

# Designing for Social Infrastructures in Complex Service Systems: A Human-Centered and Social Systems Perspective on Service Design

**Abstract** Service design is one of the keys to improving how we target today's complex societal problems. The predominant view of service systems is mechanistic and linear. A service infrastructure – which includes solutions like service blueprints, scripts, and protocols – is, in some ways, designed to control the behavior of service professionals at the service interface. This view undermines the intrinsic motivation, expertise, and creativity of service professionals. This article presents a different perspective on service design. Using theories of social systems and complex responsive processes, I define service organizations as ongoing iterated patterns of relationships between people, and identify them as complex social service systems. I go on to show how the human-centeredness of design practices contributes to designing for such service systems. In particular, I show how a deep understanding of the needs and aspirations of service professionals through phenomenological themes contributes to designing for social infrastructures that support continuous improvement and adaptation of the practices executed by service professionals at the service interface.

## Keywords

Service design  
Public sector innovation  
Social systems  
Complex responsive processes  
Human-centered design  
Phenomenological themes

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1 Kees Dorst, *Frame Innovation: Create New Thinking by Design* (Cambridge, MA: MIT Press, 2015), 1.

2 Fernando Secomandi and Dirk Snelders, "The Object of Service Design," *Design Issues* 27, no. 3 (2011): 29, DOI: [https://doi.org/10.1162/DESI\\_a\\_00088](https://doi.org/10.1162/DESI_a_00088).

3 Christian Bason, "Designing Co-production: Discovering New Business Models for Public Services," in *Leading Innovation through Design: Proceedings of the DMI 2012 International Research Conference*, ed. Erik Bohemia, Jeanne Liedtka, and Alison Rieple (Boston: DMI, 2012), 318.

4 Stephen L. Vargo and Robert F. Lusch, "Evolving to a New Dominant Logic for Marketing," *Journal of Marketing* 68, no. 1 (2004): 1–17, DOI: <https://doi.org/10.1509/jmkg.68.1.1.24036>.

5 The term service consumer applies to a broad range of stakeholder classifications—citizens, health care patients, and students, for example. The roles of service provider and consumer are often blurred; for example, if learning is the preferred outcome of a teacher-student interaction, then both student and teacher must actively contribute to the service interaction to achieve that outcome.

6 Sabine Junginger, "Services as Key to Effective Government," in *Transforming Public Services by Design: Re-Orienting Policies, Organizations and Services around People* (London, UK: Routledge, 2017), 38–44.

7 Secomandi and Snelders, "Object of Service Design," 29.

8 I adopt a broad definition of service professional that includes any (expert) professional or organizational staff member that contributes actively to addressing complex challenges at the interface between the organization and the service context. Teachers are an interesting example, as education has been a surprisingly neglected sector of activity in research on service design, as recently argued in Lucila Carvalho and Peter Goodyear, "Design, Learning Networks and Service Innovation," *Design Studies* (2017), forthcoming.

## Introduction

The world is increasingly confronted with complex societal challenges including poverty, crime, health issues, and an aging population. Better service design is one of the keys to improving how we address societal issues. As many of these societal issues have an open, complex, dynamic, and networked character,<sup>1</sup> the service systems we do implement to address these issues tend to have a complex character as well. In this article, I will discuss the design of such complex service systems.

If we want to understand the design of complex service systems, we first need to understand what a service is. Within the service design field there is a consensus that a service emerges in a process of co-production or co-creation between provider and client,<sup>2</sup> or between public service organizations and citizens in a public sector context.<sup>3</sup> This principle – based on one of the foundational premises of service described by Stephen Vargo and Robert Lusch<sup>4</sup> – is part of a service-dominant logic that emerged in the marketing field at the beginning of the twenty-first century. Without the consumer,<sup>5</sup> there is no service. The service comes about when the consumer interacts with the material and immaterial elements provided by the service providers – the movie rented, the cleaner hired, the website consulted, and the machine-distributed ticket bought. If the service does not come about until there is interaction between the service provider and the service consumer, it is essentially intangible. Services are also heterogeneous, because the quality of their delivery depends on the time and place as well as on the people involved.<sup>6</sup> If a service is intangible and heterogeneous, how do we design it? To answer this question, the service design literature distinguishes the interface of the service from the infrastructure of the service.<sup>7</sup>

The interface consists of those aspects of a service that are directly available to consumers, while the infrastructures are the resources that are indirectly available – the front office and back office. In this article, I focus on the parts of the interface that are available through human beings, rather than through technologies. I also focus on those parts of the infrastructure that support or guide a service professional's behavior – the physical/digital environment and the organizational structure, for example. If we look at a teacher as a service professional,<sup>8</sup> for instance, the interface is the social interaction between teacher and student, while the infrastructure consists of the classroom, teaching materials, smart board, organizational structure of the school, teacher-teacher and teacher-principal interactions, and the school's educational philosophy. Infrastructure is a fundamentally relational concept. It becomes infrastructure in relation to organized practices.<sup>9</sup> For example, for a teacher, the classroom is integral to teaching – it becomes infrastructure in teaching – but for a cleaner, that classroom is an object of their work. As Susan Leigh Star and Karen Ruhleder ask, "when – not what – is an infrastructure?"<sup>10</sup>

Many scholars contend that since the service interface is intangible, design efforts should be focused on the service infrastructure. Bo Edvardsson and Jan Olsson argue that service design is about developing the appropriate generic prerequisites for the service.<sup>11</sup> These prerequisites are the system's resources – its staff, organizational structure, and physical/technical environment, for example. The current popularity of designing touchpoints in the service design community is in line with this focus on service infrastructure. However, Fernando Secomandi and Dirk Snelders<sup>12</sup> argue that the focus on service infrastructure has neglected what is essentially the core of the service, the service interface, and claim that this should be the object of service design.

This article will contribute to this discussion in two ways. The first is by using theories of complex social systems to provide a new perspective on service systems. The second is by introducing a human-centered design and innovation approach that enables designing for such complex service systems. To achieve this, the next

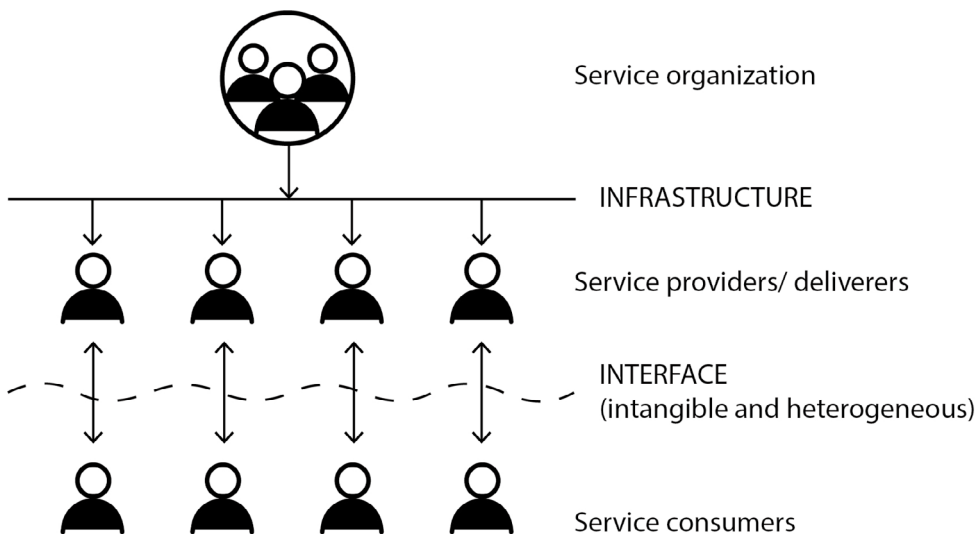
section describes the complexity of service organizations and will particularly focus on the role of social interactions on both an infrastructure and interface level. I will then introduce a model that supports human-centered innovation, by showing how different levels of depth in understanding stakeholders' needs and aspirations contribute to innovation. Next, the model will be used as a provisional framework to analyze two case studies about designing for complex service systems. In the first case study, the model is used as a lens to analyze the design of an intervention for an educational service system, while in the second case study the model was applied by the author and her colleagues in the design of an intervention for a complex health issue. I will conclude the paper with a discussion on how a deeper understanding of the needs and aspirations of service professionals contributes to designing for 'social infrastructures' that support a continuous improvement and adaptation of complex service systems.

## The Complexity of Service Organizations

This research is focused on those elements of a service infrastructure that are aimed at influencing the service professionals' behavior. Popular strategies and interventions for influencing behavior from the (public) service design and management literature include, for example, scripts,<sup>13</sup> service blueprints,<sup>14</sup> protocols, guidelines, and standard operating procedures.

These strategies are based on a linear view of the relationship between service infrastructure and interface (Figure 1). The linear view can be analyzed using Snowden and Boone's Cynefin Framework.<sup>15</sup> The Cynefin Framework distinguishes five different types of contexts with regard to their complexity: simple, complicated, complex, chaotic and disorder. Each context requires leaders to act in contextually appropriate ways. The framework is useful in the context of service design to distinguish the levels of complexity in service tasks and contexts, and the way they can be managed through an infrastructure.

Within this framework, the linear view of the influence of service infrastructures on service interfaces can be considered a simple perspective. Snowden and Boone<sup>16</sup> define a simple context as one characterized by stability and clear cause-and-effect relationships that are easily discernible by everyone. In simple contexts, managers can act straightforwardly: they sense, categorize, and respond. For example, think of a call center where a customer rings the center, the center staff



DOI: <https://doi.org/10.1016/j.destud.2017.09.003>.

9 Susan L. Star and Karen Ruhleder, "Steps toward an Ecology of Infrastructure: Design and Access for Large Information Spaces," *Information Systems Research* 7, no. 1 (1996): 111–34, DOI: <https://doi.org/10.1287/isre.7.1.111>.

10 Ibid., 113.

11 Bo Edvardsson and Jan Olsson, "Key Concepts for New Service Development," *The Service Industries Journal* 16, no. 2 (1996): 146–47, DOI: <https://doi.org/10.1080/02642069600000019>.

12 Secomandi and Snelders, "Object of Service Design," 33.

13 Rohit Ramaswamy, *Design and Management of Service Processes: Keeping Customers for Life* (Boston: Addison-Wesley, 1996).

14 G. Lynn Shostack, "Designing Services That Deliver," *Harvard Business Review* 62, no. 1 (1984): 133–42, available at <https://hbr.org/1984/01/designing-services-that-deliver>.

15 David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making," *Harvard Business Review* 85, no. 11 (2007): 68–76, available at <https://hbr.org/2007/11/a-leaders-framework-for-decision-making>.

16 Ibid., 70.

Figure 1 The interface between service professional and service consumer is intangible and heterogeneous. The predominant perspective in the public and social service on the relationship between infrastructure and interfaces is linear. Copyright © 2017 Mieke van der Bijl-Brouwer.

17 Of course, some call centers deal with more complex questions that have no predetermined answers.

18 Snowden and Boone, "A Leader's Framework for Decision Making," 71.

19 Russell L. Ackoff, *Ackoff's Best: His Classic Writings on Management* (New York: John Wiley & Sons, 1999), 16.

20 Russell L. Ackoff and Fredrick E. Emery, *On Purposeful Systems: An Interdisciplinary Analysis of Individual and Social Behavior as a System of Purposeful Events* (London: Tavistock Publications, 1972), 215.

21 *Ibid.*, 31.

member assesses the situation, categorizes it, and responds accordingly.<sup>17</sup> All management needs to do here is set directives for dealing with the situation – a linear command and control management style (Figure 1).

Service infrastructures such as protocols and scripts are set up to maximize control over people's behavior, by prescribing in detail what service professionals must say and do in specific situations. This might be useful in the case of simple contexts – where situations can be predicted and categorized by service professionals – but for complex service contexts this prescriptive perspective on infrastructure design is not very useful.

Consider the task of teaching in a primary school. People are required to complete years of training to become teachers, and are guided in their work by an infrastructure comprising an educational philosophy, school guidelines, and a set curriculum. Nevertheless, what happens in the classroom cannot be completely predicted or controlled. Even a very prepared teacher often has to improvise based on the children's behavior on a particular day. And the children's behavior is influenced by factors outside the school – and outside the control of the teacher and educational institution – including their parents, siblings, and peers. Furthermore, the teacher's work is influenced by outside factors such as changing educational policies and procedures, new technology, and societal developments. Controlling the teacher's behavior would be ineffective, because it is impossible to predict the specific teaching intervention required in each specific instance of interaction between teacher and student.

A service like primary school education can be characterized as a complex context. In complex contexts, we can only understand the relationship between cause and effect in retrospect.<sup>18</sup> For example, a teacher might only be able to identify in hindsight whether a certain intervention he or she used to engage a distracted child was effective. To be able to design such complex services, we need a deeper understanding of the service organizations through which such services are delivered. In the next section I will build on theories of complex social systems and processes to contribute to a better understanding of complex services.

## Service Organizations are Complex Social Service Systems

A number of theories about organizational complexity have emerged in response to the mechanistic views of organizational management, which are based on reductionism and determinism. In this article, I will use elements of systems thinking, social systems theory, complex adaptive systems, and the theory of complex responsive processes.

### Service Organizations as Systems

In systems thinking, a system is a whole that cannot be divided into independent parts without losing its essential properties.<sup>19</sup> A system's performance therefore depends more on how its parts interact than on how they act independently of each other. From a systems viewpoint, an organization cannot define its success by how efficiently it optimizes individual employee performance. Rather, management efforts should be focused on setting conditions for optimal interactions between individuals.

### Service Organizations as Social Systems

In a social system, both the parts and the whole are purposeful.<sup>20</sup> Purposeful individuals can change their goals in constant environmental conditions; they use free will to select their goals and the means by which to pursue them.<sup>21</sup> This is opposed to an animate system, whose whole is purposeful, but whose parts are not – such

as the human body and its organs. As Ackoff explains,<sup>22</sup> a social systemic view of organizations treats employees as human beings with purposes of their own, rather than as a “body” – an operating unit without consciousness, and one that cannot choose – ruled by the management “brain.”

### ***Service Organizations as Complex Adaptive Systems***

A complex adaptive system consists of very large numbers of interacting entities known as agents, such as a flock of birds and termites building large structures. By adapting to each other during their interactions, they form a system that adapts to its environment. Complex adaptive systems behave according to generally agreed principles, including self-organization and emergence.<sup>23</sup> Self-organization is “the ability of interconnected autonomous agents of a complex adaptive system to evolve into an organized form without external force.” Emergence is “a bottom up process whereby a groundswell of activity enables something to come into being, to become prominent.”<sup>24</sup> In other words, long-term, population-wide patterns emerge without an overall plan or blueprint. A complex, adaptive view of organizations takes into account that employees behave according to a certain social order without external management (blueprint), and that new, unpredictable, behaviors can emerge through interactions between employees.

### ***Service Organizations as Complex Responsive Processes***

A final theory that contributes to understanding complex service organizations is the theory of complex responsive processes developed by Ralph Stacey.<sup>25</sup> The theory is a response to Stacey’s frustrations about the differences between his personal experiences as a strategist in industry and the theories about strategic management described in the traditional management literature. The dominant models in the management literature showed linear relationships between actions and strategic goals, but Stacey experienced that strategic management seldom resulted in the expected outcome.<sup>26</sup> Building on Elias’s theory of process sociology,<sup>27</sup> and on theories of complex adaptive systems, he subsequently developed the theory of complex responsive processes to describe how organizations work in reality: “organizations are not actually existing things called systems but, rather, are ongoing, iterated patterns of relationships between people.”<sup>28</sup> In line with social systems theory, Stacey argues that unlike (digital) agents in complex adaptive systems, human agents in organizations are not simple, rule-following beings. They are “conscious and self-conscious beings capable of spontaneity, imagination, fantasy and creative action.”<sup>29</sup>

If we use the theories of social systems and complex responsive processes to look at complex service systems, we see a service organization consisting of ongoing, iterated patterns of relationship between purposeful human beings. It is not just the interface between service consumer and service professional that is social (intangible). The parts of the system infrastructures created by patterns of relationships between employees – both within and across service organizations – are social as well. I will therefore refer to these service organizations as complex social service systems.

Above mentioned complex social systems theories have been used in organizational management to develop management and leadership practices. However, these theories do not explain how we can design for them.<sup>30</sup> If service organizations are ongoing patterns of relationships between people, then it becomes relevant to explore the application of human-centered design principles in designing for such service organizations. The application of design to complex and social systems is not new. Kees Dorst<sup>31</sup> showed that designers’ framing practices contributes to addressing open, complex, dynamic, and networked problems; Bella Banathy<sup>32</sup>

22 Ackoff, *Ackoff’s Best*, 36.

23 For an example overview of these theories, see Helen Hasan, “Complexity Theory,” in *Being Practical with Theory: A Window into Business Research*, ed. Helen Hasan (Wollongong: Lulu Press, 2014), 49–54.

24 *Ibid.*, 51.

25 Ralph Stacey, “Ways of Thinking about Public Sector Governance,” in *Complexity and the Experience of Managing in Public Sector Organizations*, ed. Ralph Stacey and Douglas Griffin (London: Routledge, 2006), 32.

26 Ralph Stacey, “The Theory of Complex Responsive Processes: Understanding Organizations as Patterns of Interaction between People,” in *Tools and Techniques of Leadership and Management: Meeting the Challenge of Complexity* (New York: Routledge, 2012), 9–22.

27 See Norbert Elias, *The Civilizing Process*, rev. ed., trans. Edmund Jephcott (1939; Hoboken: Wiley-Blackwell, 2000).

28 Stacey, “Ways of Thinking about Public Sector Governance,” 39.

29 *Ibid.*, 33.

30 I use the term designing for complex social systems because the complex and dynamic nature of these systems determines that they cannot be designed in themselves. We can only design interventions that influence the behavior of the system.

31 Dorst, *Frame Innovation*, 2.

32 Bela H. Banathy, *Designing Social Systems in a Changing World* (New York: Plenum Press, 1996).



33 Harold G. Nelson and Erik Stolterman, *The Design Way: Intentional Change in an Unpredictable World*, 2nd ed. (Cambridge, MA: MIT Press, 2012), 261.

34 Vargo and Lusch, "Evolving to a New Dominant Logic for Marketing."

35 Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage* (Boston: Harvard Business School Publishing, 2009).

36 Pelle Ehn and Dan Sjögren, "From System Descriptions to Scripts for Action," in *Design at Work: Cooperative Design of Computer Design*, ed. Joan Greenbaum and Morten Kyng (Hillsdale: Lawrence Erlbaum Associates, 1991), 241–68; Michael J. Muller and Sarah Kuhn, "Participatory Design," *Communications of the ACM* 36, no. 6 (1993): 24–28, DOI: <https://doi.org/10.1145/153571.255960>.

37 A well-known example of HCD methods and practices that focuses on human physical characteristics is presented in Henry Dreyfuss, *The Measure of Man: Human Factors in Design* (New York: Whitney Library of Design, 1967).

38 Examples of works that have introduced the need for a focus on usability and cognitive needs include Donald A. Norman, *The Design of Everyday Things* (New York: Basic Books, 2002); and Lucy A. Suchman, *Plans and Situated Actions: The Problem of Human Machine Communication* (New York: Cambridge University Press, 1987).

39 For example, see the work of Pieter M.A. Desmet, "Measuring Emotion: Development and Application of an Instrument to Measure Emotional Responses to Products," in *Funology: From Usability to Enjoyment*, ed. Mark A. Blythe, Kees Overbeeke, Andrew F. Monk, and Peter C. Wright (Dordrecht: Kluwer Academic Publishers, 2005), 111–23; and Patrick W. Jordan, "Pleasure with Products: Human Factors for Body, Mind and Soul," in *Human Factors in Product Design: Current Practice and Future Trends*, ed. William S. Green and Patrick W. Jordan (Philadelphia: Taylor & Francis, 1999), 206–17.

argued that purposeful systems design can guide societal evolution; and Nelson and Stolterman<sup>33</sup> promote a "design-driven approach to the world," and show how the systemic nature of design inquiry and design action is not only at the core of traditional design, but can be applied in any kind of complex context such as organizational design, social systems design, and educational systems design. In this article I will show how design's human-centeredness contributes to designing for complex social systems and, in particular, social complex service systems.

## Human-Centered Design and Innovation

Human-centered design (HCD) is a group of methods and principles aimed at supporting the design of useful, usable, pleasurable, and meaningful products or services for people. These methods describe ways to gain and apply knowledge about human beings, and their interactions with the environment, to design products or services that meet human needs and aspirations. Even though the work of Vargo and Lusch<sup>34</sup> and Roger Martin<sup>35</sup> largely defines the humans at the center as customers and users,<sup>36</sup> HCD has adopted a broader perspective of the human that includes stakeholders such as service professionals, since the introduction of participatory and work-oriented design in the early nineties.

HCD can be aimed at various types of needs and aspirations. There are HCD methods and practices that focus on human beings' physical characteristics,<sup>37</sup> on usability and cognitive needs,<sup>38</sup> and, more recently, there has been a focus in design on emotional needs and user experience.<sup>39</sup> There are a large variety of HCD methods, each having their own specific purpose within a specific design context.<sup>40</sup>

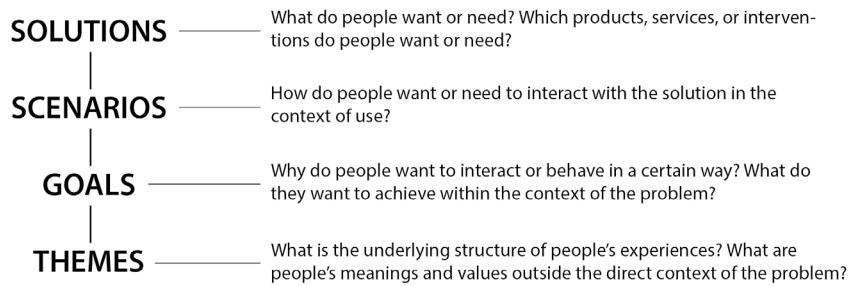
Human-centeredness is one of the key characteristics of design that has been widely adopted outside the traditional design field through design thinking and design innovation.<sup>41</sup> At the same time, HCD has been critiqued for only bringing about incremental types of innovation, rather than the radical innovation that is often preferred in a strategic business or organizational context.<sup>42</sup> Instead, many have argued that deep customer insights or a deep user understanding<sup>43</sup> is what is required to be able to innovate in more radical ways.<sup>44</sup> Even though I contend that such deep insights essentially keep human beings at the center – and can thus be considered HCD methods and practices in themselves – these insights are apparently different from the insights gathered through more traditional HCD methods.

Innovation is not just about designing products and services – it is also about designing an organization or system that is able to disseminate solutions. Innovation takes design to a systems level. If deep user insights are seen as fundamental to an innovation process, then it becomes relevant to explore how these types of insights could contribute to designing for social complex service systems. First, we need to develop a better understanding of what deep user insights are. For this purpose, we<sup>45</sup> developed a model that identifies different levels of depth in needs and aspirations in a design and innovation process.

## The NADI Model

We have developed a four-layer model of human Needs and Aspirations for application in a Design and Innovation process, which we abbreviate as NADI.<sup>46</sup> We chose to include the term aspiration to focus on longer-term hopes, desires, and ambitions – not just needs. By analyzing the types of needs and aspirations that emerge through the application of different HCD methods, we were able to distinguish four levels of insights: solutions, scenarios, goals, and themes (Figure 2).

On the most concrete level – the solutions level – are insights related to what people need or want. Solutions are the desired characteristics of design proposals



**Figure 2** The NADI model: four layers of human Needs and Aspirations for a Design and Innovation process. Image © 2017 Mieke van der Bijl-Brouwer.

such as products and services. For example, in gaining insight into user or consumer needs for the design of a convertible car,<sup>47</sup> one might find that people ask for characteristics such as heated seats or a soft top. We chose the term in line with the notion of the solution space – the term used by design scholars to refer to what is being designed.

One level deeper, the scenario level describes how people want to interact with a solution in a specific context of use. Someone driving a convertible, for example, might imagine cruising around the city and getting attention from people. We named this level “scenario” to highlight the influence of the context of use on interactions between people and products or services. The importance of context of use on interactions is widely acknowledged in HCD, based on Lucy Suchman’s work on situated action, which stresses that every course of action depends in essential ways on its material and social circumstances.<sup>48</sup> The integration of context of use and interaction in scenarios is at the core of many HCD methods, for example in scenario-based design.<sup>49</sup>

The deepest levels of insights are found at the goals and themes levels, which describe why people want or need certain solutions and scenarios. The difference between goals and themes is that goals describe what people want to achieve within the context of a certain design problem, while themes describe the underlying needs and aspirations that can be analyzed independently of that context. In the car example, imagine a single woman who has been driving a family car for twenty years, but whose children are now old enough to drive their own cars. Her goal could be to have a car all to herself, while the underlying themes are related to independence and identity. Independence and identity are themes that can be explored outside the context of a car.

We derived the word theme from hermeneutic phenomenology<sup>50</sup> and Dorst’s work<sup>51</sup> on how insights into themes support designers’ ability to create frames – new approaches to problems. Dorst found that the explorations that designers engage in to be able to reframe problems are a subtle process of analysis that is very close to methods used in the creation of phenomenological descriptions of lived experience. Just like phenomenologists, designers analyze a situation by discerning the underlying themes in stakeholders’ lives and worlds. Themes described in phenomenology are typically both deeply personal and also universal. For example, in their exploration of the phenomenon of care (by parents and nurses) at a children’s hospital, Marikken Høiseth and Martina Keitsch<sup>52</sup> identified phenomenological themes such as “feeling helpless” and “being in an ambivalent struggle,” and used these themes to inform the design of a nebulizer.

We developed the NADI model because, in our work, we have seen that the model’s different levels of depth each serve a different purpose in the design and innovation process. For example, the scenario level is extremely useful in participatory and co-design processes. Scenarios can form a common language that supports

<sup>40</sup> Examples of HCD methods include user evaluations, see Dreyfuss, *The Measure of Man*; and Jakob Nielsen, “Usability Testing,” in *Usability Engineering*, Jakob Nielsen (Boston: Academic Press, 1993), 165–206; participatory design, for example, see Ehn and Sjögren, “From System Descriptions to Scripts”; Muller and Kuhn, “Participatory Design”; generative design, for example, see Elizabeth B.-N. Sanders and Pieter Jan Stappers, *Convivial Toolbox: Generative Research for the Front End of Design* (Amsterdam: BIS Publishers, 2012); scenario-based design, for example, see Mary B. Rosson and John M. Carroll, *Usability Engineering: Scenario-Based Development of Human-Computer Interaction* (San Francisco: Morgan Kaufmann, 2002); and Mieke van der Bijl-Brouwer and Mascha C. van der Voort, “Exploring Future Use: Scenario based Design,” in *Advanced Design Methods for Successful Innovation: Recent Methods from Design Research and Design Consultancy in the Netherlands*, ed. Cees de Bont et al. (Delft: Design United, 2013), 57–77; contextual inquiry and ethnography, for example, see Hugh Beyer and Karen Holtzblatt, *Contextual Design: Defining Customer-Centered Systems* (San Francisco: Morgan Kaufmann, 1998); and many others.

<sup>41</sup> A well-known introduction to the strategic application of design is Tim Brown, “Strategy by Design,” *Fast Company*, June 1, 2005, <https://www.fastcompany.com/52795/strategy-design>. An overview of design-led and design-driven innovation methods and practices is given in Andy Dong, “Design X Innovation,” in *Consilience and Innovation in Design: Proceedings of IASDR 2013*, ed. Kazuo Sugiyama

(Tokyo: Shibaura Institute of Technology, 2013), 234–45.

42 For example, see Donald A. Norman and Roberto Verganti, “Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change,” *Design Issues* 30, no. 1 (2014): 78–96, DOI: [https://doi.org/10.1162/DESI\\_a\\_00250](https://doi.org/10.1162/DESI_a_00250).

43 Martin, *Design of Business*, 161.

44 Martin, *Design of Business*, 161; Roberto Verganti, “Design, Meanings, and Radical Innovation: A Metamodel and a Research Agenda,” *The Journal of Product Innovation Management* 25, no. 5 (2008): 436–56, DOI: <https://doi.org/10.1111/j.1540-5885.2008.00313.x>.

45 The NADI model was developed by the author of this article in collaboration with Kees Dorst.

46 Mieke van der Bijl-Brouwer and Kees Dorst, “Advancing the Strategic Impact of Human-Centred Design,” *Design Studies* 53, (November, 2017): 1–23, DOI: <https://doi.org/10.1016/j.destud.2017.06.003>.

47 This example is drawn from the product design industry. Please note that the model can also be applied to social services, for example, as shown in van der Bijl-Brouwer and Dorst, “Advancing the Strategic Impact of Human-Centred Design.”

48 Suchman, *Plans and Situated Actions*.

49 Rosson and Carroll, *Usability Engineering*.

50 Max van Manen, *Researching Lived Experience: Human Science for an Action Sensitive Pedagogy* (Albany: State University of New York Press, 1990), 78.

51 Dorst, *Frame Innovation*, 65.

52 Marikken Høiseth and Martina M. Keitsch, “Using Phenomenological Hermeneutics to Gain Understanding of Stakeholders in Healthcare Contexts,” *International Journal of Design* 9, no. 3 (2015): 39, available at <http://www.ijdesign.org/ojs/index.php/IJDesign/article/view/1947>.

53 van der Bijl-Brouwer and van der Voort, “Exploring Future Use.”

communication between designers and different types of stakeholders.<sup>53</sup> Again, there is strong agreement in the strategic business and innovation field that deep customer insights are required for more radical types of innovation. In a recent article,<sup>54</sup> we show how insights on the themes level are most useful in such innovation processes.

In this paper, I further explore the NADI model as a provisional framework for complex service systems design by applying it to two case studies. The first study shows how themes can be used to explain the success of an intervention designed for a complex problem in an educational context. The second describes a project in a complex health service context in which themes were actively used by the author and her colleagues to design interventions using Dorst’s frame creation approach.<sup>55</sup>

## Case Studies: Designing for Complex Service Systems

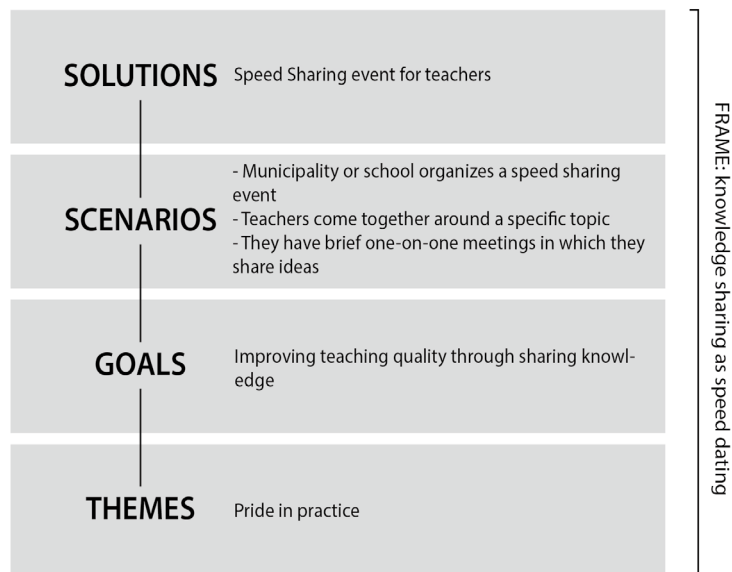
### Case Study 1: A Time-Quality Dilemma for Elementary School Teachers

The first example is a retrospective study of a project executed by MindLab (a Danish cross-governmental innovation unit) for the Danish municipality of Odense. This case study is part of a larger group of case studies examining the innovation practices of agencies working in the public and social sector to address complex societal problems. To conduct the case study, I interviewed members of the design team and their clients from the public or social sectors, and analyzed design documentation provided by the teams.

The municipality had asked MindLab to help design interventions for primary school teachers who needed to adjust their teaching practice in line with a reform recently introduced by the education ministry. The reform required teachers to deliver the same quality of education with less preparation time.<sup>56</sup> The MindLab team used provocative prototypes, inspired by practices from other industries, and various co-design sessions with teachers and the municipality to explore different types of interventions. An initial design proposal was a box of ingredients that teachers could use for their lessons. The idea was inspired by the “Årstiderne-box,”<sup>57</sup> a box containing organic produce and products plus recipes for a meal. In a second iteration, MindLab invited teachers to help design and prototype the ideal content of this box. But the teachers did not accept the idea – they thought the box was too static. Rather than copying a complete lesson, they were looking for inspiration to develop their own lessons. This eventually led to the design of a more successful proposal, a speed sharing event (based on the speed dating metaphor). Speed sharing would enable teachers share ideas about lessons around a specific theme, for example physical education, during an event facilitated by the municipality and/or schools. The teachers were very enthusiastic about speed sharing, and this intervention is now being implemented and disseminated.

The theme of “pride in practice” might help us understand the success of the speed sharing intervention. When you have independently developed an expert practice – as teachers do – you do not want an anonymous agency to tell you how to improve your practice. It would be like giving a pre-prepared meal kit to a chef! When people take pride in their practice they want to share their knowledge and learn from their peers, not passively receive tips in a lesson box. The pride in practice thematic structure applies to every expert practice, and can therefore be explored outside the context of the original problem of teaching, thus providing a deeper understanding of the problem. Figure 3 shows how the speed sharing event can be explained using the NADI model.





**Figure 3** The NADI model for case study 1. Copyright © 2017 Mieke van der Bijl-Brouwer.

### Case Study 2: Supporting People Suffering from Severe Mental Illness

The second case study is a project conducted by my design and research team for an Australian not-for-profit organization established by and funded through a federal government initiative. Its mission was to solve the systemic problems associated with supporting people with severe and persistent mental health problems during an acute mental health crisis. We applied Dorst’s frame creation methodology,<sup>58</sup> which can be used to address open, complex, networked, and dynamic problems. The main principle of the approach is that addressing these problems requires actors to “reframe” the problem from a new perspective. This case study illustrates the core steps of Dorst’s reframing method.

My team and I used different methods to identify the needs and interests of the various stakeholders of this case, including interviews, cultural probes, and various participatory design sessions. In line with the frame creation approach, we used principles of hermeneutic phenomenology to analyze themes and develop frames and solution proposals. We used the NADI model to communicate frames and solutions to stakeholders. The project lasted six months.

The project targeted the problems that arise when people with a severe mental health problem urgently need service professionals’ help – for example when they are experiencing a psychotic episode, acute anxiety, and/or suicidal thoughts. The current collective service response is very traumatizing for these people, and there are many conflicts between different service providers. Before engaging our team, the partner agency had brought various stakeholders together, and the kind of solutions they were thinking of included new protocols and standard operating procedures. However, in the past, such interventions had not led to satisfying outcomes.

Once we had explored the needs and aspirations of these stakeholders, we found a number of reoccurring themes. In this article, I will use the reoccurring “drive to make a difference” theme to illustrate how thematic analysis can lead to the development of solutions. All the interviewees and workshop participants working in the context of this problem mentioned their drive to make a difference. As one ambulance paramedic put it, “There’s no better feeling than saving someone’s life.”

During frame creation, we use methods borrowed from hermeneutic phenomenology to develop an understanding of the theme outside the context of

<sup>54</sup> van der Bijl-Brouwer and Dorst, “Advancing the Strategic Impact of Human-Centred Design.”

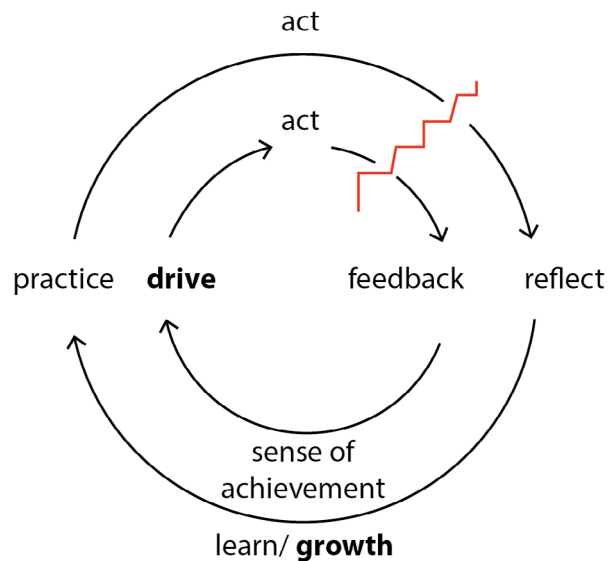
<sup>55</sup> Dorst, *Frame Creation*, 73–79.

<sup>56</sup> See also Lene Nygaard and Sophie Reynolds, “Creating Solutions for Danish Teachers: The Time and Quality Dilemma,” *nesta.org.uk* (blog), October 30, 2015, <http://www.nesta.org.uk/blog/creating-solutions-danish-teachers-time-and-quality-dilemma-0>.

<sup>57</sup> See <http://organicdenmark.com/organic-companies/aarstiderne-as>, and <https://www.aarstiderne.com/velkommen> (in Danish) for more information.

<sup>58</sup> Dorst, *Frame Creation*, 73–79.

Figure 4 The broken cycle of drive and growth. Copyright © 2017 Mieke van der Bijl-Brouwer.



59 For some examples, see Kees Dorst et al., *Designing for the Common Good* (Amsterdam: BIS Publishers, 2016).

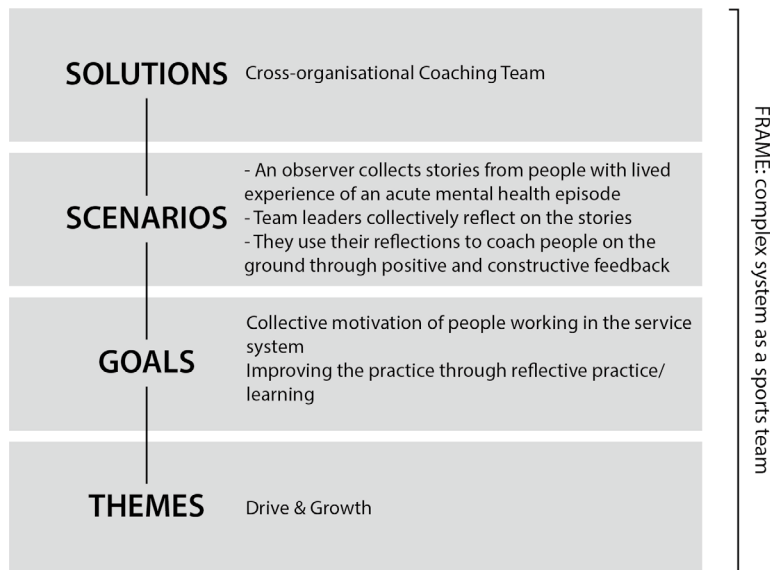
60 Dorst, *Frame Innovation*, 78.

the problem. This includes various exercises – reflecting on the theme through personal experience, reading literature about the theme, and exploring pieces of art or music that reflect the meaning of the theme.<sup>59</sup> Through these exercises, we discern the theme’s pattern. For example, we asked ourselves the questions “When do you experience the drive to make a difference?” and “What does it feel like?” Through this analysis, we found that to sustain that drive, there is a need for feedback. When you are driven to do something good, you feel a sense of achievement when you see the results of your efforts. For example, when your friends express their enjoyment after you have cooked them a big meal, it feels good. That feeling might, in turn, motivate you to continue organizing dinner parties for your friends. Without the feedback, that drive cannot be sustained.

That feedback is exactly what was missing in the problem context of acute mental illness response. For example, some police officers indicated a sense of futility and frustration to us. “If we do not hear from the person again,” they agreed, “there is the assumption that one of three things happened to them: 1) they got better, 2) they moved away, or 3) they died. We are essentially feeding our efforts into a ‘cone of silence’ that gives no response.” The ambulance paramedics mentioned similar experiences with regard to getting feedback on their actions: “It’s not like stopping the bleeding or starting the heart.”

Feedback is also an essential element of another prominent theme: learning or “growth.” People only learn if they know what the effects of their actions are (Figure 4). In the cooking example, people can only become better at cooking when they can taste the food or when their friends (honestly) express their thoughts about the meal prepared. Feedback is therefore essential to learning. A police officer confirmed this and indicated it would be useful to know what works and what does not. One part of the systemic problem of supporting people with severe and persistent health problems is, therefore, this broken cycle of drive and growth.

To reframe the problem, we looked at how elements of these themes have been dealt with in domains outside the problem context. Exploring these metaphors can lead to new frames.<sup>60</sup> A frame that turned out to be particularly fruitful for the themes of drive and growth was to look at generating a shared response to mental illness as if the actors were all members of a sports team. We found that the shared response at the time was like a sports team whose players each had a different coach and each took the field at different times. This makes it very hard



**Figure 5** The NADI model for case study 2. Copyright © 2017 Mieke van der Bijl-Brouwer.

to collectively coach mental health episode responders, and sustain their drive and growth.

Through this frame, we developed a solution: a “coaching team.” [Figure 5](#) expresses this solution using the NADI model. A coaching team is a group of team leaders from each of the participating organizations (such as ambulance and police). The scenario we envisioned for this coaching team is that they frequently meet to reflect on what is happening on the field. To be able to get an appropriate view of this newly created field we designed a new role: the observer. This is someone who interviews people with a severe mental illness who have recently been through an episode, and maps their experiences on a journey map, for example. The journey map would then be delivered to the coaching team, enabling them to reflect on their collective actions. They can then adjust their coaching to provide constructive feedback on the negative stories and positive feedback on the rest. The goal of this scenario is to stimulate motivation and provide reflective learning practice for the service providers in acute mental illness situations. The underlying themes are drive and growth.

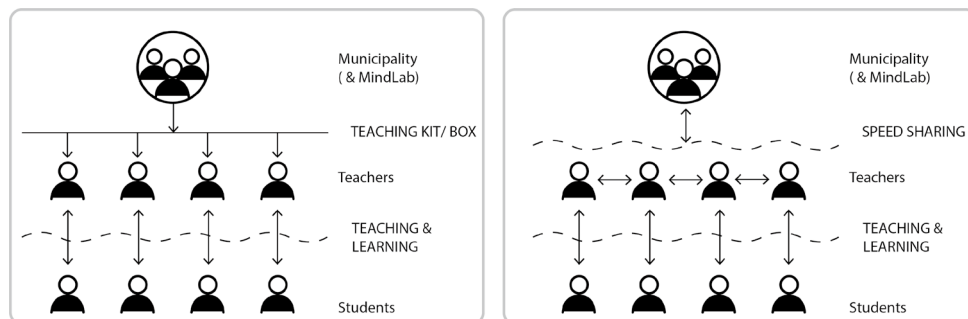
## Discussion: Designing for Social Infrastructures

### Social Infrastructures

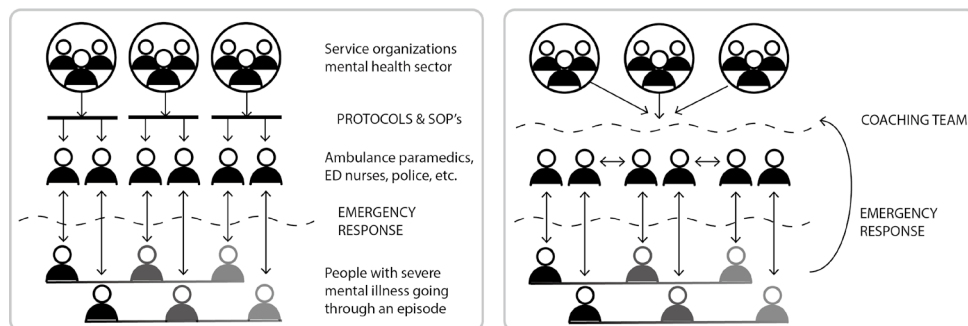
Both case studies reflect Stacey’s theory of complex responsive processes and the social systems and complex adaptive systems theory on which his work is based. The initial perspective in each was top-down and linear. The lesson box in case study 1 and the protocols and standard operating procedures in case study 2 tried, to a certain extent, to control the behavior of the service professionals. The successful interventions in each of the two case studies are more in line with complex responsive processes. If we look at these interventions (in context) as if they were complex responsive processes, ongoing iterated patterns of relationships between people emerge. We see

- A focus on interactions between service professionals rather than a focus on the actions of individual service professionals, and
- A process conducted by and through conscious and creative human agents rather than rule-following agents. Change comes from within through the service professionals’ creative actions.

**Figure 6** A linear service infrastructure: the lesson box (left), versus a social infrastructure: a speed sharing event (right) in case study 1. Copyright © 2017 Mieke van der Bijl-Brouwer.



**Figure 7** A linear service infrastructure: protocols and standard operating procedures (left) versus a social infrastructure: a coaching team (right) in case study 2. Copyright © 2017 Mieke van der Bijl-Brouwer.



The interventions also reflect the characteristic of emergence – they do not prescribe or control the behaviors of the service professionals, but allow for emergent actions. The coaching team supports the emergence of new collaborative practices among acute mental health crisis responders, while the speed sharing event supports the emergence of new teaching practices.

These perspectives on the case studies are illustrated in Figures 6 and 7. Ongoing, iterated patterns of relationship between people can be seen at both the service interface and infrastructure level in both cases. I will therefore refer to these parts of service infrastructures as “social infrastructures.”

Social infrastructures are intentionally designed interventions that have a clear structure or process. This was illustrated by one of the municipality staff members in the first case study:

“I think the main issue is that [the teachers] don’t have enough time to do their work as thoroughly as they want to, so they have to think differently. Plus, a lot of the new reform addresses more teamwork and more sharing of good ideas. You don’t have the time to make up your own ideas all the time so you need to steal and borrow whatever you can from your co-workers.... They do that already, but they had a lot of things lying around and no one was using them. They needed a more systematic way to share these good ideas.... So they came up with this speed sharing idea, which has its roots in speed dating so everyone can relate to it even if they haven’t tried it. So it’s a very systemic way of sharing a good idea.”

Design activities can be considered at two different levels of the social infrastructure. There is the (expert) design team that designs the social infrastructure, and there are the service professionals that “design” their services within those social infrastructures through incremental improvement and adaptation. With this in mind, let us return for a moment to the focus on infrastructure versus interface discussion from the introduction. Both are relevant to the social infrastructure design process, even though neither of them can be fully designed because of their social systemic natures. In a social system, interface and infrastructure are both

composed of purposeful human beings who have the power to decide how they are going to behave as part of either the interface or the infrastructure of the service. It is therefore more appropriate to talk about designing for social infrastructures rather than the design of social infrastructures.

Figures 6 and 7 contrast social infrastructures with traditional (linear) service infrastructures to clarify the fundamental differences between the two. However, a more nuanced view might be required in which these linear and social infrastructures co-exist, each with a different purpose in complex service delivery. For routine tasks that are part of service delivery – such as marking exams – linear service infrastructures such as standard operating procedures ensure efficiency, while non-routine tasks benefit from social, non-linear infrastructures to allow for adaptability. Another limitation of this perspective is that it only considers the human element of service interfaces and infrastructures. In future research, considering the interaction between these human elements and non-human elements – environments, technologies, and physical products – will further develop these viewpoints in greater detail.

### Designing for Social Infrastructures

To design for social infrastructures, we need to put the human beings that enact the social infrastructure – service professionals and their colleagues – at the center. Edvardsson and Olsson<sup>61</sup> argue that a service provider’s staff is its key resource. “We must understand how individuals and groups of staff can be encouraged to work in the best manner. We must take their special needs, demands, and wishes into account, not just those of the customers.”<sup>62</sup> This is in line with Stacey’s comment that we need to draw from the fields of psychology, sociology, and philosophy to understand human relating.<sup>63</sup> But if we want to move from an understanding of human beings and human relating to creating solutions, we need further, design-based practices. Both case studies show how (re-) framing the perspective on the problem was key to generating designs for the social infrastructures. Dorst<sup>64</sup> has demonstrated that framing is at the core of expert design practice. Design expertise is therefore key to designing for social infrastructures.

The second case study showed how an investigation of phenomenological themes contributes to (re-) framing and designing for social infrastructures. As opposed to other levels of needs and aspirations in the NADI model, a theme can be explored outside the context of the problem, and through that supports frame creation based on metaphors from non-related contexts, which in turn opens up the solution space. Themes are particularly useful in a complex, networked context because they are relatively stable and are shared among different stakeholders.<sup>65</sup> Case study two showed how the “drive to make a difference” theme was shared among service professionals, and that common ground in turn became a pathway toward an intervention that met the needs and aspirations of these different stakeholders. Our experience has shown that we can also find common themes across different case studies with similar types of stakeholders. For example, the “drive to make a difference” theme is relevant in almost any kind of design problem that includes service delivery. Future research is therefore aimed at identifying those common themes, and a deeper analysis of these themes through hermeneutic phenomenology.

### Addressing Complex Societal Problems

In this article, I argue that human-centered innovation contributes to the design of complex service systems, and that these service systems are one of the keys to

61 Edvardsson and Olsson, “Key Concepts for New Service Development,” 140–64.

62 *Ibid.*, 151.

63 Stacey, “Theory of Complex Responsive Processes,” 15.

64 Kees Dorst, “The Core of ‘Design Thinking’ and Its Application,” *Design Studies* 32, no. 6 (2011): 521–32, DOI: <https://doi.org/10.1016/j.destud.2011.07.006>.

65 Dorst, *Frame Innovation*, 77.



66 For example, Don Norman and Pieter Jan Stappers have argued that instead of trying to construct a large, complex system in one step, the solution should be reached through modularity and the introduction of numerous incremental steps. Donald A. Norman and Pieter Jan Stappers, "Design X: Complex Sociotechnical Systems," *She Ji: The Journal of Design, Economics, and Innovation* 1, no. 2 (2015): 83–106, DOI: <https://doi.org/10.1016/j.sheji.2016.01.002>.

67 An overview of recent case studies and ideas about design for policy is presented in Christian Bason, ed., *Design for Policy* (London: Routledge, 2014).

68 Junginger, "Services as Key to Effective Government," 38–44.

69 Stacey, "Ways of Thinking about Public Sector Governance," 15–42.

addressing complex societal issues. The NADI model was presented as a provisional framework to show how a deeper understanding of service professionals' needs and aspirations contributes to innovation in this context. The developmental nature of this study presents some limitations and requires a further discussion with regard to its application. In particular, the NADI model as presented in this paper might incorrectly suggest that there is a simple approach to addressing a complex problem. Firstly, the application of HCD for this purpose will predominantly occur in the public and social sector. In this context, the service should not only deliver value for individuals, but for the public and society as well. The levels in the NADI model do not currently reflect these societal and public needs and aspirations. Furthermore, the term "solutions" in the NADI model and the case studies presented might suggest that there could be 'one-off' solutions to complex problems. However, scholars in the complexity field<sup>66</sup> agree that, rather than one-off and single solutions, complex systems require the continuous development of multiple interventions. This is also reflected in both case studies – multiple solutions were developed and prototyped rather than aiming for single solutions. This was aptly summarized by a municipality staff member who was involved in case study 1, who said, "I think, in a way, we have not solved the problem with this, but we have developed some very, very new ways of thinking in sharing knowledge and doing something else [for] the teacher."

A final discussion point that relates to service design in the public and social sector is the broader application of design in public and social sector innovation and, more specifically, policy development. Increasingly, people are recognizing that design can positively contribute to policy development.<sup>67</sup> In the traditional policy development cycle, design is only applied in the implementation of the policy through designing services. This happens *after* the policy making process, which includes an identification and clarification of policy needs (policy intent) and a formulation of the policy. However, Sabine Junginger<sup>68</sup> argues that to achieve better outcomes, service design ought to be integrated with policy making from the start through HCD. The cases and social infrastructures I have presented in this paper do not have an integrated policy development cycle. For example, in the MindLab case study, the social infrastructure of speed sharing made the educational reform at the policy level workable for teachers, but design was not integral to the design of the reform itself. To address the issues discussed in this section, future work will further develop the NADI model to reflect the complexity and dynamics of this innovation context, and explore its application in an integrated policy development cycle.

## Conclusion

In this article, I have discussed designing for social complex service systems with the goal of addressing complex societal issues. Using Stacey's theory of complex responsive processes,<sup>69</sup> I showed that service organizations, including the service infrastructure and the service interface, are ongoing iterated patterns of relationships between human beings. Social infrastructures are those parts of service infrastructures that empower human beings working in the service organization to creatively and continuously support each other and themselves. The two case studies showed how a human-centered design approach contributes to designing for such social service infrastructures. The NADI model was used as a provisional framework to illustrate how themes – the deepest level of stakeholder needs and aspirations – are particularly useful in this design context. It is essential that we integrate a deep understanding of service professionals and their relationships with their colleagues in systemic design to foster their drive, pride, and passion to make

a difference. The NADI model will be further developed to align it to the complexity and dynamics of designing for social complex service systems.

### **Acknowledgments**

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