared by a group of people or by a society. The design community shares some norms, such as valuing the creation of novel solutions and appreciation of aesthetically pleasing products,[24] while other norms may be stressed in a specific domain in which designers work, such as the emphasis on safety in maritime industries used as an example in this paper. Both the design community and the maritime domain, however, place value on protecting human life.

Making *appreciative judgments* is twofold, and includes what Vickers refers to as *reality judgments* and *value judgments*. Reality judgments are judgments about which facts are relevant to a current situation and help a person identify "what is the case." Such judgments

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[16] Frederic C. Bartlett, *Remembering: A Study in Experimental and Social Psychology* (Cambridge, UK: Cambridge University Press, 1932).

[17] Philip N. Johnson-Laird, "The History of Mental Models," in *Psychology of Reasoning: Theoretical and Historical Perspectives*, ed. Ken Manktelow and Man Cheung Chung (Hove, UK: Psychology Press, 2004), 179–212.

[18] Klein et al., "A Data-Frame Theory of Sensemaking," 118. Note that Schön's use of the term "frame" is different and that "to frame a problematic design situation" in Schön's understanding is to "set its boundaries, select particular things and relations for attention, and impose on the situation a coherence that guides subsequent moves." Schön, "Designing: Rules, Types and Words," 182.

[19] Brenda Dervin and Charles M. Naumer, "Sense-Making," in *Encyclopedia of Library and Information Sciences, Third Edition*, ed. Marcia J. Bates and Mary Niles Maack, Third Edit (New York: Taylor & Francis, 2009), 4696–4707, doi:10.1081/E-ELIS3-120043227.

[20] Schön, *The Reflective Practitioner: How Professionals Think in Action*.

[21] Geoffrey Vickers, *The Art of Judgment: A Study of Policy Making* (London: University Paperbacks, 1965).

[22] Originally referred to by Vickers as "instrumental judgments." Ibid., 40.

[23] Ibid., 54.

[24] My starting point is physical and digital products; however, a broader understanding of products, including services and organizational design, may be applied in reading this paper.

involve considering hypotheses and making predictions as to what is most likely to happen. Making value judgments involves judging what is good or bad and considering "what ought to be the case." According to Vickers, reality judgments and value judgments are inseparable: "The relation between judgments of fact and of value is close and mutual; for facts are relevant only in relation to some judgment of value and judgments of value are operative only in relation to some configuration of fact."[25]

Action judgments depend on appreciative judgments; they involve judging what is possible and not possible given the situation at hand, and answering the question, "What are we going to do?" Thus, action judgments lead to decisions. Vickers connects these judgments to innovation, and stresses that they require imagination. It is also natural to tie such judgments to Schön's concept of *repertoire*[26] – the collection of images, ideas, examples and actions that designers can draw upon in their work and thus use to come up with answers to the question of what to do.

Our *appreciative setting* is dynamic and will change based on our judgment-making. This is a circular process in which the appreciative setting informs the judgments made, and the judgments made in turn change the appreciative setting. Checkland and Casar[27] have summed up Vickers' appreciative system in a visual model that illustrates this circularity (shown in Figure 1).

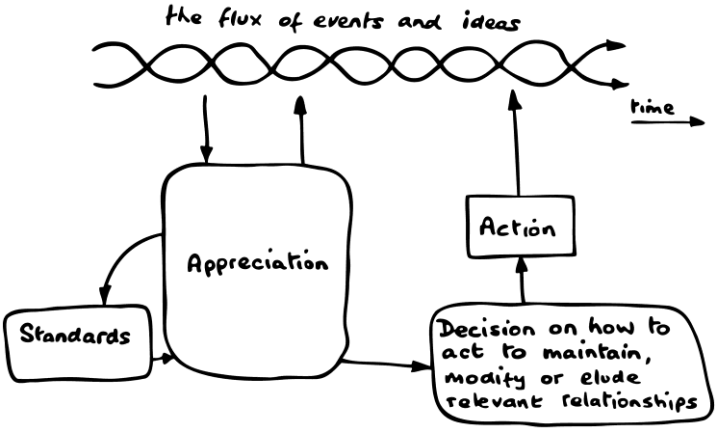

Figure 1: Appreciative system emphasizing appreciation leading to action. From: Peter Checkland and Alejandro Casar, "Vickers' Concept of an Appreciative System: A Systemic Account," *Journal of Applied Systems Analysis* 13, no. 3 (1986): 3–17. Reproduced with permission from Peter Checkland.

At the top is the flux of events[28] and ideas unfolding through time. By employing appreciation, we select parts of this flux (situations), about which we make judgments. These judgments

[25] Vickers, *The Art of Judgment*, 40.

[26] Schön, *The Reflective Practitioner*, 138.

[27] Peter Checkland and Alejandro Casar, "Vickers' Concept of an Appreciative System: A Systemic Account," *Journal of Applied Systems Analysis* 13, no. 3 (1986): 3–17.

[28] Vickers did not define explicitly what he meant by event but through reading his texts it seems like he understood events in the everyday usage of the word as an occurrence. Dewey on the other hand stated that

form a basis for decision-making that may lead to action. Both our appreciative judgments and our actions contribute back to the flux of events and ideas. Nelson and Stolterman[29] refer to Vickers and stress appreciative judgments play an important role in making design judgments. I argue that we also can use Vickers' theories to reflect on the role of our design in a broader context and consider the products we design actions that contribute to the world's flux of events and ideas.

To sum up: sensemaking for design, as defined in this paper, is a designer's continuous process of developing an understanding of the design situation at hand, which enables them to develop adequate designs. Sensemaking is contextual and dependent on both the designer making sense of the situation and characteristics of the situation of which they try to make sense. It involves making appreciative judgments and identifying what is the case and demands attention. Sensemaking is also linked to design decisions and involves making action judgments. In this paper, I propose a systemic model of the design situation that makes visible what designers need to make sense of to grasp the full complexity of their design situations. Before I introduce the model, however, I will present the context from where it originates.

The Ulstein Bridge Concept

The propositions put forward in this paper were developed within a three-year-long design research project called the Ulstein Bridge Concept,[30] which addressed the design of the bridge of an offshore service vessel.[31] The design of a ship's bridge serves as a good example of a complex design project that makes substantial demands on the sensemaking abilities of a design team: the technical systems on a ship are advanced; the use situation on the bridge is complex, with many actors and demanding user tasks in a high-risk setting; the industry is global, with actors from different nations and cultures; the industry is highly regulated by overlapping and sometimes contradictory regulations; and many stakeholders are involved, often with different and even competing goals.[32] The purpose of our project was to design a completely new ship's bridge by taking advantage of the possibilities offered by new technologies, while at the same time being human-centered and taking on a holistic approach. This ambitious scope made further demands on the design team's sensemaking abilities, because it required us also to make sense of the new technologies and understand how they could be used as design material in the complex setting of the ship's bridge. The bridge design developed by the project is shown in Figure 2.

"every existence is an event" and even acknowledged the formation of mountains as an event. Dewey, *Experience and Nature*, 104.

[29] Nelson and Stolterman, *The Design Way: Intentional Change in an Unpredictable World.*

[30] For more information, see: http://designresearch.no/projects/ulstein-bridge-concept/ (accessed August 20, 2015).

[31] The ship's bridge (or wheelhouse) is the place from which the captain and the deck officers control a ship. An offshore service vessel is a ship that supports the offshore oil and gas industry.

[32] Sigrun Lurås, Margareta Lützhöft, and Birger Sevaldson, "Meeting the Complex and Unfamiliar: Lessons from Design in the Offshore Industry," International Journal of Design 9, no. 2 (2015): 141–54. http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/1845

Figure 2: The ship's bridge developed by the Ulstein Bridge Concept design research project.

The project employed a *research by design* approach in which design practice is at the core of research and "the explorative, generative and innovative aspects of design are engaged and aligned in a systematic research inquiry."[33] The model presented in this paper was not developed deliberately as part of the project, but rather evolved as a consequence of our experiences throughout the project work. These experiences included the breadth of what influenced our design work and of what we needed to make sense in order to make satisfactory designs, and also what we influenced through our design work beyond that which was anticipated. Throughout the project I kept a research diary in which I reflected on our daily work, and these reflections helped shape the model. In addition to being based on own experiences, the model was informed by an interview study we carried out with the purpose of understanding how designers find working for the offshore ship industry.[34] After the Ulstein Bridge Concept project was finished, the final version of the model was developed by considering our experiences in relation to the presented theories on sensemaking and judgment-making.

A Systemic Model of the Design Situation

The systemic model of the design situation proposed in this paper (Figure 3) offers a framework for thinking systemically and systematically about the systems by which one is influenced and which one influences in a design process. The model does not offer a true

[33] Birger Sevaldson, "Discussions & Movements in Design Research," *FORMakademisk* 3, no. 1 (2010): 8–35, doi:10.7577/formakademisk.137.

[34] Lurås, Lützhöft, and Sevaldson, "Meeting the Complex and Unfamiliar: Lessons from Design in the Offshore Industry."

description of the design situation, but is rather a construct to help designers consider the situation they find themselves in. It builds on the assumption that a "system is not something given in nature, but something defined by intelligence."[35] This implies that anything that can be "perceived/conceived as consisting of a set of elements, of parts, that are connected to each other by at least one discriminable, distinguishing principle" can be considered a system.[36]

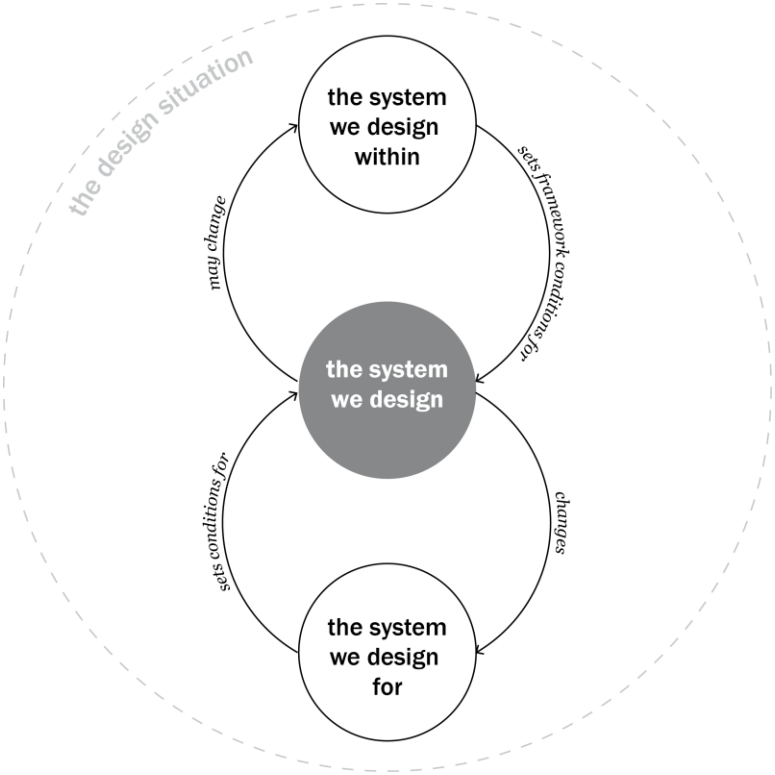

Figure 3: A systemic model of the design situation.

In the model, I propose that the design situation is seen as a "system of systems"[37] constituting three systems of which designers need to make sense:

- The system we design
- The system we design for
- The system we design within

[35] Stafford Beer, *Decision and Control: The Meaning of Operational Research and Management Cybernetics* (UK: John Wiley & Sons, Ltd., 1966/1994), 242.
[36] Nehemiah Jordan, "Some Thinking about 'System,'" in *Systems Thinking: Volume Two*, ed. Frederick E. Emery (Middlesex, England: Penguin Books, 1981), 24.
[37] The term "system of systems" is borrowed from systems engineering, where a "system of systems" refers to a complex system constituting several independently operating systems that have a common mission. Jason M. Held, "Systems of Systems: Principles, Performance, and Modelling" (The University of Sydney, 2008).

These systems can be further divided into sub-systems in a range of ways, depending on how we choose to divide them. There are no strict boundaries among the systems; they are intertwined and form a system in themselves – a system representing the full design situation, including all factors that influence the situated design work. In the following I will describe what I mean by each system.

The System We Design

In engineering and industrial design, there has been a tradition of viewing the product to be designed as a system.[38] The product is made up of a collection of separable elements that can be viewed as distinct units, and only when connected in the right way does the product emerge. Four wooden legs and two wooden boards are not a chair; however, they can become a chair if put together in a way that enables sitting. An engine, four wheels, a chassis, seats, and all the other parts of a car are not a car until assembled in a way that makes it possible to drive. In computer science and software engineering, the software to be developed is also viewed as a system, and the process of developing the system is often referred to as "system design." System design is also used with regard to the design of organizations, and the design of services may also be referred to as a type of system design.

When we consider the product we design a system, we are invited to make boundary judgments. Churchman uses the design of a family home as an example of different ways of setting boundaries.[39] An architect can choose strictly to address the design of the physical house, with its rooms and floor plans. However, the architect can also choose to consider "whether the house is not a component of a larger system, consisting of the family (or its activities) and the house. When he does ask himself this question, he may wonder whether his design task should include the design of a part of the family's activities."[40] Such considerations are particularly interesting in complex design projects, such as the design of a ship's bridge, which consists of a number of overlapping technical systems as well as human-activity systems and social systems.

Making sense of *the system we design* involves making sense of the parts of the system and how they are connected. In the case of the ship's bridge, this involves making sense of the advanced technical systems on a vessel, such as the propulsion system with its rudder and propellers, and the positioning system, including GPS and reference systems. Making sense of *the system we design* also includes making sense of the design material available for design. When designing the ship's bridge, we made substantial efforts to understand how new

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[38] See for example William Gosling, "The Relevance of System Engineering," in *Conference on Design Methods: Papers Presented at the Conference on Systematic and Intuitive Methods in Engineering, Industrial Design, Architecture and Communications, London, Sept. 1962*, ed. D. G. Thornley and J. Christopher Jones (Oxford: Pergamon, 1963), 23–32; David Pye, *The Nature and Aesthetics of Design* (London: Barrie & Jenkins, 1964/1978); Eskild Tjalve, *Systematisk udformning af industriprodukter: værktøjer for konstruktøren (Systematic Design of Industrial Products: Tools for the Constructor)* (Copenhagen: Akademisk Forlag, 1976).

[39] C. West Churchman, *The Design of Inquiring Systems: Basic Concepts of Systems and Organization* (New York: Basic Books, Inc., 1971).

[40] Ibid., 7.

technology worked in order to gain the knowledge needed to enable us to use these technologies as design materials when generating novel multi-modal interactions.

The System We Design for

I use the phrase *the system we design for* in a manner similar to the way in which *context of use* is used in human-centered design, describing "users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used."[41] However, *the system we design for* also includes the wider context of the use situation. In the case of the ship's bridge, this comprises the operations in which the ship is involved and the natural surroundings of those operations, including such things as topographic factors and weather conditions.

The system we design for is the situation we would seek to change by creating and implementing *the system we design*. Making sense of *the system we design for* implies understanding this situation from a macro to a micro level. Sometimes we are familiar with the system for which we design and can see ourselves as representative of the users. At other times this system is unfamiliar and substantial efforts are required to gain necessary insight. A range of methods and techniques for gaining insight into and making sense of the system we design for can be found both in design practice and the research literature. Our research asserts that field research at sea is the most valuable approach to gaining such insight when one is designing a ship's bridge;[42] however, gaining access to field sites can be difficult, and the opportunity to carry out field research depends on *the system we design within*.[43]

The System We Design within

The system we design within is the situation that shapes practitioners' ability to do a satisfactory job. This includes industry-specific factors such as regulations, culture, and tradition, and project-specific factors such as the project's scope, the project's role, budgeting and resources, and the distribution of roles and responsibilities within the project. Other influencing factors, such as the education and training of the design team, are also part of *the system we design within*. This system is distinct from the other two systems in the model in that designers themselves are part of this system.

Making sense of this system involves making sense of our own organization, our client's organization, and the domain in which we work. It includes considering all aspects of these organizations – the people, resources, structure and the purpose of the organization – and judging how they influence our situated work. And last but not least, it involves making sense of our own role, abilities, and possibilities in this context.

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[41] ISO 9241-11:1998 *Ergonomic Requirements for Office Work with Visual Display Terminals (VDTs) – Part 11: Guidance on Usability*.

[42] Sigrun Lurås and Kjetil Nordby, "Field Studies Informing Ship's Bridge Design at the Ocean Industries Concept Lab," in *Human Factors in Ship Design and Operation, 26-27 February 2014, London, UK* (London: The Royal Institution of Naval Architects, 2014), 27–35.

[43] Lurås, Lützhöft, and Sevaldson, "Meeting the Complex and Unfamiliar: Lessons from Design in the Offshore Industry."

Interconnections among the Systems

The system we design, the system we design for, and the system we design within are intertwined and connected in many ways. *The system we design for* sets conditions for *the system we design* through the goals our design should support. By "goals" I mean the system's overall goals, as well as the personal goals of the human actors (users) in the system. Examples of overall goals in industrial environments such as a ship's bridge include safe, reliable and efficient transportation of goods. At the team and individual levels, goals include conducting as effortlessly as possible the tasks needed to reach the overall goal. But the human actors also have a number of other goals not directly related to operational goals. Examples include enjoying their work time, expanding their competence, and feeling pride in their work. These goals should also inform design.

The system we design for consists of several systems, of which *the system we design* is one. That which we design needs to work well together with the other subsystems of the system we design for. Consistency among systems is particularly important in high-risk settings in which errors can have catastrophic consequences. This can present the design team with a dilemma: Is it better to make something new that, at least in isolation, is a better design, or to make something familiar to users that requires less training and is consistent with existing systems?

The system we design within both introduces limiting factors and provides possibilities with regard to *the system we design*, and thus influences our ability to change *the system we design for*. It sets requirements through regulations and standards for the system we design. These can be industry-specific, country-specific, or company-specific. They can be process-oriented, describing what kind of design process should be used or how the design should be evaluated, or they can be prescriptive, such as requirements regarding placement of equipment, definitions of what materials and technology are allowed, and specifications of symbols and colors to use in visual displays.

Further, *the system we design within* sets the scope for what to design, the designers' role in the project, and the project's frame. The scope is usually set by the designers' clients and is influenced by a client's role in the industry's "ecosystem," as well as by where in the client's organization the design project is run.[44] However, designers may also influence the scope by taking an active part in the framing of the project. Sometimes designers are invited to help frame projects as collaborators;[45] other times, they go beyond the original scope set by the client with the purpose of showing what is possible. An example of the latter is the designer Kenneth Grange, who went well beyond the requirements of the original brief when he was hired to design the painting of the outside of British Rail's High-Speed Train and ended up redesigning the whole exterior of the train without informing the client.[46]

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[44] Lurås, Lützhöft, and Sevaldson, "Meeting the Complex and Unfamiliar: Lessons from Design in the Offshore Industry."

[45] Bec Paton and Kees Dorst, "Briefing and Reframing: A Situated Practice," *Design Studies* 32, no. 6 (2011): 573–87, doi: 10.1016/j.destud.2011.07.002.

[46] Nigel Cross, *Design Thinking: Understanding How Designers Think and Work* (Oxford: Berg, 2011), 61.

The system we design influences both *the system we design for* and *the system we design within.* It influences *the system we design for* in that it can change the users' tasks themselves, change how the tasks are carried out, and change the users' experience of conducting the tasks. *The system we design* can also motivate users and make them proud. When our design of the ship's bridge was made public, a deck officer wrote in an online forum, "I'd probably take a (slight) pay cut to play with those toys full time."[47]

Designers are not always aware of how their work can change organizations.[48] Yet there are many examples of how the system we design can influence the system we design within. Junginger highlights that even traditional product development projects can lead to organizational change.[49] She describes how product development is normally aimed at external change (of what I refer to as *the system we design for*) but can also be used for internal change (part of what I refer to as *the system we design within*). I argue that through our designs, we show what is possible and introduce new ideal norms. In Vickers'[50] words, our designs add to the flux of ideas by which all stakeholders in a design project are affected, and can change everybody's appreciative settings. The next time the stakeholders judge what is possible in a design project, they may see new possibilities.

In the ship's bridge project, we did indeed see that our design changed stakeholders' appreciative settings. End-users saw that a different and better bridge was possible; our collaborative partner and its competitors became aware of the possibilities inherent in new technology and of the effects of engaging designers; and regulators saw that the functional goals of their rules could be achieved by new means.[51] When we through our designs influence the appreciative systems of the stakeholders of the system we design within we may create better conditions for creating the system we design, and thus for changing the system we design for.

From Sensemaking to Design Decisions

Through the systemic model of the design situation, I suggest that design situations consists of the system we design, the system we design for, and the system we design within. Through the extended model in Figure 4 I argue that making sense of all three systems is necessary in order to make design decisions that result in satisfactory solutions for the system we design that

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[47] *gCaptain.com*, http://gcaptain.com/forum/professional-mariner-forum/9631-ulstein-bridge-vision-video-crazy-ass-stuff.html (accessed August 20, 2015).

[48] Richard Buchanan, "Introduction: Design and Organizational Change," *Design Issues* 24, no. 1 (2008): 2–9, doi:10.1162/desi.2008.24.1.2.

[49] Sabine Junginger, "Product Development as a Vehicle for Organizational Change," *Design Issues* 24, no. 1 (2008): 26–35, doi:10.1162/desi.2008.24.1.26.

[50] Vickers, *The Art of Judgment*.

[51] Sigrun Lurås and Kjetil Nordby, "Radical Design Processes for Systemic Change," in *Relating Systems Thinking and Design 2013 Proceedings*, ed. Birger Sevaldson and Peter Jones, Relating Systems Thinking & Design Symposium (Oslo, Norway: The Oslo School of Architecture and Design, 2013).

change the system we design for in desirable ways, and also influence the system we design within.

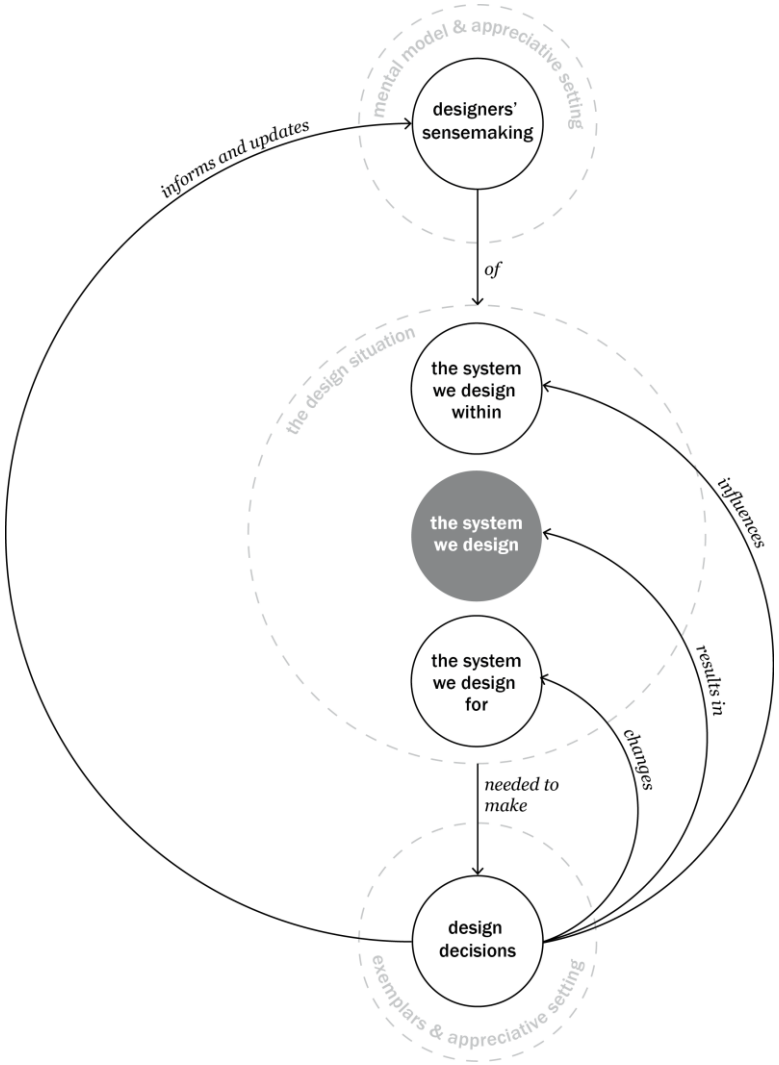

Figure 4: A systemic model of the design situation including relationships between the design situation and the designers' sensemaking and design decisions.

The model points out that our sensemaking relies on our mental models of these systems as well as on our appreciative setting.[52] As designers, we must make appreciative judgments and identify the facts we deem relevant to our situated work, and determine what those facts mean to our designs. A design team must consider what is given and not possible to alter, and what they can in fact change and thus address in their designing. Most obvious in a design project is to consider *the system we design* and *the system we design for*. It is, however, equally important to make sense of *the system we design within* to be able to judge what designs are possible in this context and to have the insight needed to employ a proactive strategy to boundary setting. Setting boundaries proactively can help the designer see opportunities beyond the original

[52] Vickers, *The Art of Judgment*.

design task and thus create a situation in which design can be more influential. Part of a designer's judgment-making involves deciding where to draw the line in terms of what he or she needs to make sense of. As an example, if we require too deep an understanding of the technical aspects of *the system we design,* at some point the expertise of an engineer will be required. Yet to be able to come up with truly relevant designs, a certain level of insight into technical systems is required, or else our task may be limited to styling the product only.[53]

Decision-making in design relies heavily on judgment-making. The final design decision involves making a choice among concrete alternatives – in Vickers words to make action judgments.[54] Identifying desirable alternatives is dependent on our repertoire of exemplars[55] we use to generate ideas for what is possible, and on our appreciative settings,[56] which we use to judge which of the possibilities is desirable.

Through the feedback loop from design decisions to sensemaking the model also makes visible that our sensemaking relies on the actual act of designing, as described by Schön through his concept of *seeing-moving-seeing.*[57] This implies that it is possible, or even desirable, to start designing without understanding the systems in full. Weick's reference to a quote by Wallas illustrates this aspect of sensemaking quite well: "The little girl had the making of a poet in her who, being told to be sure of her meaning before she spoke, said: 'How can I know what I think till I see what I say?'"[58]

Conclusion

Through the systemic model of the design situation proposed in this paper, I argue that a design situation can be viewed as a system consisting of *the system we design*, *the system we design for*, and *the system we design within.* The proposed model makes visible connections among the systems of the design situation and emphasizes that developing satisfactory designs depend on an understanding of all these systems. The model also makes explicit that we can influence our framework conditions of *the system we design within* through *the system we design.*

Models can lead to action,[59] and the vocabulary introduced in the model can initiate an inquiry process and serve as a probe to identify what one needs to make sense of in a design project. The model also invites consideration of the design process as a dynamic system that must respond and react to each design situation in a flexible and adaptive manner. As we learn more about *the systems we design*, we may see a need for new competencies within the

[53] Ibid.
[54] Vickers, *The Art of Judgment.*
[55] Schön, *The Reflective Practitioner.*
[56] Vickers, *The Art of Judgment.*
[57] Ibid.
[58] Graham Wallas, *The Art of Thought* (New York: Harcourt Brace, 1926), 106. Cited in Weick, *Sensemaking in Organizations*, 12.
[59] Hugh Dubberly, "Models of Models," *Interactions* 16, no. 3 (2009): 54, doi:10.1145/1516016.1516029.

design team. When we learn about *the system we design for* and *the system we design within*, we may decide to expand the boundaries of *the system we design* and the scope of the projects. By employing such a systemic view of the design situation, we are not only able to gain a better understanding of that which influences our designing but we can also see how, through our designs, we might have a broader influence on the world than we might have originally thought.

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