

Design multiple: How different configurations of participation matter in design practice



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This article critically interrogates how participation is practiced during the design process. We present the findings of three different configurations of participatory design workshops, each involving a different stakeholder group (age researchers, care experts and older adults). Building on insights from Science and Technology Studies (STS), we reveal how, in design practice, different configurations of participation enact and materialize multiple versions of ageing. To refer to this ontological layer of design processes, we introduce the concept “design multiple”. Our study adds to current debates on the practices of participatory design and STS, as it shows how different configurations multiply enact objects into several material realities. We raise awareness on the practices of configuring participatory design, and their ontological consequences

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Keywords: design practice, participatory design, ageing, technology, philosophy of design

Participation has long been of great interest in design research (Arnstein, 1969; Sanoff, 2011). Its relevance has been discussed across a broad range of design areas, such as community planning (Toker, 2007), sustainable transitions (Smith & Iversen, 2018) and the ageing population (Sumner, Chong, Bundele, & Lim, 2020). In its Scandinavian tradition, participatory design refers to a specific approach developed in the 1980s to empower people to have a say during the introduction of new computer systems into their workplace (Bjerknes, Ehn, & Kyng, 1987; Ehn, 1993; Greenbaum & Kyng, 1991). Generally, participatory design suggests that users should be treated as experts on their own life circumstances, and play important roles in design. The design process is seen as a collaboration between different expert groups that possess unique knowledge in one domain, but lack knowledge about the other. By bringing designers together with other stakeholders, each group may benefit as the participants mutually learn about the opposite’s knowledge. Since its early inception, many different methods and tools have been developed to include various stakeholders in

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www.elsevier.com/locate/destud

0142-694X *Design Studies* 74 (2021) 101016

<https://doi.org/10.1016/j.destud.2021.101016>

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the design process, providing designers today with a wide repertoire of available strategies to involve people in design (Simonsen & Robertson, 2013; Spinuzzi, 2005).

Following from its growth in popularity (Luck, 2018; Smith, Bossen, & Kanstrup, 2017), the diversity of participatory design as a *practice* has become an increasingly prominent subject (Halskov & Hansen, 2015). Several critical design studies have explored how participatory design is performed in practice (Bratteteig & Wagner, 2012; Frauenberger, Good, Fitzpatrick, & Iversen, 2015; Kohtala, Hyysalo, & Whalen, 2020; Luck, 2007; Sanders & Stappers, 2008; Vines, Clarke, Wright, McCarthy, & Olivier, 2013). For example, Vines et al. (2013), critically interrogating how designers ‘configure’ participation, call for a greater reflection on the procedures of involving people and their underlying power dynamics. Different configurations of participation can concern, for example, the question of *who is participating* in practice and who not (Frauenberger et al., 2015; Vines, Clarke, Light, & Wright, 2015; Vines et al., 2013). Relatedly, research in Science and Technology Studies (STS) has a long history of investigating how technology design and social practices are interconnected (Latour, 1991, 2005; Suchman, 2002), and laid bare how design practices may embody values and preconceptions that can be included in objects and thereby configure users (Akrich, 1992; Fischer, Östlund, & Peine, 2020; Woolgar, 1991). Scholars from this field have also placed scrutiny on the involvement of different mediators in design that act as advocates on behalf of users (Akrich, 1995; Schot & Albert de la Bruheze, 2003).

The aim of this study is to contribute to the ongoing discussion about participatory design practices, by making visible how different ‘configurations’ of participation come to ‘matter’ in practice. While there is a prolific body of work dedicated to develop more nuanced methodologies to improve participatory design practices, rather few design studies have been concerned with unpacking the dynamics underlying design practices themselves. Notable exceptions are the works by Fischer, Östlund and Peine (2020), Bucciarelli (1988), Lloyd (2000) and Luck (2007), who have explored how design practices unfold as a collaborative social process imbued with meanings, ideas and ongoing negotiations. Yet, the relevance of different configurations of participation has not been the focus of these studies. In this research, we specifically focus on one pertinent aspect of configuring participatory design practices: the inclusion of different groups of participants in different workshop settings (Frauenberger et al., 2015; Vines et al., 2013), and ask: *How do different configurations of participation, crafted through different workshop settings including different participants groups, matter during the design process?*

In doing so, we examine the contributions offered by three different groups of design participants for the design of technologies for older people: researchers in ageing and technology, care experts, and older adults themselves. We conducted three participatory design workshops, which generally focused on the same objective: the development of ideas for a technology for older people. However, each workshop provided a slightly different setting, and a different group of people was involved. Analyzing notes and observations from those workshops, we highlight how such different configurations of participation - enacted through the inclusion of different stakeholder groups in different workshop settings - can create different versions of ageing. In our empirical accounts, ageing became a 'design multiple'. To explain this phenomenon, we draw on ontological insights in recent STS scholarship (Barad, 2007; Law, 2004; Mol, 2002). Our findings imply the need for a heightened reflexivity about the role different configurations of participation have for the *object* of design: Different configurations of participation may work to evoke several embodiments of ageing.

1 Technologies for older people

We chose to focus on different designs of *technologies for older people* specifically because the topic is increasingly relevant to design research. Ageing is a particularly timely design topic, contextualized by demographic change and the widely pursued endeavor to develop technological innovations in conjunction with old age policies (Peine, Faulkner, Jäger, & Moors, 2015). In order to better embrace the needs of older people in technology design, a growing amount of design studies now investigates how to develop collaborative approaches to design technologies for, and with, older people. As with participatory design in general (cf. Halskov & Hansen, 2015), a diversity of design approaches has emerged either involving older people directly (e.g. Botero & Hyysalo, 2013; Essén & Östlund, 2011; Joshi & Bratteteig, 2016) or through the addition of proxy users, such as caregivers, family members or other types of experts (e.g. Bjørkquist, Ramsdal, & Ramsdal, 2015; Müller, Hornung, Hamm, & Wulf, 2015; Waycott et al., 2012). Moreover, design studies have investigated a broad range of different methods and tools that can be utilized to facilitate knowledge exchange in design projects with older people, such as cultural probes (Jarke & Gerhard, 2018), prototypes (Hanrahan, Yuan, Rosson, Beck, & Carroll, 2019), video prompts (Lindsay, Jackson, Schofield, & Olivier, 2012) and Living Labs (Müller et al., 2015).

2 Critical design studies: different configurations of participation

While the examples mentioned above share an interest in designing technologies with older people, each one of them also represents its own unique design

case and setting in which participatory design is *practiced*. Critical design studies have begun to interrogate these practices of participatory design, and highlighted a couple of relevant concerns. [Vines et al. \(2013\)](#) critically engage with the question of how designers may ‘configure’ participation, scrutinizing how participation is enacted in practice, who initiates and benefits from participatory design projects, and how control is distributed among the participants. They argue for a heightened transparency about existing pre-conceptions and how control is shared, as well as for future work to “configure multiple forms” (p.436) of participation, to bring in the voices of those participants less probable to be heard. Likewise, [Bratteteig and Wagner \(2012\)](#) brought into question the decisions designers are making during participatory design projects, and showed how many design decisions were made implicitly on the basis of underlying power aspects ([Foucault, 1977](#)). They found that power related aspects like loyalty and influence are important in how many design decisions take shape, and that crucial design decisions may be taken-for-granted as they are made by ‘trusted experts’ and materialized in pre-existing artifacts.

A similar concern with the tacit aspects of participatory design is put forward by [Frauenberger et al. \(2015\)](#), who stress the need for designers to be reflective about the implicit aspects underlying their work. The authors develop a “tool-to-think-with” to address the nature of participatory design in terms of four distinct lenses (epistemology, values, outcomes and stakeholders), and argue that an increased reflection on these aspects may equip designers with better means to obtain accountability. Example questions they suggest asking are: Who are the stakeholders involved? How do they participate in practice? In addressing how participatory design may be differently enacted in practice, other critical design scholars turn more prominently to the role of the designer. [Sanders and Stappers \(2008\)](#), for example, debate a shifting role of the designer to become a facilitator of participation. Similarly, [Pedersen \(2020\)](#) explores the evolution of the designers’ role to a stager and facilitator. [Luck \(2007\)](#) highlights how language and talk matter in the constitution of different design settings. And [Dindler and Iversen \(2014\)](#) emphasize the benefits of designers building ‘relational expertise’.

Our research has in common with the critical design studies mentioned above a general interest in how participation can be differently ‘configured’, and how such configurations are performed in practice. By additionally analyzing how these different configurations may *matter* in practice, our research also builds on insights developed in the field of Science and Technology Studies (STS), in particular those that have investigated the socio-material constitution of technology design, participation and objects.¹

3 *Science and Technology Studies*

3.1 *The socio-material constitution of technology design*

In Science and Technology Studies (STS), one main interest of concern has been how technology design and usership are constituted through social and material practices (Oudshoorn & Pinch, 2003). In this literature, Woolgar (1991) observed how, while building a computer, designers involved users to ‘configure’ certain possibilities for action into the machine while foreclosing others. Related to this, Akrich (1992) described how certain ‘scripts’ may be designed into technologies that embody values and preconceptions about who the user might be, though users may resist these scripts through ‘anti-programs’ (Latour, 1991). Suchman (2002) discusses ‘located accountabilities’ as a central concern for design, arguing for a heightened awareness of the socio-material relations and environments in which technology design takes place. Design, according to Suchman (2002), is not simply the creation of concrete, inherently meaningful objects, but instead founded on power differentiated networks of visible and invisible work that constitute “a process of inscribing knowledges and activities into new material forms” (p.100). Fischer, Östlund and Peine (2020) empirically demonstrated how such localized design activities themselves can be constitutive of ideas about future use and users. User images, they show, may be intricately tied in with the everyday practices of engineering work. Hence, design practices, in the sense of the authors outlined above, come to ‘matter’ quite literally, as their underlying values, assumptions and power aspect jointly work together in the creation of new materials.

Along parallel lines, STS research has also brought to light how participation can be differently configured through including different mediators. STS studies on expertise have highlighted, amongst others, the centrality of boundaries in the making of expertise (Abbott, 1988; Collins & Evans, 2002), as well as the dynamic nature in which expertise emerges in practice (Jasanoff, 2003; Knorr Cetina, 1999). With regards to the role of experts in participation, Akrich (1995) addressed the role of designers, when they for instance project themselves into use to represent the users, something she calls the ‘I-methodology’, or when they consult external user ‘experts’. Schot and Albert de la Bruheze (2003) directed their attention specifically to such processes of representation, and show how not only producers, but also mediators influence and configure design and use. The authors argue that such mediators “often claim to represent specific users” (p.235), and form a central part in how the user and product are “defined, constructed and linked” (p.230). Connected to this are the findings by scholars working more closely at the intersection of STS and ageing, who have problematized how proxies who act on behalf of users can matter significantly in the design of technologies for older people, when the insights they provide are given priority (Frennert & Östlund, 2016; Peine et al.,

2015). The inclusion of different mediators and stakeholders in design, thus, is a core aspect of differently configuring participatory design in practice.

From this literature strand, we adopt the idea that participatory design can be differently configured with the inclusion of different experts in different settings (Schot & Albert de la Bruheze, 2003; Woolgar, 1991), and that such configurations can lead to different materializations of design objects (Akrich, 1992; Latour, 1991; Suchman, 2002). In particular, we use this literature to study specifically the *practices* of participation. While there is now increasing attention paid to the practices of design (e.g. Bratteteig & Wagner, 2012; Vines et al., 2013), only a few studies thus far have *empirically* investigated *design in practice* (Bucciarelli, 1988; Fischer, Östlund, & Peine, 2020; Lloyd, 2000; Luck, 2007). We address this specific aspect of participation and explore how different configurations of participation play out in practice, and in this vein contribute to the ongoing debates about the practices of participatory design.

3.2 *Objects and ontology*

In doing so, we draw on more recent ontological works in STS (Barad, 2007; De Laet & Mol, 2000; Law, 2004; Law & Ruppert, 2013; Mol, 2002). This work interrogates the assumption that objects and technologies exist independently of their observers as stable entities (left untouched, just looked at from an outside perspective) and foreground their very *existence* and *emergence* as relational and situated within different enactment practices (handled, dealt with, given shape in practice). In so doing, this literature offers an extension to the previous work on social constructivism (Pinch & Bijker, 1984) and empirical relativism (Collins, 1981) in STS, highlighting the need to analyze objects not only through different perspectives or interpretations, but also by understanding them as manipulated and actively created within practice (Mol, 1999).

In this literature stream, Karen Barad (2007), argues that objects and subjects (such as ‘gender’ or ‘race’) are not necessarily a priori existing entities, but obtain their identities only in single phenomena as they are enacted in practice through their mutual ‘intra-action’. To her, everything in the universe is entangled, and each practice is a phenomenon in which, for a moment, the lines that separate inside from outside an object are stabilized. What makes an object an object, then, is always contingent and relational: the boundaries of the object are drawn only as they are enacted in practice. Similarly, other studies highlight how objects and technologies are not necessarily fixed entities, but multiply distributed and fluid across various different locations (De Laet & Mol, 2000; Mol, 2002). Mol (2002) traces the emergence of the disease/illness atherosclerosis at different enactment sites in a Dutch hospital. Like Barad, she finds how an object (in her case atherosclerosis) becomes ‘real’ as it is enacted in practice, but she also argues that this necessitates the possibility

for *multiple* versions of an object to exist: “And since the object of manipulation tends to differ from one practice to another, reality multiplies” (p.5). For example, she illustrates how atherosclerosis is practiced differently by vascular surgeons and patients in outpatient clinics, and by pathologists and refrigerated, amputated leg parts in pathology departments. What she observes, hence, are multiple versions of one object in different enactment sites.

Despite this multiplicity, however, Mol (2002) also argues that the different enactments of an object are still connected, overlapping and cooperating with one another, jointly achieving the reality of one object. For example, the different ways of diagnosing atherosclerosis are still coordinated into a single patient file and a coherent treatment decision. “This, then, is what I would like the term *multiple* to convey: that there is manyfoldedness, but not pluralism. In the hospital *the body* (singular) is *multiple* (many)” (p.84, emphases original). De Laet and Mol (2000) make a similar point about different versions of a technology at the example of the Zimbabwean Bush Pump, which they portray as variously practiced at different sites by different networks of relations, while being yet conceivable as one object. Law (2004) and Law and Ruppert (2013), finally, address how the practices of research *methods* (such as measurements, but also participatory design) work themselves as devices that are implicitly enacting social operations. As objects emerge in practice, they argue, then methods and research practices destined to investigate those objects also take part in creating and altering social reality, resting in particular choices and underlying assumptions. Participatory design, hence, can be seen as both a method and device that strives to extend into different versions of the social.

We adopt these conceptual ideas to help us analyze our empirical material, and to make sense of our findings. Specifically, we take inspiration from the idea that the enactment of participation itself (Law, 2004; Law & Ruppert, 2013) is a boundary-making practice that defines what an object is (Barad, 2007), and that through different configurations of participation, multiple versions of an object can be brought into being (De Laet & Mol, 2000; Mol, 2002). As we will elaborate in the later sections (5) and (6), our findings show how *ageing* can be such an *object of participation*, enacted in multiple forms through different configurations of participation.

4 Methodology

4.1 Research design

To generate new knowledge on how different configurations of participation matter in practice, we followed an inductive research approach. As Flyvbjerg (2001) argued, the values and power aspects underlying the social context and setting in which knowledge is generated should form a central

concern for social science research. To thoroughly consider such power aspects for design, and at the same time induce new knowledge on the effects of differently configuring participation, hence, we followed a multiple case study design (Eisenhardt & Graebner, 2007; Yin, 2013). We conducted three participatory design workshops, each with a different group of stakeholders or experts (Akrich, 1995; Schot & Albert de la Bruheze, 2003), and in a slightly different setting, thereby creating different configurations of participation (Bratteteig & Wagner, 2012; Suchman, 2002; Vines et al., 2013; Woolgar, 1991). In this way, each design workshop presented a unique case: The first case referred to the participation of researchers in ageing and technology studies, the second case focused specifically on care and nursing experts, and the third case included in particular older adults.

We chose these different groups of participants because they were theoretically relevant (Glaser & Strauss, 1967). As we have outlined before, older adults are still rather underrepresented in design, and their potential to contribute is not yet fully documented (Frennert & Östlund, 2016; Peine et al., 2015). On the other hand, care providers and age researchers are known to be relevant, and are frequently considered in design projects targeted at older people (Björkquist et al., 2015; Müller et al., 2015; Waycott et al., 2012). Consequently, we felt it was theoretically reasonable to investigate and compare how the participation of these three different stakeholder groups matters in practice. The participants were recruited through academic networks and relationships that have been built up consecutively over several years.

4.2 Participatory design workshops

Following the general recognition that participants may be involved at different degrees of participation (Arnstein, 1969), we focused in our design workshops on reaching a somewhat similar degree to which our stakeholders could participate. Our intention was for stakeholders to have the freedom to engage with design ideas on their terms. In this vein, we believe we could illuminate the vast spectrum of the contributions that are possible with involving different types of stakeholders, and understand the nature of the content with which they can contribute.

Hence, we adopted similar procedures for all three workshops, with an overall similar structure: Each workshop was introduced by the same presenter (second author). We began with a brief introduction of ourselves, highlighting our research areas and backgrounds. We then presented different digital applications and technological developments to illustrate to our participants the design possibilities that could potentially support older people. Most notably, we introduced social robots, smart phone applications, and home assistant devices as promising technologies for older people. We chose to highlight these technologies as examples for all three workshops, to illustrate to the

participants some of the most frequently discussed technologies aimed at serving the ageing population (Sumner et al., 2020). We found this approach effective, as it gave the participants some entry into the topic, without compromising too much on their creativity. In the design brief, the participants were then asked to select among, modify and adapt these digital applications in line with their views of how technologies could support later life. A few questions posed were: Why is this alternative important? Meaningful? Enjoyable? How to make the most out of the usefulness? Why is this useful? After that, the participants discussed in small groups how the selected alternatives or the new ideas can be developed and modified to be of use. They were also asked to illustrate and motivate their ideas, using different simple design workshop materials (e.g. papers, pens, coloured pencils, plastic bricks, post-it notes etc.). After this creative phase, the participants were invited to present their ideas and jointly discuss each suggestion. The workshops lasted 3–4 h. All workshops took place in Stockholm, Sweden and were contextualized by an ongoing international research project on social connectedness during old age. While part of the overall project, ethical approval for the workshops was not needed according to the Swedish law on ethical review as no sensitive data was included in the research (Lag, 2003, p. 460). The details of the workshops are summarized in Table 1.

While we strove to implement similar procedures in all three workshops, we also set up our approach to specifically recognize that social settings are dynamic and involve shifting aspects from workshop to workshop that cannot easily be controlled. Hence, to embrace this complexity, we treated our procedures as *similar yet different* from workshop to workshop, which is why we opted to speak of our different workshops in terms of different ‘configurations’ (Vines et al., 2013). By means of this approach, we intend to draw attention to the situated and contingent nature of each particular workshop, while at the same time keeping the inclusion of different stakeholders as the main change in the configuration. We will elaborate more on the different configurations of each workshop in the result sections (5.1.1, 5.2.1 and 5.3.1).

4.3 Data collection and analysis

As the primary method for data collection, we used participant observations of the design workshops. Participant observation is a method designers mostly

Table 1 Overview of the three design workshops with different participants

	<i>Workshop 1</i>	<i>Workshop 2</i>	<i>Workshop 3</i>
Participant group (n)	Age researchers (n = 11)	Care experts (n = 14)	Older adults (n = 18)
Date	17.09.2018	18.03.2019	10.05.2019
Location	Stockholm, Sweden	Stockholm, Sweden	Stockholm, Sweden
Main devices introduced at beginning	Robots, smart homes, smartphones	Robots, smart homes, smartphones	Robots, smart homes, smartphones

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value and use to elicit knowledge about the use context as an input to design (e.g. Blomberg, Giacomi, Mosher, & Swenton-Wall, 1993; Hughes, Randall, & Shapiro, 1992). However, in our study, we used participant observation as a method to understand design activities themselves (Bucciarelli, 1988; Lloyd, 2000). During each participatory design workshop, the first author observed the participants' engagement and took field notes - with a specific emphasis on how the configuration of participation might matter in practice. Our research data also comprised pictures of the workshop, informal conversations that occurred during the workshop, as well as the materials and low-fidelity prototypes provided by the participants during our design workshops, which we kept for data analysis. We then analyzed the data through an iterative form of thematic analysis (Braun & Clarke, 2006). The first author systematically reviewed and analyzed the notes and documents obtained during the workshops, and identified relevant themes with regards to how the different configurations of participation came to matter in practice. The authors then jointly discussed these themes and refined their relation into broader categories. To thoroughly consider potential subjectivities in our data interpretation, we continuously engaged in a critical reflection of our own role as researchers in relation to the data, thoroughly considering how our data may have been shaped by our own assumptions (Hammersley & Atkinson, 2007, p. 15). By means of this ongoing reflexivity, we believe we could interpret our observations in a ways that were close to the realities expressed and enacted by our participants.

At one point, we returned to the literature on empirical philosophy outlined before (Barad, 2007; Law, 2004; Law & Ruppert, 2013; Mol, 2002), and used these ideas to come to grips with how our different configurations of participation seemed to matter in practice. As we will show below, our empirical material illustrates how different configurations of participation created different versions of 'ageing', materialized in different prototypes and articulated in various ideas about where technology and old age might intersect.

5 How different configurations of participation matter in design practice

In the following sections, we present the results from our analyses and observations of the design workshops. For each workshop, we begin by briefly outlining the configuration, including participants and contextual set-up. We then move on to elaborate on the different versions of ageing created by each configuration of participation.

5.1 Age researchers (Workshop I)

5.1.1 The configuration

The first workshop was attended by an interdisciplinary team of eleven academics active in ageing studies at universities in four different countries: The

Netherlands, Canada, Sweden and Spain (six women, five men). For the workshop, they met up in Stockholm, Sweden, and they brought with them in-depth experiences in ageing and technology across a variety of research fields, including social gerontology, media studies and gerontechnology. In the workshop, the researchers were assigned to work in small groups, develop personas of older people, highlight their potential needs, and suggest digital technologies that could solve them. The workshop was contextualized by an international project in particular seeking to improve social connectedness among older adults.

Even though the researchers were aware of design topics, they had little experiences with participating in design workshops themselves - apart from the workshop organizers. Hence, the workshop organizer helped to provide some guidance and distributed a couple of persona templates (hinting at potential relevant features, such as age, gender, skills, hopes, dreams and current technologies) in order to support the researchers in the beginning. The workshop design activities went on for about two hours. [Figure 1](#) shows some workshop participants working in groups in this phase. Following the design activities, the researchers presented their ideas about possible older technology users and low-fidelity prototypes of a potential digital technology that could be useful for older persons.



Figure 1 Age researchers in workshop/configuration 1

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Below, we hone in on the content of the design workshop with the age researchers. In this regard, our analyses yielded a first theme of how ageing was enacted: ageing in terms of age-associated problems in connection with existing technology.

5.1.2 Ageing in terms of age-related problems and already existing technologies

In many of the illustrations and suggestions provided, we found how the researchers addressed *problems* that can occur in older age. For example, we observed how the researchers often articulated the concern that older people could suffer from loneliness. This idea of isolated older people mostly was expressed through the imagined personas of the researchers: For example, three researchers created the persona of one older man who was divorced and desperately searching for a partner, at the same time having increased worries that his social circle was shrinking, and not having any friends. Another four researchers suggested the persona of an older man who lives separately from his prior partner. And yet another two researchers put forward the persona of one older woman who was a widow. The aspect of loneliness was further emphasized, as two personas included older people who were foreigners in the country they were imagined to live in now, but had distant relatives still living in their home country. In particular, the widowed older woman was imagined to be born in India, but living in Canada, wishing to stay in contact with her relatives and friends in India, but also seeking to extend her social network. The older man who was divorced was envisioned as a first generation migrant from China who lives in Sweden since 40 years, whose children all now live in different cities, and who is tired of struggling to find new friends in bars.

Apart from loneliness, we observed also a second age-related problem that the age researchers evoked. This referred to health problems with regards to deteriorating body functionalities, including chronic diseases and physical impairments. To a degree, each of the personas alluded to the requirement for biomedical attention. For example, one suggested persona was portrayed as suffering from diabetes leading to reduced mobility, another one was imagined to experience hearing and vision loss and weakening hands, and again another one was envisioned to struggle with cleaning the house. The age researchers also brought forward that with age, older people would have it increasingly hard to maintain their household. The old man who was divorced and searching for a partner, for example, was portrayed as having poor skills in keeping the home environment clean, though he would really wish a nice and tidy house.

Our observations show how the age researchers then materialized these life-situations in possible design objects. In so doing, the researchers addressed the age-related struggles older people face, by seeking to design technological objects that they felt older people would already be experienced with. For example, two researchers emphasized that their imagined older user would be used to using a mobile phone or iPad. So, they created a low-fidelity prototype that assumed these technical capabilities, as it could be used for communication just like a mobile phone or iPad, and combined these with possible strategies to cope with age-related problems. The prototype they created was a small-size artificial intelligence (AI) powered machine designed primarily for communicating (to address the issue of loneliness), and included a sculpture-shaped structure (so it could more easily be steered with ageing hands) and embodied a bone conductor (to enable continued communication despite hearing loss). Relatedly, we have seen how another group of four researchers also pointed out the possibility that new technology could be more acceptable if it would fit the objects and devices older persons already are working with, and connected this to the age-related problems they envisioned. Hence, they created a prototype of a digital device with the look of a conventional book, but it embodied advanced technology, such as control of the home environment (to make up for increasingly reduced mobility at later age), medicine reminders (referring to issues with diabetes and blood pressure) and video chatting (to tackle the problem of loneliness).

Likewise, we observed how three age researchers built a prototype to tackle the age-related problems their previously suggested persona was having, while attending to their idea of what technologies older people had experience with. So, their design of a low-fidelity prototype resembled a radio, and their idea was to upgrade this radio-looking device with technology that could allow different channels for communication (to find new contacts in the social network) as well as monitoring sensors of the home environment (to detect when the house needed cleaning). Finally, we witnessed how two age researchers highlighted specifically the experiences of older people with existing technologies, and suggested that, instead of building technologies based on their knowledge about older people, older people themselves could be involved during the design of a technology. These researchers did not develop a *technological* design object like the other three groups, but instead provided a paper-based design *strategy* to co-design technologies together with older people.

The examples above show how, in design practice together with age researchers, the object of ageing took the shape of different age-related impairments, such as loneliness, diabetes or loss of vision, and in connection with the idea that old age could be addressed by existing technologies to serve these problems. As it was enacted in practice, these objects then materialized in four different prototype versions for design.

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5.2 Care experts (Workshop II)

5.2.1 The configuration

The participants at our second workshop included 14 female care teachers and managers from a national organization for the education of assistant nurses. They were a professional group with a broad range of experiences in home health care, at nursing homes and in home help services. Based on these experiences, the care experts were willing to participate in our workshop in Stockholm and explore new ideas for useful technologies for older people. Just like the researchers in the previous workshop, we asked the care experts to work in small groups for about two hours and make suggestions for different alternative digital technologies for older people. We also supported them with some introductory knowledge about design workshops. Compared to the previous workshop, this workshop had a slightly stronger focus on smart home devices in the introduction slides, outlining in detail different options for home assistants in different sizes, but also thoroughly discussing the other options. This added detail was incorporated as a dynamic adjustment to the questions that we encountered during the workshop. We also did not provide them with any templates, but rather encouraged them to explore what could be useful for older people in a less prescribed manner.

We now move on to elaborate on the content of the participatory design workshop together with this group of professionals. Analyzing our observations, we found that in this setting, ageing was particularly enacted as possible daily frustrations and appreciative of human relations.

5.2.2 Ageing as possible daily frustrations and in need of human connections

In the design workshop we observed, one way the care experts empathized with ageing people was through referring to their previous experiences, and then relating these experiences to their views of the *possible daily frustrations* older people might have. For example, a couple of professionals suggested that, from their experiences, voice recognition implemented in smart home assistance was, to date, still very sensitive. If the smart home device was to be placed in the center of a room, the distance might be too far for the device to understand the older people. Empathizing with the older person, they imagined it could be very difficult and frustrating for older people to speak clearer and louder. Ageing in this example hence became a set of possible frustrations: the frustration of older people to have to speak clear and loud, and not being able to hear over distance. The nursing professionals materialized this version of ageing in particular by means of a bullet-point form of prototype that would include a lighter, portable version of a smart home assistance (to bring the device closer, and thereby avoid having to listen and speak across far distances).

Similarly, another group of care professionals envisioned how some older people may feel overwhelmed by the way a smart home device may be activated. They reflected on the often absent choice using such devices, which would normally start when someone says a certain term. As this may be annoying for older people, the care experts brought forward additional ways of measuring (such as head tilt or eye contact) so that the device only activates if one talks directly to it, and the older person could retain a feeling of choice. Again, a version of ageing in the face of possible frustrations became apparent and embodied in a preliminary prototype: the frustration that something would become activated unintentionally, addressed through the design idea of a modified smart home device that includes built-in visual and motion sensors that would more accurately identify if an activation of the technology is indeed intended. The care experts also considered other frustrations that might emerge during old age, and materialized these concerns in modified prototype ideas: For example, some uttered the possibility of mishaps such as water spilling over a technology. They came forward with the idea to adjust the prototype of a smart home device so that is waterproof. A few care experts also considered the possibility of frustrations with seeing or reading, and came forward with corresponding modifications. Here, it was suggested to include the ability of reading books or newspapers aloud. Another professional suggested to design a chip that could be attached to the arm that could be used complementary to guide dogs for the blind. In different shades, these examples show how ageing in relation to technology was enacted often as frustrations that technologies could address.

Besides possible daily frustrations, a second version of ageing emerged in our design workshop with the nursing experts: that of ageing people appreciating *human connections*. We found this often implicit in the articulations and design proposals brought forward by the nursing experts, or embodied in their paper-based ideas of prototypes. For example, a rather common suggestion was to integrate the ability for calls into the new digital device, independent of whether it was a smart home device or another type of digital device. The care experts conjured having features such as video calls or calls that would allow to show pictures of loved ones would be desirable for the older adults, as this could meet their need to have connections to their family and relatives. These ideas then became materialized in early-stage prototype solutions, not seldom quite creatively. For example, in one suggested prototype solution, a group of professionals re-designed a smart home assistant to be more adjustable so that its ceiling can be opened and pictures or videos of possible call respondents could be digitally displayed. Other nursing experts proposed to modify the smart home device so that it could be linked to smartphones for that purpose. Ageing as involving the desire for human connections, hence,

emerged and became embodied as a particular version in participatory design with the care experts.

But we not only observed how connectivity to friends and family was considered by the nursing professionals. Another aspect of connectivity we observed was the ability to also be connected to doctors and care workers. Here, one group of professionals made the suggestion that it would be good to link older people with doctors and care workers, and to link doctors and care workers among each other. This, the experts debated, would be of special importance in case of situations in which the older people would need attention. Hence, they came forward with a design idea of a simple emergency button that could be integrated in the digital device, and which could be activated in case something exceptional happens. Furthermore, the experts discussed that it might be desired to be able to be connected to people from different countries. This was based on their own experience that particular situations required attention from specialists that were coming from abroad. To overcome these barriers, the professionals in our workshop suggested to design a technical feature to translate different languages, which could facilitate communication. Besides, the care experts at our workshop also thought in terms of connectivity when it were not only humans that older people could be linked to. Here, the care professionals made a number of suggestions of existing units that their new technologies could connect with: mobile phones, watches, internet shopping, radiators and temperature controls. These suggestions, however, were rather sketchy and indefinite in nature.

All these prototype suggestions were made only on paper. Yet, these examples show how, in design practice together with nursing experts, the object of ageing took the shape of daily frustrations, like water spilling and unintended activation of devices, and desires for connectivity with families, friends, doctors and professionals. As it was enacted in practice, this object then materialized in multiple small paper-based ideas for design.

5.3 Older adults (Workshop III)

5.3.1 The configuration

The third workshop also was organized in Stockholm, and joined by 18 older people, all aged 80 or above (six women, 12 men). They were part of an alumni network from a national technical university, and graduated in 1948. The workshop took place as part of their alumni reunion. First, they were given a presentation to contextualize some general technological developments in the last 50 years, and indicate what current design research focuses on today. After that, they were encouraged to work in groups for about two hours, just like in the previous workshops, and identify new technologies and designs that could be required for older people as a target group. [Figure 2](#) provides a snapshot of the workshop with older adults.



Figure 2 Older adults in workshop/configuration 3

In what follows, we describe how the design workshop with the older adults played out in practice. Here, the analyses of our observations show how ageing took the shape of a continued life course: Life-course related aspects such as familiarity, control and change came to matter to the technical solutions that the older people designed.

5.3.2 Ageing as a continued life course: familiarity, control and change

A first central aspect of how we witnessed ageing as a *continued life course* being enacted together with the older participants was *familiarity*. This is demonstrated by the observation that, even though they were introduced to many different new technologies in the beginning of the workshop (such as robots and machine learning), their ideas built almost exclusively on mobile phones and smart home devices with which they already had some experiences. None of the older adults envisaged technological suggestions based on robots or artificial intelligence. Even though the older adults appreciated the new advancements in robot technologies, they would not find this a relevant technology for older people, because it would be too unfamiliar to them.

It appeared to us that the older adults often tended to evaluate technologies by their familiarity. For example, we observed how several older adults found the mobile phone to be more familiar to them than the smart home device. Hence, they were especially critical with the smart home device, as they did not see any added value as compared to the mobile phone. Some older adults were skeptical that a smart home assistant would be necessary at all, because they found it possible to use the smartphone for almost all the tasks they imagined. Another group of older adults also uttered the worry that smart home devices and smartphones could have too many functions in common that could be superfluous, for example playing music or sharing pictures. Our observations indicate that the older adults saw certain type of technologies as familiar, and hence built on those for their design ideas.

This does not mean, however, that our observations suggest the older adults were uninterested or reluctant to advancing technologies. Rather, while familiarity was a relevant concern, we also saw how the older adults were very keen to explore new technological opportunities. In the practices of our design workshop with the older adults, this desire for *change* formed a second aspect of how ageing emerged as a continued life course. In our observations, we found a multitude of instances where the older adults asked for change in this way. For example, one group of older adults articulated that they could need some help with household work. So, they suggested to modify a smart home device to be able to call for support for laundry and washing, if needed. Another group of older adults shared their knowledge of acquaintances who suffered from mild Parkinson. They stressed that her frail older friend had difficulties controlling their hands, and created a design idea of a smartphone that implemented a reliable voice control. This way, the older adult suggested, frail older people could continue using the mobile phone.

Furthermore, one group of older adults emphasized their unsatisfactory experiences with navigating digital devices. They recommended that mobile phones could be improved by increasing the letter size and clarifying the navigation through differently colored buttons. Some older adults also became interested in the concept of exoskeletons, and were curious to identify possibilities, however without putting forth concrete ideas. These examples reveal how the older adults were willing and curious about the opportunities of novel technologies, and squarely demanded change. In this regard, we found that their contributions were specifically interesting, as their suggestions for change stemmed from their lived realities of continued ageing, and the changes they wish for on a day-to-day basis.

A final type of how we observed ageing as a continued life course to be enacted in the participatory design workshop with the older adults was the aspect of continued *control* during ageing. We observed this desire for control specifically embedded in the expectations the older adults had towards different

technology designs. For example, several older adults reported problems with having control over autocorrect. In particular, they expressed their frustration during a number of situations in which autocorrect did not send what they intended to send, and they were left helpless without the ability to change. Similarly, adhering to lacking control, some older adults remarked on ethical concerns, because certain applications would always run in the background of their smartphone, and they did not have any opportunity to shut them off. They explicated that they wanted to continue using these applications, like Facebook, in order to stay in touch with friends and family, but at the same time would not want to feel monitored.

Our observations also comprise elements where older adults thought of new technological improvements to attain a higher degree of control, thereby combining familiarity with control and change. In an interesting discussion, for instance, a number of older adults came forward with the idea to enable different ringtones, distinguishing between those to answer, and those not necessary to answer. From a technological perspective, this is a feature that, in some ways, already exists. Still, the example further underscores how a desire for continued control in later life was a central feature of the design suggestion made.

As our accounts above have shown, ageing enacted together with the older adults referred to a continued life course, expressed in a desire for control, familiarity and change, and epitomized in the different design objects the older adults presented. These solutions were not made into concrete prototypes, but their ideas materialized in paper-based sketches and drafts, and came forth during our discussions.

6 Design multiple

Building on insights from STS, our findings suggest that ageing and technologies do not exist prior to, or outside of, the design practices that enact them. Rather, ageing and technologies for old age are created, produced and brought into relation only in design practice: Without the engagement of nursing experts, researchers and older people themselves in design workshops, the specific enactments of ageing as possible daily frustrations, age-related problems or a continued life course would not exist. At least not at the sites, times and places where we observed the design workshops. Furthermore, there would be no prototypes, no paper-based sketches, no drafts that materialized – either loosely or more concretely - ageing into design ideas. In [Barad's \(2007\)](#) terms, ageing became 'real' only in 'intra-action', enacted jointly by the 'entanglement' of participants, the workshop organizers, the introduction slides, the design brief, and the workshop materials including paper, small plastic bricks, pens, pencils. During the design workshops, all these

elements were somehow in action - though some more than others - and jointly formed an assemblage that enacted the 'boundaries' of ageing.

Crucially, our findings emphasize how, across different participatory design practices, ageing emerges in *multiple* versions (Mol, 2002). That is, the boundaries of what ageing consisted in, and the design needs that followed from them, were enacted *differently* in our workshops with different configurations of participation. Hence, in the configuration involving researchers in ageing studies, ageing was enacted in terms of age-related problems that existing technologies might best address. In the configuration involving nursing experts, ageing was enacted as consisting in possible daily frustrations and requiring human connections. In the configuration involving older people, ageing was enacted as a continued life course. Our findings highlight that, once we look at the practices of design, we find that ageing is not just one single object. In design practice, we find that the reality of ageing is multiple.

Furthermore, our results outline how, in different design practices, ageing is not only multiply enacted, but these multiple versions of ageing are materialized and embodied into a number of different design objects. For example, the enactment of 'ageing as age-related problems addressed through existing technology' became embodied in the low-fidelity prototype of a *radio-looking* device that included possibilities for networking to overcome loneliness, and monitoring for cleaning support. The enactment of 'ageing as consisting in daily frustrations' was inscribed into several paper-based prototypes of *smart home* devices resistant to water spilling, or preventing unintentional activation. And 'ageing as a continued life course' found its way into paper-based sketches of designs that allowed, amongst others, for continued control in *smartphones*. These designs are indeed objects and entities quite distinct from another in both their technical abilities, as well as the versions of ageing they could meaningfully relate to.

This begs the question what then binds these multiple and multiply materialized versions of ageing together to jointly achieve one reality of ageing, as Mol's notion of multiplicity (2002) would suggest. In our case studies, we found no traces of how the multiply enacted realities of ageing collaborated, or somehow hung together, to achieve one version of ageing, as was the case with atherosclerosis in Mol's study. Rather, the different enactments and materializations of ageing seem to reveal tensions and contradictions that are difficult to reconcile with one another. For instance, the materialization of ageing in terms of daily frustrations (a smart home device with resistance to water spilling) suggests very different boundaries and elements of ageing than the version of ageing as a continued life course embodied (smartphones that allow for continued control). Curiously, such different materializations of ageing can matter quite literally, as they create potentially disaggregate design paths in which different versions of ageing become further articulated

and obdurate (Bijker, 1995; Latour, 1991). For design studies, the challenge then is to understand how, and through what mechanisms, different design practices can lead to different material designs, and to interrogate if and how these different designs still can achieve one common reality for objects such as ageing.

To address this challenge and make it accessible for further studies, we propose the term '*design multiple*': A design multiple is an object that is multiply enacted in design practice, and whose multiple enactments are materialized into several designs. Ageing, hence, can be seen as a design multiple: *multiply* enacted, and materialized in several *designs*. Viewing objects such as ageing as a 'design multiple' simultaneously builds on Mol's (2002) notion of multiplicity while adding a specific sensitivity to the materialization of multiply enacted realities into several designs. Multiply enacted versions of an object could drift apart as they turn into a number of designs that leave the enactment sites. Additionally, our observation relates to STS studies concerned with the interconnection between design practices and technical objects (Akrich, 1992; Suchman, 2002; Woolgar, 1991), by attending to the role of multiplicity for differently configuring and inscribing elements into design. At different enactment sites, objects may be practiced differently, hence leading to the embodiment of very different values, assumptions and ideas into design. What is materialized or inscribed into design thus depends crucially on the design practices that enact multiple versions of an object like ageing. Only when we turn to the multiple versions that different configurations enact will we understand how different designs may take shape.

Furthermore, the concept 'design multiple' contributes to the current debates in critical design research (Bratteteig & Wagner, 2012; Frauenberger et al., 2015; Vines et al., 2013). In different shades, these studies have emphasized how participation is not simply a neutral design method, but inhabited by tacit power relations and values that can subtly frame or configure participation differently. The concept of 'design multiples' adds to this research by drawing attention to the *ontological consequences* of different configurations of participation. Design research has long highlighted the heterogeneity of participatory design (Kensing & Blomberg, 1998), emphasizing the relevance of considering different perspectives (Winschiers-Theophilus, Bidwell, & Blake, 2012) and achieving inclusiveness (Bjögvinsson, Ehn, & Hillgren, 2012). However, such investigations seem to be informed by the idea that including more perspectives or becoming more inclusive can somehow make participatory design methods more or less accurate. By bringing in questions of ontology, our findings draw attention to an additional mode of engaging with design practices and participatory methods. In this additional mode, we let go of the idea that participatory design can include a more or less accurate version of an object that is addressed. Rather, using 'design multiple' as an analytical concept allows us to speak about, and address, how design practices, and

Design Multiple: How different configurations of participation matter

participatory methods, may function as arenas that constitute and re-constitute the boundaries of objects across different workshops and locations. It thereby enables us to trace how objects are brought into existence, rather than being differently represented, as dynamic entities during design practices.

This, in turn, allows design research to attend to the ontological consequences of differently configuring participation in design: With ‘design multiple’ as an analytical lens, we can ask questions such as: How is ageing *made* differently in design, not just addressed or perceived differently? What are its boundaries in the many practices of design? How do these different versions connect across different practices? How are other relevant objects brought into existence in design practice? And, how do tacit power aspects (Bratteteig & Wagner, 2012; Foucault, 1977) feature in the making of these objects? Following and investigating the emergent properties of design multiples, hence, can be particularly useful in order to develop a more nuanced understanding of the way different configurations come to matter in design. If we wish to learn more about the role of different configurations in design, thoroughly exploring the micro-mechanisms by which design multiples are constituted in practice appears like a fruitful avenue for future research.

7 *The method participatory design*

On a practical level, we have seen how participatory design as a method can yield very different results depending on how it is configured in practice. The prototypes, design ideas and notions of ageing can take very different shapes based on how participatory design is performed. This observation relates to the argument by Law (2004) and Law and Ruppert (2013), who have stressed that methods can influence the type of realities that are produced. In a design context, our findings further underscore the implicit consequences that participatory design as a method may have: If we practice design differently, very different outcomes can be achieved. In this view, participatory design is not just the impartial extraction of knowledge about design ideas in cooperation among various participants. Rather, participatory design and user involvement entail a socio-material assemblage of various elements that, once practiced, jointly constitute not only technology, but also ageing as an object itself. Even more so, as these socio-material arrangements can differ from locale to locale, from site to site, from time to time, workshop to workshop, and design setting to design setting, they can create very different versions of ageing. And along with them, they can create different material realities for future societies, as they move into - and potentially transform - existing socio-material arrangements among both humans and nonhumans (Latour, 2005; Suchman, 2002).

In this way, participatory design relates to the discussions about the political implications of ontological enactments (Mol, 1999; Woolgar & Lezaun, 2013).

As enactments, and the heterogeneous elements involved in them, render knowledges and objects, they also make norms and goodness (Mol, 2002). For us, the question arises: What is a *good* configuration of participation in practice? Or, what *could* good participation be? Here, we are attempting to offer one way forward towards achieving ‘good’ participatory design for older adults: In our research, we have particularly zoomed in on participatory methods as an important process in the co-constitution of ageing and technology (López Gómez & Criado, 2021; Peine & Neven, 2020). We find that our results imply the importance for designers to be reflective about their own position in differently configuring participatory design, and the ontological consequences this has. Their practices, choices, agendas, all play a role for the technological designs, and objects, that become real. We have shown how it made a significant difference to either involve researchers, nursing experts or older people. This is particularly relevant in the context of technologies for older people, where many technological ideas continue to struggle to gain traction and meet the expectations of ageing populations. One of the reasons for this disappointment appears to be that the full potentials of user involvement as a method are not yet fully reached (Fischer, Peine, & Östlund, 2020). To us, our findings suggest that designers could, for example, reflect on what types of goals and outcomes they want to achieve with a particular method, and whether their current enactment matches these visions. Based on this reflection, it would be possible to refigure current design practices, and bring them into alignment with the aspirations and wishes of designers, participants and recipients alike. However, what is ‘good’ is a matter of continuous work, of care, tinkering, failing and re-doing (Heuts & Mol, 2013; Mol, Moser, & Pols, 2010), and hence, what good participation is, may change, transform, and move in the hands of others. Further design research may refine this, exploring and identifying how participation could be crafted ‘well’ in different ways.

8 *Limitations*

Over the life cycle of a design project with ample instances and modifications, there is always the possibility that eventually, many of the design prototypes that are initially enacted do not materialize. This is also true for our different participatory design workshops, as they did not encompass a fully-fledged design project that lasted across several iterations yielding high-fidelity prototypes. Future research could address when and how design multiples are enacted over an extended period, when and why they appear and disappear in such long-term projects, and how they may be stabilized during the development of more concrete technological artifacts. We also caution that our findings are particularly focused on ageing and technologies for ageing. This is a timely topic, but a rather limited scope for design. Scholars could investigate how design multiples might be practiced in the context of other large-scale societal developments relevant to design, such as sustainability transitions,

climate change or medicine. Finally, the configurations of participation we dealt with predominantly encompassed the involvement of different stakeholders, though other elements also may have differed. This leaves open as to how ageing would be enacted if the configurations of participation differed in different terms, such as in terms of their level of involvement or impact of participants on the design outcome. Configuring other forms of participation, and investigating how other forms of design multiples may take shape in practice, appears to be an intriguing path for research.

9 Conclusion

Our study has shown how different configurations of participation – achieved through the different workshop settings with different participants – can matter in design practice. We have shown that these different configurations matter by enacting, and materializing, multiple versions of ageing. Taking note of this multiplicity, we have introduced the concept ‘design multiple’, to attend to how design practices enact multiple realities of ageing embodied into several designs. Our findings call for further research on the micro-mechanisms through which design multiples are constituted, and linked, in design practice. Furthermore, they imply the need for an increased awareness among designers about multiplicity in participation, and its ontological consequences.

Funding

This work was supported by the Swedish research council for health, working life and welfare FORTE [grant number 2017–02301], as part of the More Years, Better Lives Joint Programme (MYBL).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We are grateful to the anonymous participants in the workshops: the 14 nursing teachers, the 18 older people and the 11 researchers in ageing studies. Without their openness to, and interest in, participating in our workshops, this publication would not have been possible. In addition, we would like to thank June Lio for her support with picture editing.

Notes

1. The concern with socio-materiality has become increasingly recognized as a relevant perspective in design research (see, for example, [Le Dantec and DiSalvo, 2013](#); [Kohtala et al., 2020](#); [Pedersen, 2020](#)).

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