USING DESIGN METHODS TO EXPLORE THE CONTEXT OF COMPLEX BEHAVIORAL DESIGN PROBLEMS IN THE EARLY STAGES OF BEHAVIOURAL DESIGN

Falcão Duarte, Carolina;
Daalhuizen, Jaap

Danmarks Tekniske Universitet

ABSTRACT

Behavioural design has been gaining momentum to address critical societal challenges such as elderly care. At the same time, it struggles to deal with complex challenges and integrate multiple contextual factors' influence in domains like healthcare. Behavioural design processes lack guidance on how to prevent this and instead define problems that are ecologically valid. Conventional design methods do guide designers to do this. Thus there is a need to investigate how design methods can support behavioural designers to explore the context and integrate multiple perspectives on the problem, resulting in context-sensitive problem definitions. To respond to this need, we present a case where designers used a combination of design methods to investigate the complex context of hygiene in nursing homes. We show how combining different design methods supported the designers in advancing their understanding of a complex context and the problematic behaviours that occurred in it. We conclude by discussing the importance of using design methods to reveal important insights at the early stages of the behavioural design process.

Keywords: Behavioural design, Case study, Elderly care, Design methods, Complexity

Contact:
Falcão Duarte, Carolina
Danmarks Tekniske Universitet
Denmark
cfadu@dtu.dk

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1 INTRODUCTION

Behavioural design has been gaining momentum to address societal challenges such as those faced in the healthcare domain. For example, several authors have advocated the importance of changing behaviours to address problems like the transmission of COVID-19 and antimicrobial resistance. However, behavioural science approaches (Schmidt and Stenger, 2021), such as nudging, struggle to deal with complex challenges and to integrate the influence of multiple contextual factors in domains like healthcare (Carrasco et al., 2021). Thus, researchers are drawn to the importance of designing context-sensitive and user-friendly interventions. Developing context-sensitive interventions entails considering and reconciling multiple, and often misaligned, perspectives to the problem and working with problems with blurred boundaries. Further, it entails dealing with problems that cannot be detangled from the context where they occur, a characteristic of wicked-problems. Nevertheless, there is little knowledge about how to explore the context of behavioural design problems and how to translate the resulting rich insights into effective design processes.

At the same time, design approaches offer various methods to explore contexts and resolve wicked problems (von Thienen, Meinel and Nicolai, 2014; Bowen et al., 2016; Ney and Meinel, 2019) as well as take into account and integrate the perspectives, concerns and needs of diverse users and stakeholders (von Thienen, Meinel and Nicolai, 2014). This lack of guidance is especially pressing in the context of behavioural problems found in healthcare contexts. These problems are usually embedded and intertwined in multiple social and economic factors, configuring a scenario that excludes traditional problem solving approaches (Kreuter et al., 2016).

The use of design methods offers a promising starting point to explore how behavioral design processes can integrate design principles and methods in order to resolve this problem. Existing literature has explored behavioural design methods (e.g. Lockton, 2017), and suggested that behaviours can be analysed by diverse user research methods (Kuijer and Jong, 2012). Yet, despite the potential of design to address the context intertwined with behaviours, little is known about how to address complex behavioural problems (Bay Brix Nielsen, Daalhuizen and Cash, 2021). In order to address this, we propose the following research question: How can we use design methods to explore the context of complex behavioural design problems and define context-sensitive approach to problem definition? In order to answer this question, we take a Research Through Design approach (Zimmerman and Forlizzi, 2014) and combine three different design methods to explore the context of complex behavioural design problems in a care context. We focus on how each method supported the designers to advance their comprehension of the context and contributed to scoping the behavioural problem. We then discuss how design methods supported designers to simultaneously enhance and extend their comprehension of the context and behavioural problems in an integrated way.

This paper has two main contributions. First, we advance our understanding of how design methods can be used to compliment conventional behavioural design processes in order to investigate the context where behaviours occur. We do so by showing how the Social Implication Design (SID) method (Tromp and Hekkert, 2014), Co-creation (Sanders and Stappers, 2008) and Design probes (Sanders and Stappers, 2014) were combined to help the design team explore a behavioural design problem in a complex context. Second, we show the value of using each design method to address behaviours embedded in challenging social contexts. Finally, we discuss how a design led use of methods was key to reveal insights for the behavioural design process.

2 BACKGROUND

Behavioural design is an approach that considers behavioural change as the primary goal of a design process and the design of any artefact or experience as means to achieve that goal. In that respect, behavioural designers base their work on the idea that artefacts shape people's behaviours (Niedderer et al., 2017). This can happen be either implicitly for example through nudging or seduction or explicitly through persuasion or enforcement (Tromp, Hekkert and Verbeek, 2011) and either through encouraging desired behaviours or discouraging undesired behaviours (Tromp and Hekkert, 2018). In doing so, designers draw on knowledge from diverse disciplines, building on other fields like

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psychology, human-computer interaction, decision research (Lockton, 2017) as well as on existing behavioural change models and frameworks (Niedderer et al., 2017). Thus, behaviour design integrates constructs from behavioural science with design. Yet behavioural design approaches typically lack guidance to explore and frame the user context, understand the behavioral problem in context, and envision possible scenarios and solutions (Reid and Schmidt, 2018). Even though conventional design methods exist to support such practices, there is a need to understand how these can be used to explore the complex context of behavioral design problems and to address societal challenges.

Design for behavioural change approaches often describe distinct phases, with different authors distinguishing an initial phase for identifying and framing the behavioural problem (eg. Cash et al., 2017). In this initial phase, behavioural economics-led or behavioural science-led approaches typically work towards precisely defined problem behaviors, detangled from the convoluted context they emerge from in order to develop discrete and measurable solutions that can be tested, for example, in randomized control trials. In contrast, a design-led approach can flip this logic and explore problems in context while allowing for co-evolution of problem understanding and solutions in order to deal with ill-defined or wicked problems (Ney and Meinel, 2019). Moreover, design approaches typically support the integration of multiple and divergent perspectives of users and stakeholders (von Thienen et al., 2014b). This is also crucial to address behavioural problems, given that even behavioural change strategies that appear to be simple at first glance entail several intertwined factors that must be considered to achieve success (Cash et al., 2017). Thus, a design perspective can stretch the realm of behavioural problems that can be solved, from well-defined problems, to complex ones (Reid and Schmidt, 2018). Yet, despite the possibilities that design-led approaches to behavioural change offer, there is little guidance on how to explore the context of complex behaviours and question the behavioural challenge. This is clearly problematic, since exploring the context is an essential phase of design (Cross, 2008; Design Council, 2021). Further, there is a consensus that, in general, discussions regarding processes and methods in behavioural design need to advance since it is an emerging design field (Niedderer, Clune and Ludden, 2017). For these reasons, exploring the use of design methods to understand the context where behavioural problems occur is crucial.

3 CASE DESCRIPTION

In order to answer our research question, we report on a Research Through Design (Zimmerman and Forlizzi, 2014) case on design for behavioural change to improve infection prevention in the elderly care domain. In this case, a design team combined different design methods in the early stage of a behavioural design project to explore their contribution to context exploration and advance the problem formulation. Thus, the Research Through Design approach was used to generate knowledge (Prochner and Godin, 2022) regarding the use of design methods in the early phases of behavioural design. In this sense, the design process itself was the object of study (Herriott, 2019). In this case, we focus on how the use of each method contributed for the design team to explore the context and evolve their simultaneous understanding of the context and the problem. The outcomes of the project are fully reported in Pedersen and Stilbo (2022).

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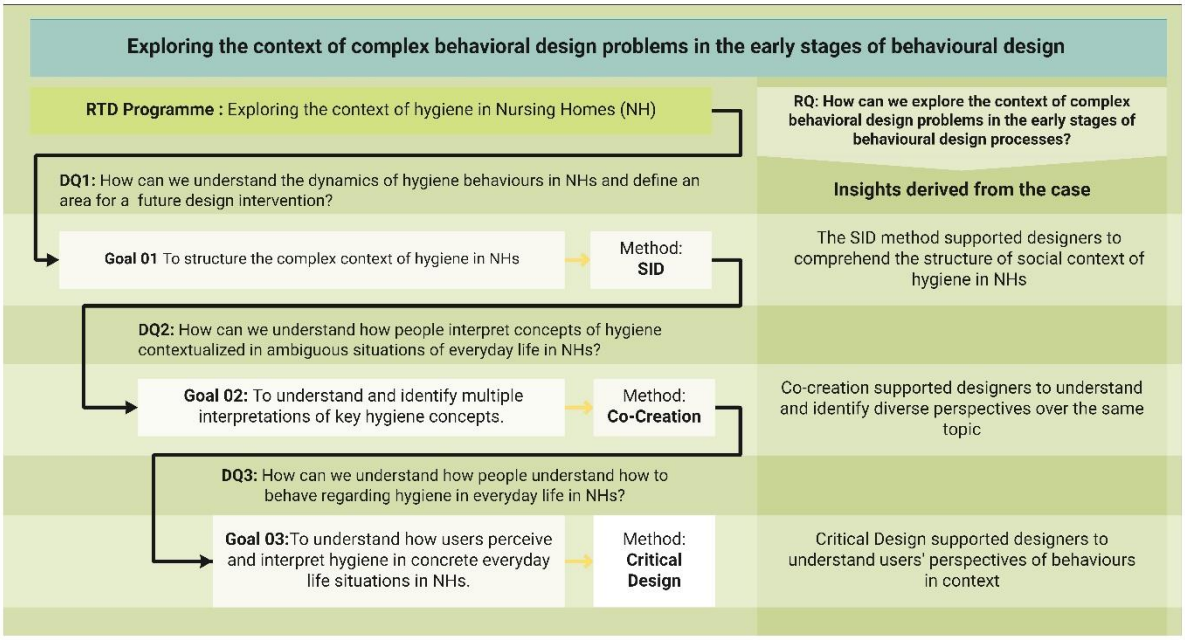

Figure 1. The research through design approach used by the designers

3.1 Case selection: Designing for infection prevention in nursing homes

The design case reported took place between February to June 2022, as part of a master thesis (Pedersen and Stilbo, 2022), conducted by two master design students and supervised by a PhD student and an Associate Professor. In the case, the design team, consisted by the two master design students, investigated how to design a behavioural change intervention for preventing the spread of contagious diseases in two Danish nursing homes during the COVID-19 pandemic.

Behavioural design to prevent infection prevention in nursing homes provided a suitable case for several reasons. First, nursing homes are places that accommodate multiple perspectives over what preventing infections entails, since these homes have at their core the ambivalent mission of providing a place to live and a place where residents are cared for (Wikström and Emilsson, 2014). In contrast to hospital settings, the staff faces the complex mission of controlling infections, while keeping the environment with homely characteristics (Mody, Bradley and Huang, 2013). Thus, how much infection prevention should be prioritized over keeping a homely environment is an open question without a clear answer.

Second, in nursing homes, the context affects several important care decisions. Previous research has shown that staff members take care decisions, including those related to evidence based practices (e.g. sanitize hands), and conduct adaptations on practices based on a myriad of context factors (Cammer *et al*., 2014). Therefore, there are a number of negotiations and adaptations made to fit the hygiene guidelines to the context. In this sense, nursing homes provide a case where understanding the tensions and ambiguities of the context is key, before defining any behaviour to intervene on in a behaviour design process.

Further, the need to go beyond discrete behaviour change and grasp diverse perspectives allowed us to use a design approach to explore the context. Consequently, this presented an opportunity to investigate the value that design methods to explore context could deliver for an investigation that targets future behavioural change.

3.2 Three design methods to explore the context of infection prevention in nursing homes

In the following sections, we describe our Research Through Design approach, the design methods chosen, and the data we collected to be able to answer our research questions (see Figure 1). During the entire RTD process, the designers adopted a reflective approach (Zimmerman and Forlizzi, 2014) to derive new research insights to feed the next step of their investigation. The reflection process meant that, to achieve each goal of the process, the team looked at the data collected, at the literature

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about hygiene and hygiene guidelines (e.g. Sundhedsstyrrelsen, 2020) multiple times to iterate and elaborate themes, as well as derive new questions. The complete set of themes derived at each stage of the process can be found in Pedersen and Stilbo (2022).
To reflect regarding method use in the design process we relied on data collected from the report made by the designers (Pedersen and Stilbo, 2022) and from field notes made during twenty four meetings to discuss the project, when the team discussed and reflected on the design questions and the methods used. The reflections targeted the contributions of each method, thus we travelled back and forward on the literature regarding the methods chosen, the topic of investigation and the progress made by the design team during the RTD process. In the following sections, we report the RTD process and the use of methods made by the design team.

3.2.1 Exploring elderly care and infection prevention: Using the social implication design method

Providing a dignified elderly care is considered a fundament of the Danish state (Healthcare Denmark, 2019), thus, it was crucial to understand the design domain as a societal concern and avoid isolating behaviours from contextual factors. As a first step, the team explored the literature on infection prevention and elderly care and derived an initial design question (DQ1) 'How can we understand the dynamics of hygiene behaviours in nursing homes and define a point of intervention?' In order to answer this question, and given that this method supports the exploration of the societal context of a given problem area, the design team used the Social Implication Design method (Tromp and Hekkert, 2014). The designers used it to explore the phenomenon (step 1 of the method) and to define a social statement (step 2 of the method).
To conduct such exploration, the team collected a diverse set of data, which consisted of documents, guidelines and literature about life in nursing homes, infection routes and hygiene (n=73), interviews with hygiene experts (n=3) and observations (n=10) of everyday life situations in the two participating nursing homes. The team also read the transcriptions of interviews with nursing home employees (n=3), residents (n=3), and a resident's relative (n=1) collected as part of an ethnography study conducted by the first author between May and November 2021 that focused on understanding how visitors, residents and staff members experience infection prevention in nursing homes.
From the data, the team derived a number of factors of context factors that were clustered regarding meaning. After several iterations, the team organized clusters and reflected regarding their interactions.
With the method's support, the designers elaborated a coherent structure of the context hygiene in nursing homes, identifying dilemmas and the existence of diverse perspectives regarding the phenomenon (e.g health authorities' perspectives versus nurses' perspectives). Following, the designers identified an area for a potential behavioural design intervention that needed to be further investigated, without misapprehend how this area was linked to the bigger context. The area included intersections between a number of clusters. The first being 'communication and subjective interpretations', meaning that different people might understand the same hygiene guidelines, or the same infection prevention measure differently. The second 'resources' referring to the lack of resources and the characteristics of nursing homes' equipment and personnel to prevent infections. The third being, 'employee-resident relationships', referring to the characteristics of the interactions and relations between workers and residents in nursing homes. And the last, 'staff members priorities' referring to elements of everyday life in nursing homes, whether these relate to supporting residents' well-being or paying attention to hygiene that different workers prioritize.
Thus, using the SID method resulted in a comprehension of the wider context of the design domain of infection prevention in nursing homes. In conclusion, the exploration of the structure of the social context was key to allow the team to derive a new question (see DQ2 in Figure 1) and move forward with their investigation.

3.2.2 Exploring diverse perspectives on hygiene in nursing home: Using the co-creation method

Once the focus area was established, the design team needed to explore how the different stakeholders in the nursing home context perceived it. They formulated the second design question; 'How can we understand how people interpret concepts of hygiene contextualized in ambiguous situations of everyday life in nursing homes?'. In order to answer this question, the team decided to use the Co-Creation method (Sanders and Stappers, 2008), since the method supports the elicitation and capture

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of diverse stakeholder perspectives. The design team developed 'design probes' to provoke responses from participants (nursing assistants and helpers), following Sanders and Stappers (2014) and, thus, understand how participants' classifications of 'clean' and 'unclean' processes applied to everyday situations of life in nursing homes could, first, contrast with the definitions provided by guidelines (e.g. Sundhedsstyrrelsen, 2020) and, second, differ between participants.

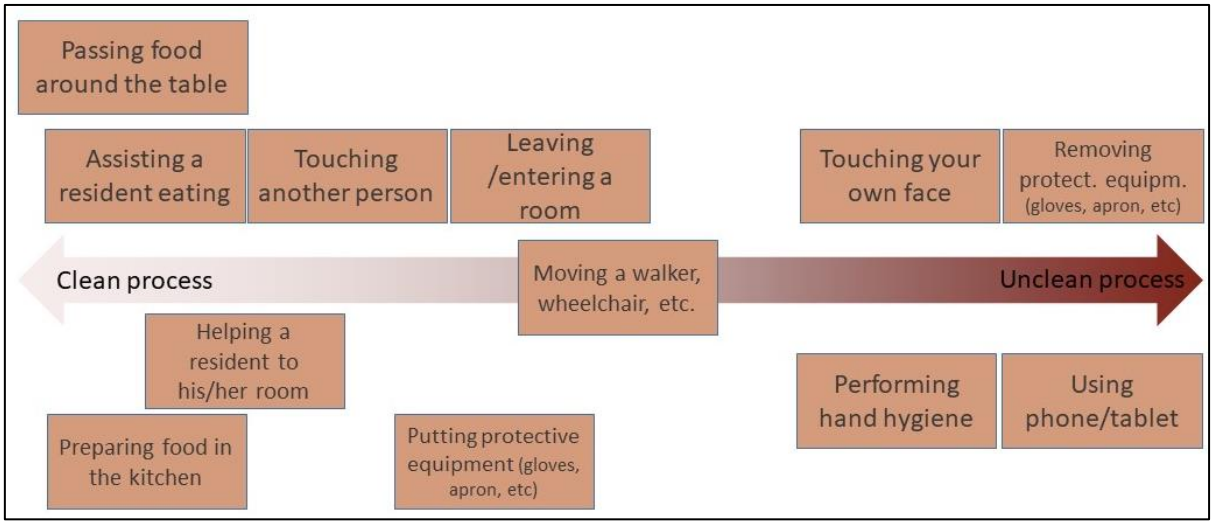

Figure 2. Example of a material created by a participant. Extracted and translated from Pedersen and Stilbo (2022).

The design team designed and organized a co-creation session in which six staff members from two nursing homes participated in individual workshops (between thirty to forty minutes each). The idea was to capture aspects of motivation to perform hygiene practices and gain a nuanced understanding of the participants' perspectives. The workshops were divided in three rounds. In the first round, participants were sensitized to talk about aspects of their work that motivated them and the importance of hygiene in a general sense. In the second round, participants were invited to choose different cards with everyday life situations in nursing homes, and position them on an axis, between two extremes: clean and unclean (see Figure 2). Participants were stimulated to talk about the materials they created and why they considered an activity unclean or clean.

Finally, in the third round the design team asked each participant to take a card that described a persona (van Boeijen, Daalhuizen and Zijlstra, 2020) based on nursing home worker (e.g. Peter, a worker who enjoys chatting and spending time with the residents), and a card describing a situation from the previous round (e.g. using a phone/tablet). The idea was to help participants to adopt a diverse perspective on a previously discussed situation. Thus, participants were asked to reflect on possible problems or challenges (not only related to hygiene) that could derive from the chosen situation and then talk about how the persona could overcome such problems. After that, participants were asked to reflect on how they believed the persona would manage such situation, thus, stimulating participants to change their perspective, reflect and describe hypothetical scenarios regarding how different colleagues could perceive hygiene.

The audio of each workshop session was recorded. The materials created by each participant were digitalized, and participants' comments and explanations, transcribed. To analyse the data the designers, compared the materials created by each participant. The team discussed the results; they travelled back and forward from the data to the literature previously collected and derived new themes. Co-creating with participants to elaborate nuanced definitions of key concepts, (i.e. how do staff members perceive 'clean' and 'unclean' processes), concerning behaviours related to hygiene helped the designers to understand different perspectives on hygiene in nursing homes and propose a new DQ (DQ3) for the third and last stage. Thus, Co-creation was crucial to identify and understand conflicting perspectives on the same topic in the context and helped the team to progress their investigation.

3.2.3 Exploring behavioral responses in context: Using design probes

Once a deep understanding of the context and the nuanced and often conflicting stakeholder perspectives on hygiene was reached, the team wanted to understand better stakeholders' behavioral responses to

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typical activities in nursing homes. In order to do so, they used the critical design method. Thus, the designers decided to investigate how participants would react to routine situations depicting risks of spreading infections. To be able to provoke these reactions, the designers used Critical design (Sanders and Stappers, 2014). They designed probes to provoke reactions to behaviours that can spread infections (e.g. touching food without sanitizing the hands beforehand) and organized individual workshops (from thirty to forty minutes each), with the same participants who joined the co-creation session.

In the first round, to sensitize participants on the topic of infection prevention, participants were given a transmission route of an infection (e.g. transmission through droplets) and asked to describe a situation in which someone could be infected in such a route. In the second round, the designers asked the participants to watch video clips and stop the videos when they could identify any risky behaviour in a routine situation (e.g. entering a resident room without sanitizing hands) and explain how and why they identified it. Each clip had a maximum duration of two minutes, and the situations were inspired by the observations conducted in phase 01.

The designers transcribed the responses to the video clips. To analyse the data, the team compared the situations the participants' reacted to (identified as risky in terms of transmitting infections), with the explanations given by each participant. The design team found disparate responses during this round. From this process, the designers reflected about the insights found. They connected these with the themes and dimensions derived when meeting the previous goal until they could evolve a final scheme with themes and dimensions.

The use of probes in the workshops contributed to revealing that participants had multiple reasons for identifying or ignoring risky behaviours. For example, when analysing the data, the design team identified a missing link between participants' theoretical knowledge of hygiene and knowledge of hygiene in guidelines (investigated in Round 01) and practical situations (investigated on the reactions to videos showed in Round 02). This allowed the design team to comprehend that situations of risk, or situations where hygiene should be performed, were connected to subjective perceptions and interpretations rather than with theoretical knowledge or with instructions from guidelines.

4 DISCUSSION: HOW DESIGN METHODS CONTRIBUTE TO CONTEXT EXPLORATION IN THE EARLY STAGES OF BEHAVIOURAL DESIGN

There is a need to explore the context of behavioural design problems, and define behavioral problems in more context-sensitive ways. Conventional design methods are known to support context exploration (Cross, 2008; Dorst, 2015), thus there is a need to explore how such methods can contribute to behavioral design processes. Therefore, we set out to answer the following RQs: ' How can we use design methods to explore the context of complex behavioral design problems and define context-sensitive approach to problem definition?'. We used a Research Through Design approach to explore how three different design methods can be used to do so. That is, we used the Social Implication Design method (Tromp and Hekkert, 2014), Co-creation (Sanders and Stappers, 2008) and Critical design (Sanders and Stappers, 2014) to explore how designers can use these to understand and define their behavioral problem in a context-sensitive manner. Our paper contributes to behavioral design literature in several ways.

First, the use of the Social Implication Design method (Tromp and Hekkert, 2014) supported the design team in collecting and integrating multiple sources of information about the context of hygiene in nursing homes at a societal level, effectively supporting them to identify, organize and work with diverse perspectives from both a societal, organizational and stakeholder level. This helped them comprehend the societal context of hygiene practices and how this affects specific infection prevention behaviours in the context of elderly care institutions. This allowed the design team to identify areas where such perspectives were most ambiguous and conflicting, and should focus their attention in the following stages. Thus, using this method was crucial to understanding the broad context of hygiene in nursing homes, comprehending and integrating diverse sources of information in the design process, informing a design direction, and further exploring more specific problem behaviours related to hygiene.

This method use also addresses a critical need to better contextualize behavioral design problems (Schmidt and Stenger, 2021), which is key to understanding the outcomes of interventions (Burke *et al*., 2009; Schmidt and Stenger, 2021). Thus, our work aligns with the view that interventions should fit real-world scenarios and consider individual behaviours as part of a broad social context (e.g. Tromp and Hekkert, 2018; Schmidt and Stenger, 2021).

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Second, the use of a Co-creation method supported the design team in exploring key stakeholders' nuanced perspectives and reveal important divergences and conflicts in how stakeholders understood and viewed hygiene and infection prevention practices. This helped the design team to identify diverse notions of hygiene in everyday life situations and to understand how individual perspectives regarding real life, as presented by the designers, differed from situations described in guidelines and how perspectives differed between participants. Thus the use of this method was crucial to comprehend how the existence of multiple and misaligned notions of hygiene could be problematic.

Our findings align with work on the use of co-creative approaches in conventional design (Sanders and Stappers, 2008); involving users' creativity in the early stages of design has long term benefits for the design process and its outcomes. It also corroborates prior work in behavioral science that has advocated that co-creation can support a robust investigation of behaviours (Leahy et al., 2018) and that stakeholder involvement across the problem-solving process is key to approaching wicked problems in healthcare (Kreuter et al., 2016). It also addresses the need to integrate co-creative approaches in the field of behavioral design and is in line with prior research (Lievesley et al., 2022), highlighting that co-design approaches can be integrated into behavioural design processes to allow designers to explore priorities and areas for possible interventions. We advance this discussion and highlight the value of involving stakeholders also in the early stages of behavioral design, with the purpose of exploring the context of behavioral problems as well.

Finally, the use of the design probes supported the design team in exploring highly sensitive problems of perception underlying identified problems regarding hygiene and infection prevention. The method helped reveal that nursing home staff held divergent and conflicting perspectives on key hygiene concepts. The use of design probes helped them identify the underlying root cause by revealing a discrepancy in perceptions of hygiene as captured in formal guidelines versus those emerging in concrete everyday situations. Thus, using this method was crucial to understanding how participants identify risks of infection spreading and what criteria and reasoning they used to identify such risks.

Probes supported the team in learning about aspects of human behaviours that are hard to grasp through observations and interviews by allowing them to elicit multiple interpretations and reflections regarding the topic of investigation. In this sense, our work aligns with work Sengere's and Gaver's (2006) claim that design can support a space for multiple interpretations around a topic and acknowledge such interpretations in the design process. Further, our findings also align with Mattelmaki's (2006, 2008) work in terms that probes can be used to collectively explore diverse topics, share knowledge and provoke reflection. However, despite the value of probes for collaboratively generate new insights (Mattelmäki, Brandt and Vaajakallio, 2011), and understand user's habits and the context around users' (Daae and Boks, 2017), we were not able to find their use in any behavioural change research tackling stages of behaviour design that precede the definition of the problem. Thus, we advance this discussion, by showing the importance of eliciting and exploring multiple perspectives in behavioural design, and by demonstrating how we used probes to elicit and discuss these perspectives while involving users in the process of exploring the context where behaviours occur.

In general, across the use of these methods, our work responds to an earlier call to better integrate design with behavioral science. For example, Lockton et al. (2010) argued that designers might need multiple lenses to tackle a behaviour problem. Further, Cash et al. (2022) indicate that combining methods can help behavioural design experts develop frames that pave the way for a more scientific analysis of the behaviour problem. In this paper, through a research through design case, we offer insight into how design methods can help design teams to investigate the context of behavioral problems, gradually scope and explore behaviour problems before defining them and moving on to intervention development. Therefore, we argue that design methods are key to investigating complex contexts in behavioural design and that such investigation is crucial to approach complex behavioural design problems, before attempting to define a behavioural problem without such understanding.

5 CONCLUSION

Behavioural design is an important design field set out to address societal challenges. Although societal challenges involve dealing with complex contexts and ill-defined problems, little is known about how design methods can be used to support the exploration of such contexts and integrate multiple perspectives on behavioral problems. To answer to this knowledge gap, we presented a case that demonstrated how different design methods were combined to help designers advance their

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understanding their context where behavioural problems occur. Based on this case, we provide three key contributions. First, we showed how a combination of methods supported designers in comprehending the data collected, proposing new questions along the design process and deriving important insights for their investigation. Second, we demonstrated that using design methods allowed the designers to evolve the understanding of the context and of behavioural problems in an integrated manner, while zooming in on a key behavioral problem step by step. However, further research is needed to experiment with different design methods, such as participatory design methods, critical design, among others, at the early stages of behavioural design processes and in diverse contexts (e.g. sustainable production and consumption) that entail other critical societal challenges such as sustainability, promoting gender equality, reducing hunger among others. Finally, we showed the importance of design methods to investigate the context and explore problems in a consent-sensitive manner, before defining a behaviour to intervene, extending prior discussions on the use of conventional design methods in behavioural design.

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