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Considering the role of material gerontology in reimagining technology design for ageing populations

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Abstract

The promise of technology to provide solutions to the global concern of ageing populations has largely been unfulfilled. We argue that this is, in part, related to design processes that fail to take account of the rich material lives of older people, and that often adopt stereotypical views of older people as frail, vulnerable and unskilled. We draw on empirical data from two co-design projects, to suggest the contributions that material gerontologists could make to design teams creating technologies for ageing populations. We suggest material gerontologists bring three key elements to interdisciplinary design teams: (1) making visible the intra-action of humans and non-humans in co-design processes; (2) reconfiguring co-design response-ably with older adults; and (3) reimagining possible outcomes of technology design. We believe that this approach can result in the design of products, services and innovations that respond better to the heterogeneous needs and life-worlds of older adults.

Keywords: co-design, intra-action, socio-gerontechnology, material gerontology, ageing, response-ability.

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Introduction

Digital health technologies, trackers, social media, smart home devices, assistive technologies and advances in robotics are increasingly vital to our everyday lives as we age. At the same time, technology designers in the growing field of gerontechnology often struggle to move beyond biomedical models of ageing which assume that ageing bodies can be "fixed" through technological innovation and therefore tend to adopt an interventionist logic where ageing is seen as a "problem" to be solved (Peine & Neven 2020; Vines et al. 2015). Over the past few years, gerontologists have begun to engage critically with the digitalisation of social life with some important work emerging in relation to digital health (Katz & Marshall 2018), everyday digital technology use (Kania-Lundholm 2019), the use of technologies in care settings (Neven 2011), Ambient Assisted Living (Endter 2016) and robotics (Bischof 2017). This critical work has suggested that despite the rhetoric, technology designs for an ageing society have not lived up to expectations and there are increasing calls for new approaches to the design of technologies that do not view older people as necessarily vulnerable, in need of care or unskilled in the use of technologies (Manchester 2021; Neven 2011; Peine et al. 2015; Wanka & Gallistl 2018). This research raises at least three important questions: What imaginaries about ageing and later life are inscribed in gerontechnologies? How do these technology designs reconfigure ageing and later life? (How) can older adults be involved in the design of gerontechnologies and refigure stereotypical (or even harmful) inscriptions? In this article we are interested in how the field of material gerontology and the involvement of material gerontologists in technology design projects for and with older adults might help to unpack these questions.

Material gerontologists have moved away from biologically determined ideas of later life and instead see ageing as an embodied and material experience (Katz 2019b; Twigg 2013). This line of research extends the frame of analysis in gerontological research from a social constructivist understanding of old age, that foregrounds social practices, to the exploration of ageing bodies and materialities. In this framework, age and ageing are understood as:

> "[C]o-products of human interactions, discourses, things, technical artifacts, possessions, and mobilities, among other things. From such a perspective, ageing becomes a

> complex process in which human bodies and all kinds of materiality can be involved." (Höppner & Urban 2018: 2)

Material gerontologists, and specifically those following "new" materialist approaches, adopt a relational ontology in order to explore entanglements between humans and non-humans such as objects, technologies and spaces and aesthetics, and their co-constitution (Buse et al. 2018; Cozza et al. 2021; Gallistl & Wanka 2021; Höppner & Urban 2018). This foregrounding of bodies and materialities is both an ontological and an epistemic move. *Ontologically* ageing is understood as a material "doing" (Wanka & Gallistl 2018) and not simply a bodily or socially constructed process. Material gerontologists draw attention to different phenomena in relation to age and ageing including emotions, atmospheres, the entanglement of bodies and material objects in the lives of older people. *Epistemologically*, material gerontology can challenge traditional concepts of ageing and how we research it. It has led to new methods including walking interviews, methods that focus on the mundane, and interrogation of things and their meanings in contexts (Twigg 2021). Studies have focussed on reasserting the importance of the body, and its social constitution (Katz 2019b ; Twigg 2004), on materialities that make up age such as dress as an expression of identity and agency (Twigg 2008, 2013), the role of lifelong objects in stories told about age (Höppner 2015; Manchester 2018) and the importance of mundane objects to our emotional lives as we age (Buse et al. 2018). Another focus has been on ageing spaces and environments exploring, for instance, how the material alongside the social might enable different imaginaries, metaphors or "atmospherics" associated with age and ageing to become visible (Braedley 2019; Buse et al. 2018; Keady et al. 2020). In studies of technologies and ageing, materialist scholars have tended to explore the everyday experiences of older adults with technologies, providing rich accounts of the co-constitution of older people and technologies. For instance, Urban's (2017) research on the daily routines of older people living with assistive living technologies examines the relations between ageing bodies, sensors and algorithmic formulae embedded in the technologies. However, so far, few studies have applied these concepts to the understanding of technology design, or co-design processes (see e.g. Endter 2021; Jarke 2021; Manchester 2021, for exceptions).

In this article, we adopt a materialist perspective and suggest its value in making visible taken for granted assumptions inscribed in the contexts of ageing and technology design practices. This involves taking seriously ageing bodies and the complex and fascinating material and embodied lives of older people, while locating these elements within wider systems of power and economic and political infrastructures. In doing so, we argue that material gerontologists can support technology design processes that critique imaginaries of ageing that are inscribed in gerontechnology designs and also begin to actively engage in reconfiguring these inscriptions, alongside other actors. In the following section, we explore some of the work that has been done in co-designing ageing technologies and point out what material gerontologists might offer to this field. We subsequently draw on our own experiences, as material gerontologists leading two design projects, and suggest three contributions that material gerontology might bring to co-design practice.

Co-Design, Ageing and Technologies

In the last two decades the design of gerontechnologies has been partly shaped by approaches such as human-centred, user-centred, or co-design. Such design approaches critically engage with power relations in design practice, exploring how design decisions are made, how institutional frames influence design or the differential knowledges and decision-making power of different stakeholders, including the designer in the process (Bratteteig & Wagner 2016; Lee et al. 2018; Light et al. 2015). This important work has supported an approach to gerontechnology design that questions assumptions made about older adults and includes older adults in the design process, taking seriously their everyday lives and their concerns (Baker et al. 2019; Vines et al. 2015; Wallace et al. 2020).

However, as Rice (2018) suggests, co-design research predominantly centres human agency and relations of power between humans and there has been less focus on the non-human as agentic. We argue that this anthropocentric positioning has the effect of sidelining the material and non-human actors participating in these processes, including the various effects of the technologies and design objects themselves as they come into relation within a co-design process. In this article we therefore

suggest that new materialist approaches can support participatory design projects to *foreground* the entanglement of bodies, things and technologies, situated in wider systems of power, in order to explore their agentic role in the lives of older adults. Taking Haraway's (2016) concept of response-ability seriously, we ask how material gerontologists might facilitate a change from "us" (humans) speaking *for* non-human others in co-design processes (Taylor 2018: 81).

To explore how a materialist framework may refigure gerontechnology design practice, we follow Haraway's call for response-ability (2016) and adopt Karen Barad's new materialist concept of intra-action which emphasises that human and non-human actors do not pre-exist their "intra-action" as independent entities (Barad 2007: 33). In technology design projects, this can help to shift the focus of inquiry from the bodies of older people to the ecology of practices and performances that co-produce ageing (bodies) (Höppner 2017).

In line with Barad's goal "to work in thinking about the ways in which particular entanglements matter to the production of subjects and objects" (Barad 2007: 232), we see co-design as a sociomaterial process that produces specific subjectivities and materialities. This suggests we need to look relationally and symmetrically at what entities become, do and produce when they intra-act in co-design processes, because intra-action asks us to foreground "the dynamics in between elements instead of elements" as independent entities (Dörrenbächer & Hassenzahl 2019: 29). Hence, in co-design practice, we need to provide interventions, materials, atmospheres, and spaces that inspire and enable participants and the material world to *respond* to each other and themselves (Dörrenbächer & Hassenzahl 2019) and to engage in "a collective knowing and doing" (Haraway 2016: 34). Co-design practice-ings are a communal attempt to be "response-able with" (not for) others (Haraway 2016: 20) by considering the socio-material entanglements of design practices themselves (Pihkala & Karasti 2018). This, so Pihkala and Karasti (2018: 2) argue, shifts attention in co-design practice from the "socio-material as a background or context in which things occur, to understanding it as entanglements of constantly reconfiguring forces through which things and issues come to matter." The design outcomes then might better *respond* to the relational interconnections and lived experiences of older adults.

As researchers and designers we are part of this intra-action, and as our own active interventions unfold we are continually engaged in making ethicopolitical decisions around response-able engagement. This draws attention to the "apparatus" of co-design which can support us to attend to certain phenomenon and intra-actions as the design process unfolds, and ignore others. What is required from design researchers is to find ways in which a range of human and nonhuman actors can participate in co-design processes and can "cultivate their response-ability" (Lindström & Ståhl 2016: 44). Drawing on ontologies and epistemologies of material gerontology, and particularly Barad and Haraway's new materialist thinking, we suggest that material gerontologists could have a key role to play in this. Through our own involvement in two co-design teams we identified three contributions material gerontologists could make to technology design processes which we outline below.

Making Visible the Intra-Action of Humans and Non-Humans in Co-Design Processes

In many instances, co-design projects are interested in improving the *interaction* of older users with technologies. Material geronotologists can enable design teams to switch from a focus on interaction between (pre-existing) people and (envisaged) technologies and instead explore how humans and non-humans are co-constituted through *intra-action* by focussing on the dynamic sociomaterial assemblages of ageing. To support this claim we describe methods and approaches that helped to draw attention to these unfolding entanglements. In so doing, the rich materialities of the lives of older adults cease to be merely background or context, but are foregrounded; their intra-action becoming central for the further design process. This can be achieved through including and inviting non-human actors into the design process and then making participants' (differing) relations to them visible and tangible.

Reconfiguring Co-Design Response-Ably with Older Adults

In the field of co-design for ageing populations there has been a focus on human to human agency and power relations and there has been less focus on the non-human as agentic and response-able. Response-able co-design

recognises that agency is not held in individual humans or objects but rather unfolds in practice through intra-action. This represents a shift from an anthropocentric vision of the lives of older adults to one where the apparatus of design attempts to enable new alliances to grow and/or new boundaries to become established between human and non-human actors. Recognising the various effects of the choices made about the staging and framing of the co-design process (the "apparatus") also means understanding researchers' agency in moving beyond critique to build response-able interventions designed in many ways to reconfigure, or at least raise new questions, about old age.

Re-Imagining Possible Outcomes of Technology Design Projects with Older Adults

Through building response-able co-design processes, material gerontologists can disrupt imaginaries of age and ageing often held by gerontechnology designers. This can support a reconfiguration of ageing bodies and contexts of ageing, and enable new, previously unidentified problems, and assets to emerge within co-design processes. This, in turn, can lead to designers responding differently to older participants and considering different kinds of outcomes, that might include, but are not be limited to, technology designs. These new outcomes could potentially refigure the harmful inscriptions of age that we often see reproduced in gerontechnology designs.

In order to illustrate how these three contributions might play out in practice, we investigate two co-design projects involving older adults, led by the authors. We present and reflect on both projects through these three elements and provide implications for the involvement of material gerontologists in technology design processes with older adults.

Methodology, Methods and Empirical Material

The methodology adopted in both of the projects can be characterised as critical co-design (originating in Science and Technology Studies) that demonstrates a move away from understanding "innovation" as the design of "novel" products for market and towards a focus on innovation as an exploration of sociomaterial relations in order to ask questions of

existing practices and begin to explore and design new ones (Bjorgvinsson et al. 2012). The two authors' approach to co-design is similar in that both projects worked on foregrounding interdependencies and the need to build connections between all actors who were among those collaborating. Both co-design projects also foregrounded relations between materialities (including bodies, objects, technologies and spaces) and relations between materialities and social constructions of ageing within the design process.

In addition, material gerontology is tied up with feminist knowledge politics in focussing on situated knowledges in communities (not isolated individuals) and a politics of engaged, accountable and response-able positioning in relation to the phenomenon of ageing. This epistemological position privileges building connections and hope for the transformation of systems of knowledge, practices and ways of seeing (Haraway 1988: 585). Ethically, this involves "an enlarged sense of inter-connection between self and others, including the nonhuman or 'earth others'" (Braidotti 2013: 48).

The specific methods that we adopted during our design processes differed and will be explained below. However, methods in both of the projects focused on inviting in, attending to and making visible the unfolding of sociomaterial arrangements and relations during the co-design processes. In order to do this, we needed to record, map and play back the processes to our participants in multiple ways in order to bring them out into the open, making them tangible to those taking part and ourselves. We adopted a variety of techniques such as taking photographs, using visual stimuli and maps and writing fieldnotes in order to do this work.

We present here two very different technology design projects to consider the three elements that materialist approaches might bring to the co-design process, not in an effort to compare across the two projects, but rather to offer two contrasting but similar examples of the contribution of materialist thinking to co-design with older adults.

Tangible Memories: Community in Care

In our first empirical case, we draw on data collected during *Tangible Memories:Community in Care*, a 22 month interdisciplinary project funded by the Arts and Humanities Research Council in the UK, led by Helen

(author 1). The overarching objective of the project was to co-design innovative social technologies to support democratic community building in care homes. The specific research questions asked: How do we build connections in increasingly ageing communities? How do we get better at sharing personal stories and oral histories in ways that build community as well as creating new academic insights? How can we harness the evocative power of lifelong objects and the new potentials of digital technologies to support these processes?

Material objects, including cherished, mundane and neglected objects, have been found to be important containers of memories and to support older adults to tell stories about their lives (Buse et al. 2018; Hallam & Hockey 2001; Kirschenblatt-Gimblett 1989). In order to connect digital and material lives the project team drew on research in computing that foregrounds our embodied experience of the everyday physical world (Dourish 2001) and recent work in developing tangible and Internet of Things (IoT) technologies to embed technology in everyday objects (see Vaisutis et al. 2014).

The multidisciplinary, cross-sectoral team included Helen (author 1- a material gerontologist), an oral historian, an anthropologist, computer scientists, partners from charity Alive activities, a charity that runs activities in care homes and advocates for better quality of life experiences for older adults in care, an artist-maker and a small interactive design studio. The three sites chosen for the study were deliberately varied and included a dementia care ward run by a large charitable organisation, an extra care facility, (where residents have their own flats but can buy the care they require), and a privately owned and run home.

Making Visible the Intra-Action of Humans and Non-Humans in Co-Design Processes

Visits to the settings together were an important first step in beginning to highlight the unfolding entanglements of sociomaterial actors and intangible elements that often remain invisible in caring practices (Mol 2006: Mol et al. 2010). From these initial visits and our[1] desk-based research we had identified some of the key political, economic and social infrastructures

[1] In these empirical sections of the article where "we" and "our" are used, we are referring to the project team, unless otherwise stated.

of care work which had influenced technology design processes in the past. For instance, care is often delivered under considerable time pressure and usually allocated in relation to individual biomedical needs over social, cultural and embodied needs (Ward et al. 2016). Care workers have a low status as a profession and are often also poorly paid. Thus, they may choose not to engage affectively in the context of their waged labour role (Puig de la Bellacasa 2017).

While recognising these taken for granted constructs of care, we were also interested in understanding and drawing attention to the intra-actions of the different materials, texts, technologies and human relations and how they aligned and were contested in forming practices of care (McFarlane 2011). In order to understand this better we conducted "A day in the life of" ethnographies, shadowing care workers and residents and, in the process, attempting to understand, at least partially, elements of care that had been less well documented in the past.

Although necessarily partial accounts these ethnographic encounters drew our attention to artefacts like the "space invader like" checkbox records and charts that care staff were required to complete but we also noticed the importance of touch in activities such as nail painting, and stroking of hands. A resident introduced us to Charlie, a blackbird who sings outside their window everyday, and we also noticed how the sound of the tea trolley created a familiar and often comforting rhythm to the day for some residents. We attended to technologies such as wrist monitors and alarms – with embedded sensors that collected data about the person and their bodily functions as they go about their daily lives. Although problematic for some, we discovered that they also ensured a degree of confidence to others in being alone in their rooms and flats. One resident with epilepsy told us that she wears the alarm but would rather rely on care staff members who, she felt, could predict when she is likely to next have a fit due to subtle changes in her behaviour.

Through this first phase the team began to understand how the care practices in the settings follow biomedical logics of care. However, a materialist approach also enabled the team to attend to and discuss the embodied, more-than-human and material intra-actions of caring practices in order to make visible and tangible practices that might be normally rendered invisible in processes of technological design for older people. Paying attention to the co-production of ageing and care for older people

through human and non-human intra-action in the ethnographic stage, while taking seriously the partialness of our work, enabled the project team to begin to find openings for technology design that is built from the "stuff" that seemed to matter – the sunny spot in the garden or the brass plaques made by Elizabeth's (one of our participants) now dead spouse.

Reconfiguring Co-Design Response-Ably with Older Adults

Our research "apparatus" attempted to draw attention to the dynamic intra-action between human and non-human phenomena in making practices of care that might build community and connection. This approach brought certain phenomenon to the fore and, we hoped, would enable new alliances to become established. Our focus was on agency as dynamically co-produced between all bodies (human and non-human) in practices of co-design for age care settings. We recognised our own agency in our co-design work which we saw as response-able interventions designed in many ways to reconfigure, or at least raise new questions, about age and age care.

Following the ethnographic phase the team began to develop methods of co-design that is built from some of the "things" we noticed earlier, such as the importance of the blackbird and nature in residents' lives, or how sounds and smells can create certain emotional responses and mark time. We worked with residents over time to understand their everyday material lives, and the importance of mundane, as well as cherished objects in the ongoing production of their subjectivities. We did this through one-to-one conversations in their own rooms, and observations in dining rooms, lounges and other public spaces. In these engagements with older people, objects and materialities we found that they would often say that "they didn't have any interesting stories to tell," and we observed that they had "lost" their most cherished objects or that the environments and aesthetics of the care settings (e.g. the arrangements of furniture, the constant noise of the TV and the disconnect with the natural world outside the settings) did not encourage them to build social connections.

We identified a need to intervene response-ably through our co-design process to achieve our goal of building community and connection among older adults and carers and with the material actors we had identified as important. We therefore conducted a series of design workshops where we brought new materials, sounds, and smells into the care settings in order

to attempt to reconfigure the environments of care. When we conducted a workshop in the dementia care facility on money we brought old and new money and gave purses with money to the participants to spend. One participant, suddenly having a purse and cash in her hand after years without it, started to use the money to barter for cake on the tea trolley, intra-acting with the trolley, cake and researchers and performing past experiences that she had clearly excelled at in life outside of the care setting. We also asked them to bring along objects they felt close to or that had a story attached to it. Edith, a resident in the extra-care facility, brought along a copper plate crafted by her husband as a present for her birthday some years ago. She told the story of their relationship through the plate – referring to his craftsmanship and care to detail, reflecting on their lives together through the materiality of the object. These objects, smells and sounds were able to create temporal links between the past and the present, and supported older adults to share stories of their lives and make new connections with each other and with non-human materials, in meaningful ways.

At this stage it was the researchers and designers who were "staging" the co-design work, and largely the artefacts and approaches we brought in that were creating these relational reconfigurings. A particular issue that arose during the co-design process was the difficulty of involving care staff due to the political, economic and social constructs of care that led to them being overworked and with little time "budgeted" for engagement. As response-able researchers we wanted to find ways to invole care staff who were entangled in the politics, economics and sociomaterial worlds of the care settings. We sought to bring them into the co-design apparatus in order to design technologies that might support their work, and in the process improve the sense of community and connection in the care settings.

The design team worked to disrupt the way that the settings were materially and socially configured in order to engineer a removal of the carers' responsibilities for the labour of (bodily) care, at least for a short time. We designed a series of events to reconfigure the lounge space in each of the settings into a communal space, inviting care staff, residents, families and other practitioners to come and enjoy tea and cake while they experienced the prototypes that were developed. The design team took on the normal roles of care staff by serving tea and cake, manoeuvring wheelchairs and other aids and washing up. The sound of music, bunting, and our novel technological prototypes worked together to transform the lounge space

from one where residents would routinely be sitting in armchairs around the television to a space rather like a party, festival or market place, where we hoped new relations would be made possible. Within this redesigned space our prototypes and design artefacts, including a virtual reality (VR) headset, a musical cushion and a mock-up of a storytelling app, were novel artefacts, which, when they came into relation with human actors, were able to create new, if not always lasting, connections. For instance, a musical cushion prototype was a beautifully stitched patchwork cushion (found in a local charity shop) to which Radio-frequency identification (RFID) tags in the form of buttons played music when a listening device was placed over them (see Figure 1). Residents, staff members and families not only shared their own memories and experiences with similar artefacts (patchwork cushions) but also shared the bodily surprise of the music suddenly playing.

Figure 1. The musical cushion prototype

Re-imagining Possible Outcomes of Technology Design Projects with Older Adults

While we started our project with a desire to design technologies to build democratic community "problems" were also "made" through the unfolding intra-action of bodies, materialities, space and human actions in the process. Through framing and staging our focus on these sociomaterial intra-actions we began to unpack current practices of care in order to understand how they often worked to diminish relational, emotional and embodied aspects of care.

Through staging our co-design to attend to human and non human, technologies and materialities we worked to discursively and materially constitute the older person, carers and practices of care differently. Through this process, for instance, we noticed that living with loss as we age can be better understood as complex intra-actions across time and space, involving material lives, embodied experiences and relations with and among humans and non-humans. In their stories older people often described the loss of relationships with humans, animals, as well as nature. They also told about the loss of cherished objects that made sense when emplaced in lifelong homes but made less sense when brought into care settings. This understanding, that became visible during the process, did not necessarily require or call for a simple technological solution, rather it required co-designs that considered the complexities and dynamic nature of the wider sociomaterial arrangements around any technological design.

While we had co-designed some prototype technologies and had been using them together in all the settings, we knew that the technologies alone would not bring about the kinds of changes to caring practices that we had all come to understand were needed. In the extra care setting we worked to co-design a room to be filled with evocative objects (donated by residents or procured in local charity shops), smells, a wall vinyl with an illustrated local map and our technology designs, as a space to encourage storytelling and community building (a Parlour of Wonder). The process of co-designing the room involved the bringing together of personal and historical artefacts and taking seriously material and sensory elements. The room itself has been adapted for different uses including for family and wine parties and for a story circle to meet. The co-design process was

also written up as an easy to follow "blueprint" that could be adopted by other settings (Manchester & Stand + Stare 2018). We also designed a training toolkit (see Figure 2) (Manchester et al. 2018), and a coaching process for care staff (in partnership with our charity partners), to counter the lack of confidence many felt due to a lack of training in facilitation. These artefacts worked alongside our technologies to offer others a method/ or apparatus to build community and connection in care settings.

MobileAge

The second project we draw upon is *MobileAge*, a 36 month interdisciplinary project funded by the European Commission in which Juliane (author 2) was involved. The overarching objective of the project was to co-create digital public services with older citizens based on open government data. While an increasing number of civic actors engage in the design of open data-based technologies, they rarely include older citizens. Our interest was in the development and evaluation of methods that would allow older (and also non-tech savvy) citizens to become co-designers of (open data-based) digital public services. Specifically we aimed to enable civic open data use of older adults, increase the digital inclusion of older adults, and co-create sustainable digital public services for older adults.

Overall, we conducted six co-design projects in four European cities and regions. The multidisciplinary, cross sectoral teams across the sites included social scientists, software developers, designers, computer scientists, local and regional government, social and health care service providers as well as older residents. We report here on two co-creation projects that were conducted in City 1. The focus of these two projects was on social participation, in particular with respect to neighbourhoods and ageing-in-place (Urban 2021). In the first project, a core group of eleven older adults co-designed a digital district guide over a period of 8 months. In the second project, the core group included five older adults and seven social care services providers. In addition, a total of 46 older residents became engaged for shorter periods of time/activities. Jointly they co-designed a digital walking guide comprising the interactive presentation of seven walks in the district. In both projects, printed versions of the digital services were also produced and distributed through local social care service providers.

Figure 2. The Parlours of Wonder Training Toolkit

Making Visible the Intra-Action of Humans and Non-Humans in Co-Design Processes

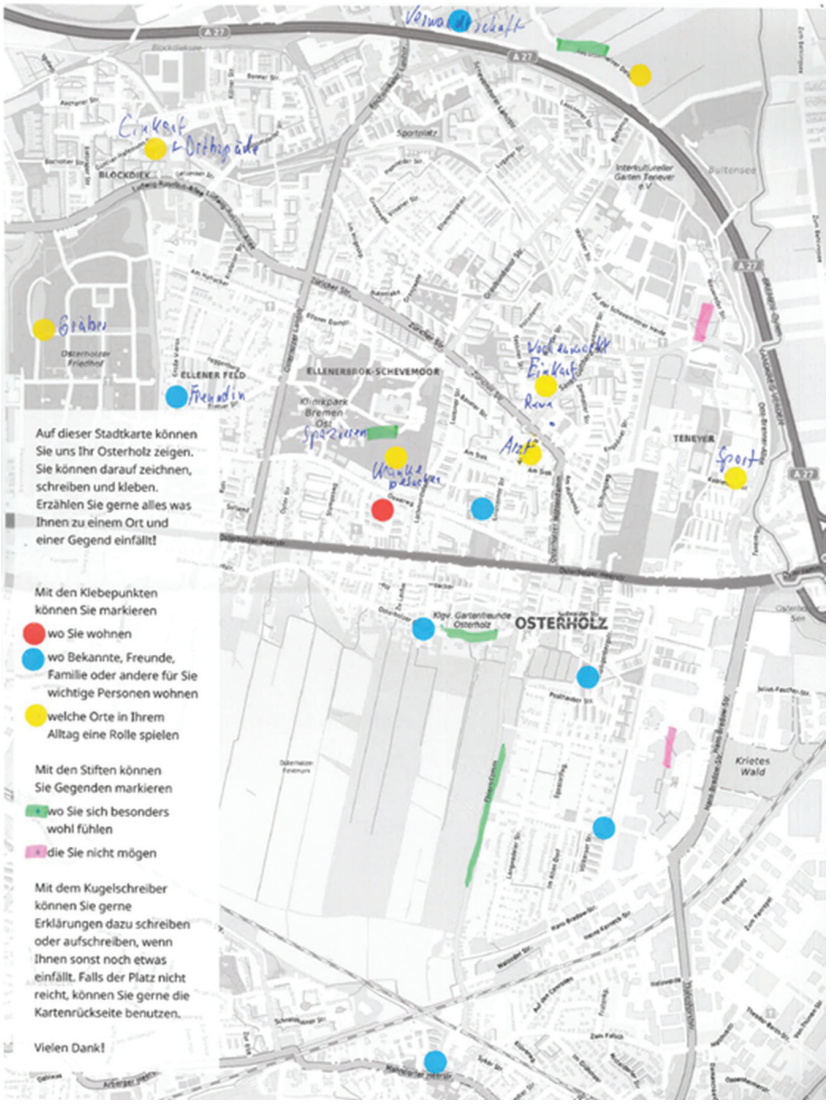
Participants of both co-design projects in *MobileAge* stated that the main reason for participating in the project was not their interest in technology (design) but rather to do something for their districts and its residents; to improve living conditions and the general public perception of the district. One of the first steps in our co-design process was hence to "invite" the district into our co-design activities and decentre the role of technology (and open data).

For the first two meetings we developed a card game about the district. In the first meeting participants were asked about places in the district that they particularly like or that are important to its residents. In the second meeting, we included pictures of the places that were named and asked participants to confirm the relative importance of a place with stickers. The use of this card game served several purposes. Firstly, the intra-action of older adults with the card game, the relating of workshop activites with the lived experience in the district, allowed participants to assume the subject position of knowledgeable and resourceful older participants. Secondly, it also made visible some of the different relations that participants had with the district.

In order to tease out these different relations and experiences of ageing in the district, we developed a set of materials through which participants could document their everyday lives in the district in more detail and reflect about it. The materials included a pack of district maps, postcards, a camera, a photo album and media diary. Participants were given 2 weeks to engage with the materials and were told they could choose the ones that "spoke" to them the most and did not have to complete all of them.

One of the materials was a map of the district in which participants were asked to highlight where they live (red dot), where family and friends live (blue dots) and which places (e.g. location of General Practitioner/Doctor (GP), sports club, shopping) are important (yellow dots). Participants were also asked to highlight areas that they particularly like (in green) or dislike (in pink). Figure 3 depicts the map produced by participant 5. Many participants considered the ways in which their socio-spatial networks in the district had changed after they retired. In addition, many stated that the map made their intra-actions within and to the district

Figure 3. Map as produced by participant 5, depicting their socio-spatial networks in the district



visible in a way that was not necessarily apparent to them. For example, some maps demonstrated that intra-actions with the district mainly took place within close proximity to the home of participants while others had more expanded networks (e.g. participant 5).

While the card game was a product of a group of participants identifying relevant places in the neighbourhood, the maps focused on the individual socio-spatial intra-actions of participants. They allowed participants to document their individual intra-actions with the district and consider how they produced them individually as older residents. In subsequent interviews a number of participants reflected on how much smaller the district had become as their everyday movements became more restricted due to reduced mobility or a city infrastructure that was not supporting the needs of its older residents (e.g. public toilets, benches to rest, street lighting). These changing relations became visible through the self-documentation materials.

Reconfiguring Co-Design Response-Ably with Older Adults

In a next step, we included the maps and other materials in our co-design workshops. In a dedicated session, we exhibited all (anonymised) maps depicting socio-spatial networks and asked participants to jointly review and discuss them. Through this intervention, we framed the joint exploration of practices of ageing in the district as part of our joint co-design work. We asked participants about the differences they could detect between the maps, whether these differences were important and how they came about. Figure 4 shows two cut outs of maps from two different participants and how they highlighted the same area/place differently. Rather than understanding these highlights as "static" relations to space and intangible concerns, they became part of a dynamic intra-action between participants and the materialities they invited into our co-design process. The participants jointly explored why they perceived of the "same" place so differently; why for some this was a place of joy and recreation while for others the same place caused uncomfortable feelings. Intangible concerns, related to the lack of knowledge about certain places became visible in these conversations. For instance, the participants would not "risk" a visit to some places because they thought it was unsafe or ugly or difficult to reach. They reflected on how their actual mobility in the district was

Figure 4. Cut-outs of two maps from two different participants highlighting the same place as recreational (green highlight) and unwelcoming/ dangerous (pink highlight)

largely determined through the places they already knew. Places were not just abstract, but rather brought into the design process and situated in the placemaking practices of individual participants. Our co-design work was hence configured as an apparatus in which participants were able to

articulate the specific material arrangements that made places welcoming to them or not (e.g. the fact that public toilets or benches are nearby, that the place included green areas or that the streets/squares are well lit in the evenings).

While the maps allowed participants to consider material arrangements of their neighbourhoods, the ways in which they invite the district into the co-design process are limited. In the second co-design project, we therefore used a different way of *staging the sociomaterial arrangements in which older adults live and perform their age* through exploring a neighbourhood together. In a first exploratory walk, 14 older adults joined through an announcement from a local senior citizen centre. We provided each participant with a notepad and pen and a list of potentially interesting information and aspects about the walk. We asked them to take notes of the kinds of things and information they considered important while we walked. After the walk, we sat together in a local café and compared and discussed notes. The points and priorities differed depending on the participants' relative health and mobility (e.g. one participant required a walking aid and was more attentive to curbs and the existence of benches), their knowledge and attitude about the area (e.g. if participants considered an area to be "unsafe," information about lighting was considered important), and their interest (e.g. some participants were particularly interested in the history of the area; others were more interested in recreational aspects). Based on these considerations, we developed a note taking template for subsequent walks (see Figure 5).

The walks were planned by older residents themselves and always included an opportunity to stop for either lunch or coffee at a café, citizen centre or meeting place. During these walks, we not only collected information about the walks but also about the physical infrastructure that was missing (e.g. if there was a long stretch of walk without any benches or broken benches) and the history of the places we visited. Many could tell stories about the places we visited and also stories about themselves relating to the places. For example, one of the cafés we repeatedly used as a stop, was a former ironmongery shop turned into double use as a second hand furniture store and café run by charity (see Figure 6). While sitting there, participants recollected their encounters with the former owner and their quests for special screws.

Figure 5. Picture of template for walks

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The stories and lived experience of older residents became an important reference for the ways in which participants wanted to describe the walks. They were complemented with practical issues such as missing benches on the way or broken city infrastructure. Such information was collected and subsequently reported to the local council that included them in their planning considerations. The walks did not only allow participants to explore their neighbourhood but also to actively reconfigure and reimagine it, including what it meant to age in this place. For example, through the installation of new benches walks became feasible to older residents who would not otherwise be able to walk for longer periods of time.

Hence, similar to *Tangible Memories*, the initial "problem focus" of *MobileAge* shifted. Inviting the district into our co-design process and making walks an essential part of our co-design methodology, shifted the

Figure 6. Interior of the former ironmongery

focus from open government data to the sociomaterial arrangements that participants lived in. The participants' engagement with maps and subsequently their own bodily experience when undertaking walks, enabled them to consider a change in sociomaterial arrangements in their neighbourhood that would be of benefit to all.

The participants realised that some relations to the district were cut off, as they did not want to visit them because of fear or lack of information or could not visit certain places because of lack of benches and/or public transport. Attending to these materialities allowed us to imagine a different sociomaterial arrangement, one in which an information service about walks in the district lowered the hurdle to explore new areas. We subsequently co-designed a digital district guide for which participants defined and described walks. The descriptions featured the information that we collected during our walks, including various historical accounts about the places along the walk. Some of these places were previously unknown, and had seemed out of reach or risky. A shorter version of the

digital district guide was printed in a booklet so as to reach all older residents. Through our co-design activities and the resulting guides, (some) relations to the district were repaired and re-established. The co-design process allowed participants to configure sociomaterial arrangements, in that they determined that it was important to maintain a strong relation with their district, not only from afar but through the actual bodily experience of walking in the district. In this way, the co-design project's focus became about re-making and re-designing sociomaterial arrangements in the district rather than simply developing an open data-based technology in the form of a digital district guide or digital walking guide.

Discussion

In this article, we have presented three contributions that we feel material gerontologists can make to co-design processes.

The first contribution relates to how material gerontologists can support design teams to pay attention to and *make visible the ways in which humans and non-humans intra-act in sociomaterial assemblages of ageing.* For example, in *Tangible Memories,* the team explored the relations of older residents with wrist monitors and alarms and discovered that, although problematic for some, they supported others to feel confident in being alone in their rooms and flats. The relations of older residents with such devices hence differed and their intra-actions produced different phenomena; some giving confidence and others producing the feeling of being surveilled. Similarly, in *MobileAge*, the aim was not to consider older participants and the district separately but to foreground their *relations* and *relationality.* This was achieved, for example, through the card game where participants articulated their different relations with the district (e.g. places they considered important for the district) or through maps in which participants documented their socio-spatial relations and movement. Overall, we illustrated the importance of spending time, and designing methods, at the beginning of a co-design process that go beyond recording social interactions between humans or interactions between older adults and technologies. Rather, material methods helped us to understand and make tangible the dynamic intra-actions between humans and non-humans through which ageing is "done" (Wanka & Gallistl 2018). In particular, we worked to make visible the presence and entanglement

of humans and non-humans in the contexts in which we were working – the district and the care settings. In this way the issues that were previously not brought into conversations around re-designing care or re-modelling the district were brought into the design conversation in the early stages. Such a design conversation becomes "response-able" in that the entanglement of bodies, things and technologies, situated in wider systems of power (e.g. in relation to designing care settings or modelling the district) are brought to the fore. This matters because through making these elements tangible and inviting them to the design process we found that new kinds of designs and, indeed, new kinds of "problems" emerged.

The second contribution relates to the research apparatus that material gerontologists can bring to co-design processes. This apparatus foregrounds an understanding of agency as co-produced dynamically between human and non-human actors during co-design processes. For example, in *Tangible Memories*, the design team observed how the environments and aesthetics of the care settings did not encourage older residents to build social connections. In staging their co-design interventions the design team therefore took care to reconfigure the sociomateriality of the care setting, through taking on the roles of carers, and the addition of music, bunting and novel technological prototypes. The purpose was to transform the lounge space from a passive space. In *MobileAge*, the design apparatus (e.g. through an exhibition of anonymised maps) invited participants to articulate the specific material arrangements that made places in the district welcoming to them or not. Overall, our case studies have drawn attention to how our research apparatus were able to bring certain phenomenon, that might have previously been ignored, to the fore, and in the process new relations and alliances were able to emerge. Through approaching research as active, respectful engagement with other actors (human and non human), we believe material gerontologists can support design teams, and those working and living in later life settings, to reconfigure stereotypical imaginaries of ageing and later life and potentially bring about a transformation in our approach to "doing age" – in our two cases involving transforming practices of care and a neighbourhood for older people to enable ageing in place and increased wellbeing and quality of life.

Evidence suggests that gerontechnology designs have often failed to live up to expectations in supporting older adults to lead rich and

fulfilling lives. Our third contribution relates to the role material gerontologists might play in influencing the outcomes of co-design processes and taking response-ability seriously. As Martin et al. (2015: 635) argue:

> "Response-ability encourages a practice of making oneself available to respond without knowing ahead of time which phenomena will call one's attention or what form the response should take."

In *Tangible Memories*, the outcome was not a technology design but rather, "a Parlour of Wonder," a site for new connections between human and non human actors. Similarly, in *MobileAge*, the focus shifted from merely building digital prototypes (such as the digital walking guide) to engaging in practices that re-designed the district itself and made it more accessible and response-able to its older residents. Our empirical data suggests that the involvement of material gerontologists in co-design processes can lead to a reframing of taken-for-granted ideas about the lives of older people, and in our cases, at least partially, rescripting current logics of care or discourses of "ageing in place." As a result of this the outcomes of our co-design processes tended to decentre the technologies themselves in innovations for ageing futures, or at least demonstrate the need for other additional designs that support the technologies to become embedded in ageing contexts.

Conclusion

We started this article with a set of questions that we identified as of increasing importance in relation to ageing and technology: What imaginaries about ageing and later life are inscribed in gerontechnologies? How do these technology designs reconfigure ageing and later life? (How) can older adults be involved in the design of gerontechnologies and refigure stereotypical (or even harmful) inscriptions? We have tried to unpack these questions through suggesting three contributions that material gerontology can bring to co-design processes.

The first relates to inviting materialities to become participants in the design process which, in response to our first question, can enable design teams to consider imaginaries about ageing and later life, that are not abstract and stereotypical, but rather build from the entangled, unfolding

material and social lives of older participants. The imaginaries considered can become, at least partially, responsive to these complex relationalities. In our second contribution, we highlighted how the practice-ing of a response-able co-design process may (re-)configure technology design processes in later life contexts to allow designers to cultivate the response-ability of all actors in modes of doing age and ageing. In so doing, and in answering our second question, co-designers may consider how specific technologies refigure ageing and later life and (in relation to our third contribution) re-imagine alternative outcomes of technology design. In response to the third question from our introduction, we recognise the anthropocentric traditions in co-design practice that foreground the participation of human actors and suggest that, in order to reconfigure harmful inscriptions of age, it may be helpful to understand and cultivate the response-ability of all actors in the co-design process.

To date, few material gerontologists have been involved in technology design processes or often we are asked to get involved with "ethical issues" or stand alone ethnographic elements of design processes that are not fully integrated into engineering led projects. We have tried to illustrate the contibutions that material gerontologists can make to technology design processes for ageing contexts when they are embedded in, or even lead, co-design processes. We believe that where material gerontologists are invovled in co-design, taking seriously the interconnections between older adults, ourselves and other human and non-human actors, products, services and innovations can be designed that respond better to the needs and life worlds of older adults; they become *response-able with* and not for ageing populations. Design approaches have much to offer to geronotologists too – especially those who are interested in engaging with older people and other publics and those who wish to intervene in creating more creative, connected later lives for all.

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