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Engaging with competing demands in systems through design: Fostering a paradox lens

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Abstract: This paper aims to foster a paradox lens on competing demands to ensure their productive engagement in design. Competing demands are inevitable and ubiquitous features of today's systems. Thus, being subject to competing demands is a pervasive and inherent feature of designerly work. Drawing from organizational studies, we first outline four main streams of competing demands underlying today's systems; related to time, cognition, social interactions, and focus. We demonstrate the importance of a purposeful conceptualization of competing demands by exemplifying how different conceptualizations can lead to different responses. We suggest employing a paradox lens on competing demands, which stresses that seemingly contradictory or even mutually exclusive factors can and ought to coexist and therefore should be leveraged simultaneously. Through a series of research-through-design experiments we explore how framing competing demands according to paradoxes impacts the way they are approached in design practice, and how paradoxes can be engaged with through design.

Keywords: Design research, system-conscious design, competing demands, paradoxes

1. Introduction

Designers are being called to design in more system-conscious and -shifting ways (Drew et al., 2021). According to a commonplace definition, a system is a set of interrelated elements that is organised in a coherent way to achieve a purpose (Meadows, 2008). As systems become more interrelated, complexity increases (Leadbeater & Winhall, 2020; Sevaldson, 2013) and competing demands intensify, being subject to which becomes a pervasive and inherent feature of designerly work (Dorst, 2006). Previously pursuing mainly form-giving aspects, designers are now being urged to develop cognitive capabilities that allow them to simultaneously hold in mind and balance various diverse, often seemingly conflicting, yet interrelated demands in a more integrated manner (Dorst, 2019). As a result, discourses addressing competing demands have gained considerable attention within design research and practice, which is not not only mirrored by this track theme. For example, Johansson et al.

(2017) report about competing demands in a healthcare service design project related to the explicit goal of developing new services versus a hidden agenda of wanting to support new ways of working. Tromp & Hekkert (2014) point out a competing demand underlying the predominant notion of designing for the prevention of undesired consequences rather than for the realisation of desired ones, and Buchanan (2019) foregrounds the challenge of designing for *what is*, while also considering proactive design approaches addressing *what if*.

Synthesizing from organisational studies, section 2.1 suggests a categorisation of competing demands according to four streams; related to time, cognition, social interactions, and focus. In section 2.2, we stress the potential of developing a clear and coherent conceptualization of competing demands within design. In section 2.3, we first integrate the notion that viewing competing demands through a paradox lens is productive. Then we articulate the research gap that this paper explores, i.e., how conceptualizing competing demands according to paradoxes changes the way they are approached in design practice, and how paradoxes can be engaged with through design. Section 3 describes the research methodology and section 4 presents the findings. Section 5 discusses the implications of the research, and section 6 concludes by outlining limitations and future research directions.

2. Literature review

2.1 Competing demands as inevitable and ubiquitous features of systems

Organizational studies have conducted extensive research on competing demands (e.g., Calabretta et al., 2017; Clegg et al., 2002; Dameron & Torset, 2010a; de Wit & Meyer, 2010b; Lewis, 2000; Poole & Van de Ven, 1989; Smith & Lewis, 2011; Smith & Tracey, 2016). Synthesizing from this body of research, one can identify four distinct, yet interrelated, streams of competing demands; related to time, cognition, social interaction, and focus. Table 1 elaborates on them.

We suggest that these four streams are not only present in organizations but manifest in socio-ecological, -technical, -political, and -economic systems as well, and are therefore at the core of designerly work aimed to shift those systems (Drew et al., 2021). Put differently, we pose that designing in system-conscious and/or -shifting ways (ibid.) comes with engaging with competing demands. Therefore, we aim to help develop a better understanding of competing demands to create a coherent body of design theories and practices that will enable productive engagement with these demands.

Table 1. Four main streams of competing demands synthesised from organisational studies with examples of how these streams are mirrored in discourses in design.

Competing demands related to …	Description of competing demands	Examples of how the competing demands are mirrored in designerly and/or societal discourses
Time	Competing demands related to time are linked to continuously having to shift between and navigate across different time horizons, namely reflecting on past experiences, present realities, and envisioning and synthesizing desirable future states (Bonn, 2005; Bühring & Liedtka, 2018; Heracleous, 1998; Liedtka, 1998; Matic & Matic, 2021; Neuhoff et al. 2021; Pisapia et al., 2005).	The design field has for long been and is increasingly stressing the mismatch between the future we are creating and the future we must create (e.g. Balamir, 2021; Papanek, 1973). Drew et al. (2021) note the discrepancy between current business models and the kind of longer-term engagement that is needed for a sustainable future; and the demand that is currently presented as most pressing is "to meet the needs and aspirations of the present without compromizing the ability to meet those of the future'' (WCED, 1987, p. 43).
Cognition	Competing demands related to cognition are linked to the need to constantly shift, differentiate, think beyond, and integrate various diverse modes of thinking and doing to reframe a situation in a given context (Neuhoff et al. 2021; Pisapia et al., 2005; Srivastava & D'Souza, 2021).	Design researchers have for long been stressing the importance of harnessing the interplay of divergent and convergent thinking (Cross, 1985) and, therefore, created a structured framework in which design methods support the respective modes within design practice (Cross, 2008; Drew, 2019).
Social interactions	In human-shaped systems (Drew et al., 2021), competing demands related to social interactions are inevitable. They are linked to the recursive interaction, analysis and utilisation of one's own beliefs, perceptions, and experiences, and those of others, to synthesise new knowledge and arrive at conclusions (Dameron & Torset, 2010a; Matic & Matic, 2021; Neuhoff et al. 2021; Smith & Lewis, 2011; Srivastava & D'Souza, 2021). Pisapia et al. (2005) note that interaction can occur introspectively, i.e., within one's own mind, and extrospectively, in community with others and with things external to one's own mind.	Also in current design debates, systems are associated with assemblages of different understandings, intelligences, perceptions and worldviews, which must be equally assessed and valued, including those of non-human and non-living actors (Drew et al., 2021). Simeone (2016) offers a take on design as translational practice in which the material dimension is key in (dis-) connecting and negotiating meaning, interpretations, and ways of operating among various stakeholders.

Focus	Competing demands related to focus result from the need to recognise, stay open, and make sense of issues and events happening across the system's scales. Dealing with these kinds of competing demands requires the ability to zoom in and out, and to recognise interdependencies within the system and relationships among the system's elements that, taken together, comprise the whole (Liedtka, 1998; Neuhoff et al. 2021; Srivastava & D'Souza, 2021).	The design field continuously explores approaches, methods, and techniques that enhance designers' abilities to cope with systemic complexity (Sevaldson, 2011), and to shift systems into more desirable states (Drew et al., 2021). Approaches such as systems-oriented (Sevaldson, 2011), or system-shifting design (Drew et al., 2021) emerged. The former approach proposes e.g. GIGA maps, i.e., extensive maps that visualise multiple layers and scales of a system, to investigate and grasp relations between seemingly separate systemic elements (Sevaldson, 2013, 2011).

2.2 The potential of conceptualizing competing demands within design research

Organizational studies contend that a clear conceptualization of competing demands, e.g., according to dilemmas, conflicts, dialectics, etc., is important, as the conceptualization prescribes how the demands are responded to (Achtenhagen & Melin, 2003; Gaim & Wåhlin, 2016). While defining each of these concepts goes beyond the scope of this paper (for a more detailed conceptual depiction see Gaim & Wåhlin, 2016), we want to illustrate that notion with an example. Within organizational studies, dilemmas, for example, are often seen as either-or situations in which one [unpleasant] alternative must be favored at the expense of another (Gaim & Wåhlin, 2016). They occur in situations, where it is difficult to choose which demands to attend to (Achtenhagen & Melin, 2003). This binary either-or characterization of dilemmas implies the inclination towards one of the elements to reduce complexity, uncertainty, and suppress tension (Gaim & Wåhlin, 2016).

In design research, competing demands are more rarely conceptualized but rather interchangeably referred to as, for example, dilemmas, conflicts, dichotomies, or dialectics, or in terms of their underlying tensions (e.g., Bau, 2010; Björgvinsson et al., 2010; Dorst, 2006; Ozkaramanli et al., 2020; Wong & Tan, 2021). Design scholars increasingly recognize the productive potential embedded in the space between competing demands. For example, dilemma-driven design utilizes personal dilemmas as stimulation for creativity and reflection (Ozkaramanli et al., 2020). Emilson et al. (2011) use prototyping to evoke, highlight, and explore dilemmas and opportunities connected to moral implications or stakeholders' different agendas in design for social innovation. Similarly, Björgvinsson et al. (2010, p. 4) utilized socio-material assemblages that deal with "matters of concern" (Latour, 2005) to surface dilemmas. Inspired by management literature, Bau (2010) suggests designing for strategy dichotomies and paradoxes to approach the fuzzy front-end of innovation and design projects. The RSD symposium held in November 2021 in Delft was titled "Playing with Tensions", and Drew et al. (2021, p. 56) describe how engaging with competing demands should resemble a "graceful dance" between poles. All these scholars point towards an underlying value of

competing demands, something that is fruitful, can be leveraged, embraced, and engaged with through design.

We believe that in an era in which competing demands are here to stay, in an era in which their potential is increasingly recognized and aimed to be leveraged, it is important to foster a clear and shared conceptualization that, per definition, permits the simultaneous co-existence of multiple competing demands. Such a conceptualization would open an opportunity space in which we can more productively and sustainably explore, catalyze, and leverage approaches to them (Jarzabkowski et al., 2013; Smith & Lewis, 2011), approaches that utilize the potential of competing demands and that allow designers to play with them (van der Bijl-Brouwer, 2021), and dance with them (Drew et al., 2021).

2.3 Fostering a paradox lens on competing demands

Inspired by organizational literature, we contribute to the debate by proposing to view competing demands through a paradox lens. A paradox is a situation in which two or more seemingly contradictory, or even mutually exclusive, yet interrelated, demands are held to be true simultaneously and over time (de Wit & Meyer, 2010a; Smith & Lewis, 2011). A paradox lens implies "rethinking the relationship between competing demands and exploits the complementarity and interdependence" (Gaim & Wåhlin, 2016, p. 35). Engaging with paradoxes involves embracing and evoking the complexity, uncertainty, and tensions that lie in-between the competing demands, and recognizing that these demands can and ought to coexist (Clegg et al., 2002; de Wit & Meyer, 2010b; Gaim et al., 2018; Smith & Lewis, 2011). A paradox implies shifting from an either-or, if-then logic towards a synthesis approach that draws on both-and, best-of-both, and neither-nor thinking that simultaneously engages and fulfils all demands to their full potential (Clegg et al., 2002; Dameron & Torset, 2010b; Dorst, 2015; Gaim & Wåhlin, 2016; Smith & Lewis, 2011). Thus, a paradox lens is a cognitive meaning- and sense-making frame, i.e., an applied view on the problematic situation (Dorst & Hansen, 2011), to make it possible to productively enact complex systems (Dameron & Torset, 2014; Luscher & Lewis, 2008). Evidence illustrates that organizations, which approach competing demands as paradoxes, i.e., who juxtapose, reconcile, and simultaneously engage both forces, are more successful in today's constantly changing environments (Gaim et al., 2018; Lewis & Smith, 2014; Tse, 2013).

While referring to competing demands as paradoxes is not entirely uncommon in design, it is quite common to equate them with, or interchangeably refer to them as for example dilemmas (as outlined in the previous section). Some scholars, such as Drew et al. (2021) note a conceptual difference, when they describe some competing demands as non-binary positions that the designer should not try to find compromise between: "Rather, they form a paradox from which a new type of skill or capability can grow, like a graceful dance between these spaces" (p. 56). Also, Dorst (2006) contributes to decluttering the lexicon. Inspired by Whitbeck's remark (1998) that "[t]he initial assumption that a conflict is irresolvable is misguided because it defeats any attempt to do what design engineers often do so well,

namely, to satisfy potentially conflicting considerations simultaneously", Dorst makes use of a paradox lens to address situations where designers and engineers have to deal with competing demands "through their design thinking" (p.14). He recognizes that "[t]he creation of solutions to a paradoxical design situation often requires the development and creative redefinition of that situation" (p.14) which poses opportunities within and for the design process. DiSalvo (2016) employs design to deliberately construct irony. According to him, irony entails paradox, and paradox ignites inquiry. As such, for DiSalvo, using design to construct irony is a way to perform inquiry: "It is the perceived inconsistency of a situation, and the desire to engage, understand, express and appreciate the conflicting aspects [...] that [...] motivate the investigation and experimentation that comprise inquiry" (p. 147).

We have tried to bring forward the argument that the distinction between the various conceptualizations of competing demands is important. Inspired by organizational literature we integrated a paradox lens as a productive conceptualization of competing demands. To emphasize the integration of a paradox lens we will from here on refer to the four competing demands outlined in section 2.1 as paradoxes, namely the time paradox, cognition paradox, social paradox, and focus paradox. We think it is precisely this conceptual sensitivity that allows us to productively engage with competing demands, i.e., to synthesize, balance, and play with the complexity and tension that is situated in the space between the competing demands. However, what remains still underexplored is how a paradox lens may be enacted in practice and how design can be utilized to productively engage with paradoxes. Therefore, we pose the following research questions:

How does conceptualizing competing demands according to paradoxes impact the way they are approached in design practice? How can paradoxes be engaged with through design?

3. Methodology

3.1 Approach
Our study employs an abductive approach that draws on theoretical and empirical inputs (Van Maanen et al., 2007). On the one hand, it builds on discourses on paradox theory in organisational studies (Lewis & Smith, 2014; Smith & Tracey, 2016). On the other hand, and noting the need to integrate these theoretical discussions in practice (Friedman, 2008), our study combines them with empirical input by employing a 'research through design' approach that draws on the implicit knowledge of design through contextual design experiments (Bang & Eriksen, 2014; Frayling, 1993). Applying a research-through-design approach enabled us to investigate the research question in a process that posed us with an opportunity to reflect on the process and the specifics of the design (Bang & Eriksen, 2014). We chose to conduct these investigations in a real-life context to ensure their relevance. *How* and *why* questions were asked to open a space in which a theory-building process could occur (Eisenhardt & Graebner, 2007). Moreover, the design experiments supported the explor-

atory nature of our research. The embedded position of the authors allowed for the generation and analysis of rich qualitative material through participant observation (Czarniawska, 2012), two focus groups (Frey, 2018), and interviews (Trochim et al., 2016).

3.2 Research context

This paper draws from insights from eight design experiments. The experiments were staged through a series of participatory design workshops that the authors conducted and in which people came together to explore issues of concern. Five experiments took place in an organization as part of an ongoing three-year action research project (Frayling, 1993). Three experiments were embedded in an academic context, i.e., in classes for service design master students. In two of the experiments conducted in academia, students were asked to develop future-proof circular city concepts. In the third experiment, the assignment was to develop a business idea with positive social and environmental impact.

The experiments were organized around the four paradoxes, i.e., we staged a process that attempted to deliberately expose the participants to one or more of the paradoxes outlined in section 2.1. The participants worked co-creatively in groups and employed designerly approaches to engage with the paradoxes and accomplish the task of the respective experiment. Table 2 describes the designerly approaches used in the experiments, most of which have been inspired or adopted from other design methods or approaches. Table 3 summarizes the research-through-design experiments and specifies which designerly approaches were employed.

Table 2.   Designerly approaches employed in the design experiments.

Designerly approach	Description
Storytelling prompts	Participants fill-in incomplete sentences to create a short story from the perspective of someone else focusing on a current problem, future success, and risks.
Time Travel	Meditation-inspired visioning exercise using storytelling, breath, and sound to make people envision various future states as alternative entities to the present.
Trend exploration	Identifying signals, trends and drivers of change and prompting participants to reflect and speculate on their systemic implications.
Scan cards	Participants write scan cards to reflect, speculate on, and communicate possible implication of various trends and drivers of change.
Future scenarios	Participants write future scenarios to reflect, speculate on, and communicate possible dystopian as well as utopian futures.

Policy interventions	Prompting participants to ideate and propose policy intervention that can potentially contribute to desired systemic change.
Thinking hats	Prompting participants to take on perspectives of diverse and excluded actors (human, non-human, non-living) to make them reflect on, and empathize with other point of views.
Artistic prototypes	Collectively developing artistic prototypes that communicate an idea to integrate and nurture emotive, intuitive, and creative thinking.
Brainwriting	Idea generation exercise where participants individually produce ideas in written form before sharing with a group.
Mind map	Visual representation of systemic relationships.

Table 3.   Overview of design experiments.

No. of experiments	Context	No. of participants	Date	Duration	Designerly approaches employed
2	Academia	32 – 40	02/03 2021	3 hours	Trend exploration, future scenarios, policy interventions, time travel
1	Academia	28	09/2021	1 week, full time	Trend exploration, future scenarios, thinking hats, artistic prototypes, mind map
5	IT company	8 – 13	10/2020	1,5 hours	Storytelling prompts, brainwriting

We conducted cross-context experiments to increase the generalizability of the generated insights, e.g., to understand whether the same effects of a given design intervention occur in other contexts and to another set of individuals (Blair & McClendon, 2021). As such, our study tries to generate knowledge through design experiments that can, potentially, be employed elsewhere (Koskinen et al., 2013).

4. Findings

In the following, we present our analysis of the eight experiments focusing on how conceptualizing competing demands as paradoxes changes the way they are approached in design practice, and how paradoxes can be engaged with through design.

4.1 Time paradox

The time paradox was established by asking participants to thoroughly explore and navigate multiple time horizons, to stay open while simultaneously make sense of emergent realizations and their contextual and temporal implications. For example, in one experiment participants were asked to iteratively explore and speculate about how various present cross-contextual trends and signals might impact a specific context in the near and far future. Based on these explorations participants had to invent a service idea that was situated between and addressed both present and emerging challenges as well as present and future opportunities. One participant reflected on the paradoxical nature, the complexity, and tension of that task: "It had at times felt like a roller-coaster. Creating a service idea, re-evaluating the idea every time some numbers or realization of the reality changed the foundation". The approaches that were employed to productively engage with this paradox were trend exploration, time travel, scan cards, future scenarios, and storytelling prompts.

That some approaches worked better than others became apparent, for example, when one participant asked: "Do we have to develop future scenarios now?", whereupon the facilitator answered: "No, you can also choose any other format to capture your speculations about the future, for example the scan cards". The participant seemed relieved and said: "Good, because that would have been difficult". In the conversation and process that followed, it became evident that scan cards (Figure 1) or storytelling prompts (Figure 2) appeared to be perceived as more fluid, non-binding, and agile formats, compared to scenarios. Opposed to scenarios, scan cards, for example, do not rely on a well-written narrative, but value and promote incompleteness and imperfection. They are quickly developed and revised, thereby allowing groups to collaboratively elaborate on multiple temporalities and interpretations. As such, they prevent a group from committing to a single fully-fledged scenario. Instead, they nurture an openness and continuation of explorations, interpretations, and speculations. In that way, these more fluid approaches placed more value on the process in which a group collaborates to derive meaning, rather than on the actual outcome.
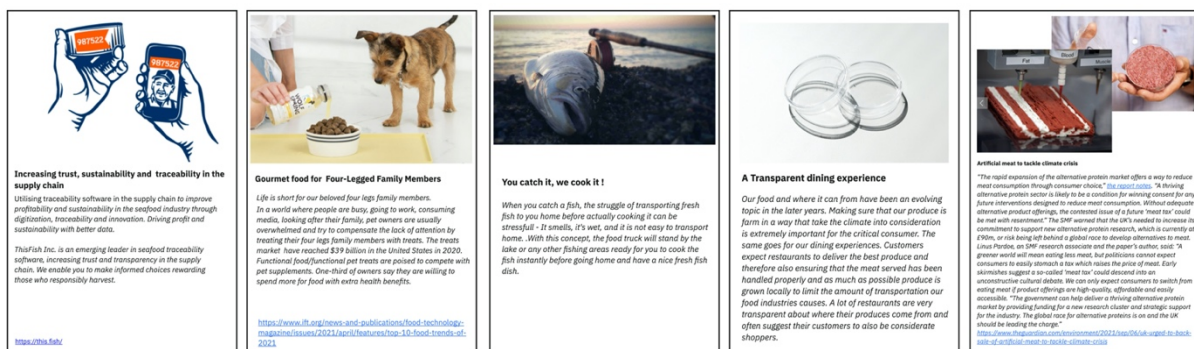

Figure 1. Scan cards.

| DEFINE PROBLEM

The current [process/workflow/solution]
is leading to [negative business result]
because [specific people]
currently can't [measurable behavior] | *The current [solution A] with workarounds is leading to operational risks and poor workflows because [work roles B and C] cannot manage [functionality D] and are exposed to signitfact operational risk* |
| DEFINE VISION

We expect … [the solution]
will be desired by [specific people]
as they will [measurable behaviour]
thus, leading to [positive business results] | *We expect that [solution B] will be desired by [any work role offering functionality C] as they will be met with customer demands for [functionality C], thus leading to efficient management and governance of the [functionality C]* |

Figure 2. Storytelling prompts.

4.2 Cognition paradox

The cognition paradox was evoked by nurturing cognitive processes that are associated with, both, divergent as well as convergent thinking. While divergent thinking is linked to, for example, being unconventional, shifting perspective, seeing the known in a new light or taking risks, convergent thinking is associated with being logical, clustering similar elements, recognizing patterns, and playing it safe (Cropley, 2006). While design is often characterized in terms of a structured framework that harnesses alternating modes of divergent and convergent thinking (Cross, 2008; Drew, 2019), we aimed to nurture more continuous and fluid cognitive shifts that at times might even feel random. For example, participants first had to work analytical and make rational financial calculations and simulate expected cash flows in excel to develop a sustainable business model. Thereupon, we asked them to co-create an artistic physical prototype to explore, represent and convey the feelings that a potential customer should have and should not have when interacting with the service they were inventing. The development of the prototypes was a radical break from the previous exercise and was deemed paradoxical in that it begged the question of why engage in art while developing a serious business idea?

Figure 3 shows photos of the process in which participants developed artistic prototypes as a vehicle to explore and communicate the feelings their service should or should not convey to its potential users. Various participants shared reflections, such as "[w]orking analytical within excel with group members was tough but the art-based, creative approach was like a refreshing, recovering experience". Another participant emphasized that many novel and rich ideas emerged during the process, in which the other participants interpreted the artistic prototypes in relation to the feelings it nurtured in them. While initially not really seeing the point in switching so radically between activities, the second exercise fostered a creative and energetic atmosphere in the room, in which the participants appeared to loosen up and started looking at their ideas from new angles. As such, the designerly approaches aided in tuning and balancing the cognitive modes of the participants and (re-) directed them in various interpretive directions. This was also voiced by the participants (e.g., "it created a nice

change when the work started to be too one-sided and when we, in retrospect, fell into a more single-minded state. It was nice to get an unnoticeable external factor that gave us a fresh perspective").
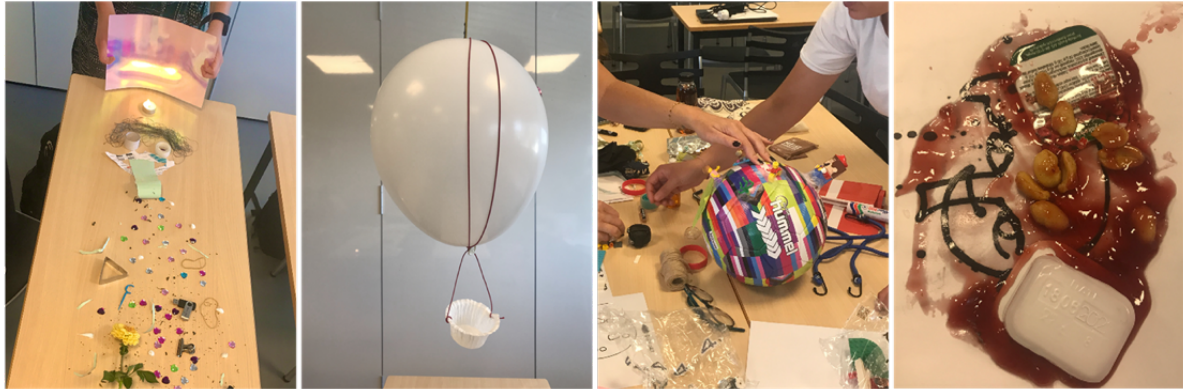

Figure 3. Artistic prototyping. From left to right: Artwork representing curiosity; artwork representing emptiness; participants in the prototyping process; artwork representing disgust.

4.3 Social paradox

The social paradox was staged by nurturing awareness and interaction of both the participants' own beliefs, perceptions, and experiences and those of others. For example, we used the time travel or brainwriting approach to create room for mindful observation of personal feelings, desires, and fears in a process based on intensive collaboration and social interaction among participants. Another approach was to ask participants to adopt thinking hats of diverse actors who had not been considered as a beneficiary of the service idea that was being developed. These actors included human but also non-human, and non-living actors, such as birds, rivers, or the air. The aim was to make participants reflect on the diverse consequences of what they were designing. Approaches like these have led participants to be attentive and curious, to engage with and seek out diversity of perspectives rather than being trapped in a single perspective. Figure 4 exemplifies the kind of realizations that emerged from the thinking hats approach. The groups used it to revise their service idea to include stakeholders not previously considered.

Figure 4. Exemplary realization emerging from the thinking hats approach.

Having to assess and value an assemblage of diverse perspectives was deemed a fruitful tension ("a lot of questions came up […] which need answers and highlight blind spot not considered before"; "I think changing perspective and ways of thinking has been really useful in the design process to investigate and consider different aspect, uncover other possible ways and understand what works and what doesn't"). One participant reflected that this process "can eat up the energy of the group members". This exemplifies the importance of balancing the paradox, i.e., nurturing appreciation of diversity but preventing a feeling of being blocked by it.

4.4 Focus paradox
The focus paradox was enacted by asking participants to engage with various issues across systemic scales, to zoom in and out, to acknowledge details while considering how these details relate to broader dimensions of a system. For example, one experiment asked participants among other things to work on the nitty-gritty details of a business idea, to situate its business model in relation to the market and potential user groups, to identify a desirable future vision to contribute to with the idea, and to analyze the social and environmental impact of that idea. We aimed to make participants gain insights into how their idea relates to the system it is situated within. One participant expressed that "it can be challenging to shift between the different parts of the project". A way participants engaged with this paradox was through mind maps. Figure 5 shows exemplary mind maps that a group employed to explore and visualize how other industries relate to the industry they were aiming to situate their business idea in (food service industry). The mind maps were then enriched and augmented with e.g., scan cards (Figure 1) that communicated speculations about how various trends and signals identified in the industries could potentially impact the food service industry. A pattern we noticed across some groups is that the process of exploring the systemic consequences of certain trends sometimes resulted in ideas aimed to promote system learning in others. For example, one group, motivated by the disconnectedness between the

production and consumption of food, developed a concept that aimed to strengthen knowledge about the origins of food by building bridges between families and farms providing sensory and experiential visits.
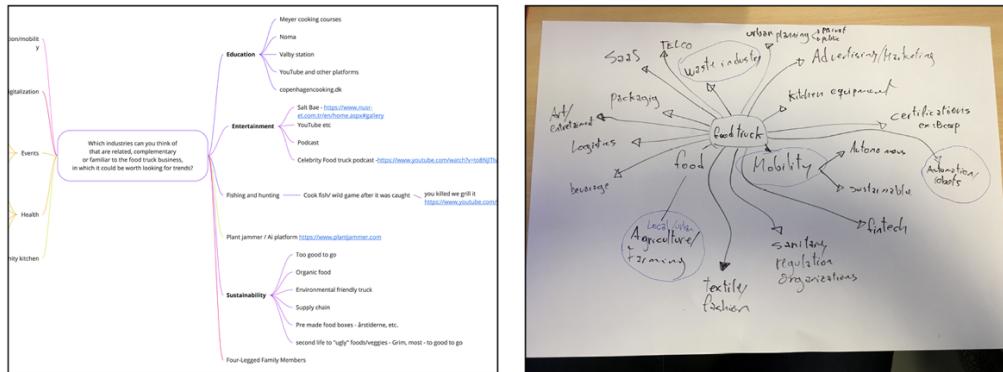

Figure 5. Mind Maps.

What was generally recognized as important when engaging with paradoxes is moving beyond a right or wrong thinking into a state that embraces complexity and tensions, recognizes them as inevitable, allows for mistakes, and balances them by continuous iteration ("[T]he process [...] allowed us not to think about whether we were doing things wrong but helped to push us, to give everything a go, and iterate along the process as we made mistakes. I think that enabled us to help navigate the tensions that arose and facilitated the process").

5. Discussion

This paper explored the following research question: *How does conceptualizing competing demands according to paradoxes impact the way they are approached in design practice? How can paradoxes be engaged with through design?*

A premise for a productive engagement with paradoxes in design was an understanding of what constitutes a paradox, i.e., the coexistence of seemingly contradictory poles. Participants, who were aware of the nature of paradoxes, tended to embrace the paradox as more harmonious, comparable to yin and yang, and appreciated the tension underlying the paradoxical elements as creativity-nurturing. Those participants could engage with the paradoxes longer, more consistently and enthusiastically.

In line with DiSalvo's (2016) findings, we observed that when we stage paradoxes, we nurture inquiry. The inconsistency and friction between the paradoxical elements ignited a will and curiosity, to explore, understand, and engage with the paradox. Design in this context did not emerge as much as a problem solving approach, but rather as a dialogic practice, enabling a fluid conversation with the respective contradictory elements. Taken together, design resembled continuous and multidimensional investigative moves that aimed to reveal and unfold the ambiguous (inter-)relationships and -dependencies constituting the paradox.

This multidimensional dialogue allowed for new understandings, thoughts, and insights to occur that could not have emerged from a singular engagement with an individual element. Synthesizing from our experiments, Table 4 summarizes the role that design played in engaging with the respective paradoxes. Our research points towards a role of design, less in terms of its ability to support decision making and problem solving, but rather to stimulate fluid, multidirectional, and relational inquiries performed in the ambiguous in-between spaces constituting a paradox. These inquiries allow for multiple interpretations to emerge and co-exist, prevent inertia caused by commitment, and permit actors to reach temporal agreements that can be revised as new understandings occur. Anchoring our research to designerly debates (DiSalvo, 2016; Dorst, 2019), we argue that staging paradoxes has the potential to decelerate the designerly tendency of solutionism and counteract the impulse to jump to conclusions all too easily.

Table 4.   The role of design in engaging with the respective paradoxes.

Competing demands conceptualized according to paradoxes	The role design played when engaging with the paradox
Time paradox	Design as navigational practice stirring diachronic investigations and interpretations of multiple temporalities and time horizons.
Cognition paradox	Design as stimulating practice allowing convergent as well as divergent modes of thinking and doing to simultaneously emerge and be sustained in an integrative manner.
Social paradox	Design as reflective practice activating, juxtaposing and interweaving partially consistent and partially conflicting, introspective and/or extrospective perspectives, values, experiences, belief systems, mental models.
Focus paradox	Design as a relational practice nurturing awareness of and moves along the interconnections and interrelations of the systemic dimensions.

The simultaneous engagement of various paradoxes requires processing and engaging with considerable amounts of complex, inconsistent, and ambiguous information (Tse, 2013). Design processes and artefacts materialized this information and supported the participants to experiment with and between them. A characteristic deemed important among many of the designerly approaches was that they did not impose a singular commitment but allowed for multiple interpretive directions. In that way, the focus was not so much on the output (e.g., on crafting a singular scenario), but more on fluid shift between the paradoxical poles aiming to inquire and (re-)frame the paradoxical space. If we use the metaphor of Drew et al. (2021), engaging with the paradoxes indeed showed resemblances to dancing.

We recognized that most participants, after going through the process, acknowledged and appreciated the creative potential underlying the paradoxes. Paradoxes are an inherent feature of complexity. As such, staging paradoxes can, potentially, be harnessed to train people to embrace complexity, which is a prerequisite for a productive designerly engagement with the world.

Competing demands are becoming more and more pervasive. Our research expands our understanding of how to productively engage with competing demands through design. We have introduced four categorizations of competing demands and argued for why they should be looked at through a paradox lens. We have shown that conceptualizing competing demands as paradoxes leads to inquiry rather than problem solving in design practice. This inquiry is supported by design that appreciates the coexistence and engagement of multiple opposites and takes seriously their underlying potential.

6. Conclusion

In an era, in which complexity increases and competing demands intensify, we believe that methodologies and approaches that more deliberately focus on competing demands in terms of paradoxes are needed. In that way we may foster a 'paradoxical thinking' capacity or mindset, i.e., one that is not afraid of but embraces and actively engages with complexity and that recognizes, aims to reveal, and leverage the productive potential underlying the oppositions.

A limitation of our work may be underlying the four streams of competing demands that we outline in Table 1. This list should not be understood as exhaustive, but rather as an invitation to use it as an initial lens that is open to revisions. Potentially, there are other streams of competing demands beside the ones we have outlined that deserve examination.

One could claim that another limitation of our study is that we deliberately created paradoxes that participants had to deal with during the design process, although we argue that paradoxes are inevitably present in systems. As this theory-building process is still in its infancy, we expected that a controlled environment is more likely to generate information that could help us find answers to our research questions. However, we contend that future studies would benefit by a comparative analysis that directs awareness to and examines those paradoxes and tensions that are embedded in the respective design context.

Our study sheds light on the role of design in confronting paradoxes. It highlights how design can support greater openness to and engagement with paradoxical poles. We suggest that future research further explores how design can support efforts to integrate opposing poles, foster imagination, and unconventional thinking, and find creative solutions to fill the promising interstices of paradoxes.

We acknowledge that our ideas and findings are preliminary, and that future research is needed to validate them. This paper should therefore be considered as an invitation to discuss, challenge, and forward our thoughts, claims and arguments.

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