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Special Issue:
Ageing and Technology

Lanzavecchia + Wai, No Country for Old Men collection (2012): I-cane & Assunta Chair

To read, to get-up, to move yourself and your possessions around, at home; the project No Country for Old Men is a small family of objects that is not only attentive to the daily difficulties encountered by the elderly but also how it can finally complement our domestic living spaces and acquired laziness.

We initiated this project as a reaction to the scarcity of well-resolved and well-designed products for the elderly at-home. Because of this scarcity, the cosy and intimate home artfully built up over the years is invaded and eroded by alien medical products from the hospital context. For the blunt re-establishment of function, pride and ownership of these most used lifestyle support objects are relinquished. Our aim was to generate enthusiasm, desirability, a sense of ownership towards elderly aid objects. A healthy and robust relationship with them by nature ensures consistent benefits to the user twofold; both as safe physical support and also psychological reconciliation and acceptance of their advanced stage of life.

https://www.lanzavecchia-wai.com/

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Special Issue

When Theory Meets Practice. Entanglements of Ageing and Technology at the Cross-Roads of STS and Age Studies

Guest Editors' Introduction

Lecture

Essays

Crossing Boundaries

When Theory meets Practice in Entanglements of Ageing and Technology

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Abstract: This special issue contributes to the new academic field known as Socio-gerontechnology, which has emerged at the cross-section of STS and Age Studies. All contributions published in the following pages explore what happens when theories meet practice in the relation between ageing and technology, by pointing out the role of design(ers) in configuring and reconfiguring such a relation. In line with the so-called "engaged program" in STS, these articles address different topics of political importance and pragmatic relevance. Indeed, they share the critique of ageist images that underlie public and specialist discourses around ageing and technology. By combining the emancipatory thrive of critical studies of age and ageing and the nuanced STS approach to the study of the entanglements of ageing and technology, this special issue offers a collection of theoretical elaborations and methodological considerations developed along with empirical analyses. Overall, they explore the practical politics of technology, within the growing field of Socio-gerontechnology.

Keywords: critical studies; design; policy; Socio-gerontechnology; stereotypes.

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Over the last two decades or so, the intersection of demographic ageing and technological change has received increasing attention by policy makers and academics. In European, national and global policy making, we see a trend to make old age policy in conjunction with innovation or digitalization policy (Neven and Peine, 2017). In Europe, for instance, large scale innovation and technology development programs fund research that explores how development in robotics, sensoring, artificial intelligence, and the like can be brought to bear on the lives of older people, and in particular support what is widely discussed in policy discourses as *active and healthy* ageing or *ageing in place*.

The notion of active ageing is, of course, a long-standing and contested one. McLean (2011), for instance, dates it back to the late 1990s, when the World Health Organization (WHO) began to promote the passage "from a 'needs-based' approach of passivity to a proactive 'rights-based' approach that encourages participation and 'equality of opportunity and treatment'" (p. 317). Lassen and Moreira (2014) point out that, while there is no agreement on a specific definition of active ageing, it is a *policy concept* that "usually refers to individual or collective strategies for optimising economic, social and cultural participation throughout the life course" (p. 33). According to this perspective, the active ageing concept is widely related to the functional capacity and engagement in social and productive activities throughout the life course. Such a life-style is meant as disability prevention and maintenance of independence, which are key goals for an ageing population. Critical studies of age and ageing, however, have long questioned the implicit normativities of the concept, where the emphasis on activity in later life, although seemingly just an innocent healthy recommendation at the surface, is rooted in neoliberal politics that delegate to (older) people the responsibility to function at a higher level, even when that is difficult or not desired (Katz 2000; Holstein and Minkler 2003; Katz 2013).

The normativities of active ageing and the "responsibilisation" (Urban 2017, p. 10) of older people are then also articulated and made operational in the technology and innovation policy programs driven by an active ageing perspective. Peine and Neven (2019) have recently analyzed this in terms of an *interventionist logic:* at their core, old age and innovation programs conceive of ageing and later life as largely unexplored territories for new applications and marketizations of digital technologies. In this perspective, technologies figure as "prostheses" meant to help older people fulfil the expectations devised at neoliberal subjects(Callon 2008; Peine and Moors 2015), enacting them as consumers and as being responsible for their health at the same time (Katz and Marshall 2018; Gilleard and Higgs 2021). But this interventionist logic widely ignores that ageing and later life have long been enmeshed with various technologies already (Loe 2011), including digital technologies like smartphones, social media and fitness trackers (Hebblethwaite 2016; Katz and Marshall 2018; Gallistl and Nimrod 2020). Such everyday encounters of older people and their friends, family and care givers with technologies, while increasingly studied in both Science and Technology Studies (STS) and Age Studies (Peine and Neven 2020), have been widely ignored by policy makers. This, we would like to add, also seems to be a missed opportunity to critically question the normativities of active ageing, and inform policy making with more empirically informed accounts of situated practices of active ageing policies and the technologies associated with them (Bergschöld et al. 2020; Moreira et al. 2020).

The intersection of ageing and technology is thus a trending topic and it has received attention by scholars from the social sciences and the humanities from various domains. This is the new academic field increasingly known as Socio-gerontechnology (Peine et al. 2021), which has emerged at the cross-section of STS and Age Studies to address "the multiple and complex intertwinements of ageing and technology that already exist, and has begun to replace naive bio- and techno-deterministic understandings of ageing and technology with the emergence of empirical studies in the design and use of technology by and for older people […]" (p. 2). A common theme in Socio-gerontechnology is a *critique* towards simplistic ideas among policy makers, health-oriented researchers, and other practitioners that position ageing and technology as separate or even separable spheres, to explore instead the assemblages and enactments through which they exist only in relation to each other. Here, Age Studies have been particularly helpful in critiquing and debunking the often *ageist* images that underlie public and specialist discourses around ageing and technology, which implies a critique toward stereotypes that position older people as incapable and in need of help in relation to technology (Vines et al. 2015; Neven and Peine 2017); or a critique toward those normativities implicit to the rhetoric around positive ageing (Katz 2013; Lassen and Moreira 2014), which promote anti-ageing ideals as part of the legitimation attempts around many technologies targeted at older people.

This special issue contributes to this wider landscape of Socio-gerontechnology with critical studies of ageing and technology relations in design. In that sense, it builds further on what Cozza (2021) calls the "agential inseparability of ageing and […] technologies". That is, contributions in this special issue study "what elderliness means and how specific meanings of it come to matter at the expense of possible others through design practices" (p. 71). This is a topic where in particular STS approaches to the study of ageing and technology have been fruitful, because they can rely on the established STS tradition that understands design as "an intervention in practice" (Shove 2014, p. 41) through which designers configure materials, ideologies, and competences that affect the everyday life. When thinking about the ageing population and the unprecedented diffusion of technologies made with older people as the target group, the relevance of design emerges straightforwardly (Cozza et al. 2019; Cozza et al. 2020).

What is problematic in the relation between ageing and technology is, indeed, the role played by design(ers). For a long-time design practice has been inspired by the mass production doctrine "one size fits all" based on Dreyfuss' book, *The measure of man* (1960), which is widely acknowledged as the starting point for "human factors" in design. The last concept refers to a conception of persons as passive, fragmented, depersonalised, and un-motivated individuals. This is in contrast to a view of people as "human actors" with personal objectives, aspirations and *agency* (Bannon 1991). By bringing this critique into the study of ageing and design, Coleman et al. (2003, pp. 3-4) point out that:

> it is now apparent that the "universal types" of much 20th century design failed those on the margins of society – especially as assumptions about what is "average" or "normal" have been too often based on the stereotype of the young, fit, white, affluent male.

In response to such perspectives, some design researchers interested in age and ageing have urged to open the black box of design, and analyse the configuring and re-configuring of ageing and technology relations in design by applying STS theories (Frennert and Östlund 2014; Östlund et al. 2015; Cozza et al. 2020; Jarke 2021). In line with this tradition and building on Kurt Lewin's maxim that "there is nothing as practical as a good theory", this special issue gathers contributions that explore what happens when theories meet practice. This purpose can easily be associated with what is known as the "engaged program" in STS (Sismondo 2008). Indeed, all contributions address different topics of clear political importance and pragmatic relevance in so far as the interactions between ageing and technology are treated as a site of study rather than a mode of analysis. Theoretical elaborations and methodological considerations are developed along with analyses that, within the growing field of Sociogerontechnology, explore the practical politics of technology.

Nelly Oudshoorn, in her introductory lecture, urges us to move beyond approaches to STS that focus exclusively on technologies external to the body. Instead, she suggests that we need to reflect on "how human-technology relations may change when technologies move under the skin". In particular, she reviews three conceptual trends in the literature – the rematerializing of cyborgs, constructivist perspectives on vulnerability and resilience, and intersectionality – to raise important questions for future studies on ageing and technology about the reconfiguration of agency in times when more and more older people become "elderly everyday cyborgs".

Defining age and who is considered to be an old person is crucial as societal efforts for older citizens are increasingly based on scientific evidence and inclusion in technological development. In their article, Guillem Palà and Gonzalo Correa take as a starting point a conference that aims to give older people the opportunity to participate in the making of policies for the digitalization of society. The conference, which opened with attempts to define age in biological terms and chronological age, soon encountered difficulties. Using the "assemblages" of relations and interactions in the conference, the authors could study the configuration of age in practice, but more so, by launching the concept "infrastructuring", they show how these subjects and materialized objects are indispensable components of this assemblage shaping the idea of what it is to become old.

Care robot ethics contains issues that have so far been overlooked both in STS user research and in usability experiments based on the moral imperative to first develop ethical guidelines which are then implemented in design as a guarantee of good care. Joni Jaakola, in his article, points to "ethics in practice" as a way to evaluate human-robot interactions in the care of people diagnosed with dementia. Using an ethnographic approach and script analysis when studying usability experiments in a care context, the author describes how ethics does not come out of universal moral values but is configured and based in care practice.

Elin Siira and colleagues, in their article, present an interesting analysis of how the logics of efficiency and effectiveness and the logics of care collide and are (partially) reconciled in specific co-productions of care. Using a case study of a peer-to-peer care initiative – the EU funded innovation project Give&Take – they unpack the complex and contradictory sociomaterial arrangements that constitute care within social innovations. They highlight in particular how the institutional logics that underlie many such initiatives challenged the possibilities to "co-produce opportunities for older people to care for each other". Ultimately, they conclude, a perspective on co-production of care practices and institutional logics may allow practitioners in policy and design to create "co-productions that serves and benefits from older citizens' care practices".

In her article, Cordula Endter applies a feminist STS perspective to analyse the politics of configuring older people as users in the design of technology. By mobilising the concept of "matter of care", Endter foregrounds the power relations and hierarchy that undermine the participation process and she re-frames caring as a responsible practice of accounting for the involvement of older people as users. This leads to question the goodness of user participation by examining the extent to which user-centred design actually empowers older people to participate in the design process and fosters a fit between technology and user needs. The author points out that actually the "good care" is not addressed to the users, but to technology, and that user-centred design should be turned into a matter of care in order to accounts for older people interests and needs rather than fitting them into the development of technology.

As Wanka and Gallistl (2021, p. 33) have recently argued, the practical relevance of STS studies on ageing and technology is often limited by a focus on "the deconstruction of processes without the aim for emancipation". For them, the main potential for a social science approach to ageing and technology lies exactly in the combination of the emancipatory thrive of critical studies of age and ageing and the nuanced approach of STS to design as configuring situated agencies between humans and non-humans. This special issue addresses this challenge. Overall, it allows to see not a conflict between theoretical interests and more pragmatic intentions but a potential overlap in studying ageing and technology.

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Graying the Cyborg Revisited

How Age Matters when Technologies Move under the Skin

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Abstract: Feminist scholars were among the first to argue for the importance of including ageing and later life in STS research. Remarkably, most studies on technoscience and ageing only address technologies external to bodies. Although this scholarship has provided important insights into the many different ways in which technologies intersect with ageing I suggest that it is important to expand our analyses to technologies inside bodies. How can we understand ageing and agency in times when technologies become increasingly implanted in our bodies? In this article I will present three conceptual approaches that correspond to growing discussions at the cross-roads of STS, age and disability studies, and feminist scholarship, including cyborg theory, constructivist perspectives on vulnerability and resilience, and intersectional approaches. I will build on some of my previous theoretical and empirical work on pacemakers and implantable cardioverter-defibrillators to discuss how age matters when technologies move under the skin.

Keywords: technology and ageing; graying the cyborg; technologies inside bodies; pacemakers and cardioverter-defibrillators; vulnerability and resilience.

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1. Introduction

Cyborgs are ageing. This applies to bodies implanted with technologies, the people we study, and the very notion of cyborg itself. In her seminal *Cyborg Manifesto*, Donna Haraway (1985) appropriated the

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cyborg figure to call for a critical engagement with the politics of techno-science and for taking responsibility for technology (Gray, 2011). Criticizing approaches that merely celebrate or condemn the increasing dependency of humans on technology, she challenged us to rethink human ontology to grasp what constitutes our contemporary life. In a world permeated by techno-science, bodies and technologies should no longer be considered as ontologically separate but as co-producing each other (Oudshoorn 2020). In her feminist intervention into cyborg discourse, Haraway not only challenged the rigid binary opposition between organisms and machines but also other long-standing dualisms such as nature/culture and male/female (Balsamo, 1996). By redefining the meaning of cyborg from a technical metaphor[1] into a concept that can be used to subvert and displace troublesome dualisms, Donna Haraway urged us to create alternative views, languages, and practices of techno-science and hybrid subjects.

In this article I will discuss three conceptual approaches to understand the agency of old people living with technologies inside their bodies. Although Donna Haraway did not attend to the ageing of cyborgs, understanding the relationship between technology and ageing has become an important, emerging theme in Science and Technology Studies (STS). Feminist scholars were among the first to argue for the importance of including ageing and later life in our research agenda. In *Graying the Cyborg*, Kelly Joyce and Laura Mamo (2006) argued that new research in STS should address the intersection between age, science, technology, and gender. Age should no longer be neglected because older people are increasingly targeted as consumers of new technologies such as assisted living devices, entertainment technologies and pharmaceuticals. Equally important, developments in biomedicine, including the rise of anti-ageing medicine, construct and redefine the ageing body as a “set of age-related diseases as well as a site for continual restoration and improvement” (Joyce and Mamo 2006, p. 99). In this important and very timely call, Kelly Joyce and Laura Mamo developed a research agenda that is still valid today. They encourage us to study the ways in which technoscience constitutes the experiences and meaning of ageing, the ageism underlying the design, marketing and use of technological devices, as well as the ways in which older people give meaning to and negotiate technological applications in their daily life.

More recent studies on the relationship between ageing and technoscience draw the attention to policy discourses which create a ‘triple win narrative’ in which technological innovation is portrayed as the ultimate solution to diminish the socio-economic consequences of ageing populations. In this promissory narrative, technological innovation emerges as a crucial actant in improving the life of old people, generating new businesses and stimulation economic growth (Joyce et al. 2017; Neven 2011, 2015; Neven and Peine 2017; Peine et al. 2015; Robert and Mort 2009). These scholars argue that this discourse is problematic because it reinforces a negative rhetoric about ageing and old people such as frailty and impairment (Peine and Neven 2011; Vines et al. 2015). Moreover, it embraces a perspective in which ageing and technological development are understood as separate processes, thus neglecting how technoscience is already inextricably intertwined with the definition, meaning and practices of ageing (Loe 2010; Peine et al. 2015). By introducing the notion of “socio-material constitution of later life”, Alexander Peine and his colleagues encourage us to study how the interaction between ageing and technoscience both shape and is shaped by a wide range of social, institutional, economic, policy, and material settings, relationships and practices that surround ageing (Peine at al. 2015).

Similar co-constitutive approaches to theorizing ageing and technology[2] underly many STS studies on ageing and later life. This research has created important insights of how sociotechnical imaginaries construct ageing[3], the ways in which these imaginaries[4] are represented and incorporated into design practices, and how elderly people are included or excluded in technological design[5]. The latter studies highlight how “design paternalism” is a key characteristic of many design practices (Peine et al. 2014). This notion refers to practices in which designers construct old people as passive, technology-averse, or technologically illiterate users “who should follow what designers offer them” (Peine et al. 2017, 927). This approach is very problematic because it leads to technological objects that are useful for a very limited group of elderly people (Bergschöld et al. 2020; Peine et al. 2017; Peine and Neven 2019). Scholars therefore aim to go beyond the one-size-fits-all approach in design practices by emphasizing the importance of taking into account and accounting for the diversity of old people (Östlund 2005; Peace and Hughes 2010; Peine et al. 2017). Equally important, feminist scholars have provided a critical intervention into practices of design paternalism by conceptualising old people as active agents of technological change or “technogenarians”: “individuals who create, use, and adapt technologies to negotiate health and illness in daily life” (Joyce and Loe 2010, 171)[6]. This important research shows how old people often are early adopters of new technologies, actively engage in tinkering with objects which inspires innovation in technological design, participate in developing Do It Yourself (DIY) technologies, or negotiate a meaningful space for technology in their daily lives. These studies thus challenge long-standing imaginaries about old people and innovation[7].

Remarkably, Kelley Joyce’s and Laura Mamo’s agenda-setting article *Graying the Cyborg* only addresses technologies external to bodies. Although they shortly mention technologies implanted in bodies, particularly cardiac implants, they don’t include any further reflections on how human-technology relations may change when technologies move under the skin. More recent studies on ageing and technology show a similar preference for studying technologies external to bodies, including rolling walk-ers and drugs[8], care robots[9], and assisted living and telecare technologies, such as remote alarms, sensors and automated pill dispensers[10]. Although this scholarship has provided important insights into the many different ways in which technologies intersect with ageing I suggest that it is important to expand our analyses to technologies inside bodies. How can we understand ageing and agency in times when technologies become increasingly implanted in our bodies? In what follows I will present three conceptual approaches that correspond to growing discussions at the cross-roads of STS, age and disability studies, and feminist scholarship, including cyborg theory, constructivist perspectives on vulnerability and resilience, and intersectional approaches. I will build on some of my previous theoretical and empirical work on pacemakers and implantable cardioverter-defibrillators (Oudshoorn 2015; 2020) to discuss how age matters when technologies move under the skin.

2. Rematerializing the Cyborg

In contrast to the dominant images of the cyborg in science fiction and popular media, hybrids of humans and machines are not only young men (Haddow et al. 2015; Joyce and Mamo 2006; Joyce et al. 2017). Because of the rise of anti-ageing or longevity medicine and gerontology, bodies of older people are increasingly subjected to medical interventions, including implants (Joyce and Mamo 2006; Joyce and Loe 2010). In recent decades we have seen the introduction of more and more technologies that operate under the surface of the body, including artificial hips, knees, and hearts, breast and cochlear implants, prosthetic arms and legs, spinal cord stimulators, pacemakers, implantable cardioverter-defibrillators, and emerging human enhancement technologies such as brain implants and nano-chips for diagnosis and drugs delivery (Oudshoorn 2020). This trend towards developing technologies that merge with bodies is also illustrated by the *Gartner Hype Cycle for Digital Government Technology* (Moore 2018), in which five of the technologies that are expected to have "the most transformational benefit for government organizations over the next 10 years" concern techniques that blur the boundaries between humans and machines, including bio-chips, artificial human tissues, and brain-computer interfaces (Moore 2018; Noort 2018). Although some of these technologies are used by people of all ages, older people constitute the major 'users' of these medical devices.

As anthropologists of medicine have argued, the increased attention to ageing in biomedicine has constructed old age as a medical problem and shaped and reinforced cultural ideals of ageing as undesirable, abnormal and even pathological, as well as the cultural belief in extending life[11]. Medical interventions in older people have increased substantially over the past decades, as exemplified by the ICD, a life-extending heart implant that has become a routine and standard treatment of older people in wealthy, industrialized countries (Jeffrey 2001). As Sharon Kaufman and her colleagues have described, the growing use of these medical devices also includes the very old, particularly but not exclusively in the U.S., where twenty percent of ICDs are implanted in persons aged 80 and above (Kaufman and Fjord 2011). In contemporary medicine saying no to life-sustaining technologies has become extremely difficult (Kaufman 2015). Decisions about appropriate medical treatment are driven by the availability and values given to technological interventions, particularly the newest and most advanced technologies. This 'treatment imperative' (Fuchs, 1968) has increasingly become a moral obligation for clinicians to continue medical interventions in ever older persons (Kaufman and Fjord 2011; Koenig 1988; Shim et al. 2008).

For many older people, cyborgs are therefore not just fictional or speculative imaginaries of the future but a lived reality, they are "everyday cyborgs". Gill Haddow and her colleagues introduced this term as a heuristic to acknowledge the importance of the "participant voice currently missing in existing cyborg literatures and imaginations" (Haddow et al. 2015, 484). But how can we understand the agency of people living with medical implants? At first glance we may think that technologies inside bodies assume a passive role of everyday cyborgs because they work automatically inside their bodies, taking them beyond the control of their hosts. Technologies implanted in bodies thus challenge a long-standing tradition of theorizing human-technology relations in STS and the philosophy of technology that only address external technologies that can be used at specific moments and places and are more or less under the control of humans[12]. However, most devices that operate under the surface of the body delegate no agency to its "users" in terms of how they are supposed to interact with these technologies[13]. Pacemakers and ICDs, for example, are designed in such a way that agency is delegated only to the device. Pacemakers give electric pulses to the heart when the heartbeat is too slow. The ICD is designed to do the opposite. It may give very fast pulses or small or larger electric shocks to intervene into very fast, life-threatening heart rhythms. These programs of action thus concern the interactions between the heart and the device rather than with their users (Oudshoorn 2020). Compared with external devices, most people living with technologies inside their bodies cannot decide when, where, or how to 'use' them. Although pharmaceuticals also intervene in the body, one can decide to stop taking medicines. In contrast, people living with medical implants such as pacemakers and defibrillators cannot turn these devices off (Oudshoorn 2020). Equally important, most of these medical implants are inserted into bodies to stay there until the end of life. Or, as Sherry Turkle (2008, 12) phrases it: "becoming cyborgs is not a reversible step". Technologies implanted in bodies are thus not bounded by a temporality of use, but should be understood as continuous devices, which is in sharp contrast to STS theories that conceptualize the interactions between humans and technologies as finite and limited temporal events, such as Actor-Network approaches and the Social Construction of Technology (SCOT)[14].

Although pacemakers and ICDs are designed in such a way that agency is delegated only to the device, the absence of programs of action for its users still raises the question of whether everyday cyborgs are really so passive. As I argued in *Resilient Cyborgs* (2020), any discourse or policy that assumes a passive role of implanted persons silences the fact that keeping cyborgs alive involves their active engagement. Many of them participate in a lifelong trajectory of specialized monitoring to check whether the devices still function properly, whether they need replacement, and to adjust the agencies of the devices and to the agencies of the body. Moreover, they have to learn to cope with the vulnerabilities of their technologically transformed bodies, which may involve changes in daily routines and social relations and a re-appropriation of how they experience their bodies. To understand the work involved in sustaining hybrid bodies, it is important to rematerialize the cyborg. As feminist scholars have argued, the linguistic turn in cyborg studies and other fields neglects the materiality of bodies (Dalibert 2014; 2016; Jain 1999; Sobchack 2006). According to Vivian Sobchack, who lives with a prosthetic leg, the use of the cyborg or prosthetic figure as a metaphor has resulted in a discourse in which "the literal and material ground is forgotten or even disavowed" (Sobchack 2006, 20). Cyborgs have thus lost their materiality. Recent feminist post-humanist studies on the intimate relationships between bodies and technologies, therefore call for new conceptual tools to recognize and account for the intimacy of human-technology relations as material and normative as well as the agency of cyborgs (Alaimo and Hekman 2008; Dalibert 2014; 2016; Lettow 2011; Oudshoorn 2015; 2020).

One way to account for agency of everyday cyborgs is to look at their sensory experiences. As Jones (2006) suggested, experiences with one's body are not just discursive or linguistic but include sensory experiences. Most importantly, technologies may participate in creating new sensory experiences (Dalibert 2014; Jones 2006). People living with pacemakers or defibrillators, for example, face new sensory experiences mediated by electric pulses and shocks that countermand or take over their heartbeats. A focus on how people living with internal devices use their sensory experiences as a resource to sense and make sense of their technologically transformed bodies thus provides an important approach to conceptualize the agency of everyday cyborgs (Oudshoorn 2020). Because older people are a major target group of many new and emerging implants, understanding how sensory experiences shape later life and vice versa is important to include in future research.

3. Constructivist Perspectives on Vulnerability and Resilience

Technologies often do much more than they are supposed to do. Acknowledging these unintended consequences, scholars in STS, medical sociology and anthropology emphasized the transformative potential of medical technologies that contributes to a remaking of bodies that has important implications for what it means to live with disorders and to be human (Brown and Webster 2004; Clarke 1995; Lehoux 2006; Rose 2007). This transformative quality of technology is also important to take into account if we want to understand what it means to live with technologies implanted in bodies. Through the years, ageing bodies may become more vulnerable. This also concerns people living with technologies inside their bodies. However, these everyday cyborgs may experience a multi-layered vulnerability because there may be something wrong with their bodies, their implants and/or the interactions between them. Although there exist high expectations and promises about what medical implants can do, technologies, like humans, can fail. These implants not only contribute to solving or diminishing specific health problems, thus reducing the vulnerability of everyday cyborgs, but may also introduce new vulnerabilities. First, everyday cyborgs face new kinds of vulnerability because they have to live with the continuous, inextricable intertwinement of technologies with their bodies. Take the example of pacemakers and ICDs. Although wired heart cyborgs, as I call them, are already familiar with their heart problems, internal heart devices transform their awareness of the fragility of their heart. The proper working of the heart now depends on the adjustment of the electric pulses of their implants to the malfunctioning electric stimuli of their heart. Crucially, an improper programming of the pacemaker or ICD may not only result in a decreased quality of life but may even lead to an untimely death (Tseng 2015). The vulnerability of these heart cyborgs can thus be conceptualized as the harm caused by a disturbance of the delicate balance between the material agencies of bodies and internal devices. Second, people living with implants may experience new vulnerabilities because their devices can fail. Compared with many technologies external to the body, anticipating the harm caused by malfunctioning implants may involve other kinds of anticipation because you can never run away from a technology implanted in your body. Medical implants thus constitute a sense of being at the mercy of the agency of the implant, including its failures (Oudshoorn 2020).

Technologies inside bodies thus not only challenge dominant views on agency but also invite us to rethink dominant approaches to vulnerabilities. Medical discourses on the fragility of humans often adopt an instrumental or essentialist view that consider vulnerabilities as given or static characteristics of humans and technologies. However, STS scholars have convincingly argued that vulnerability should not be considered as an "an intrinsic and static characteristic" (Bijker et al. 2014, 14) of technological systems or human existence. This constructivist approach invites us to view vulnerability as an "emergent property" (Bijker et al. 2014, 6) that results from and depends on specific circumstances in technological cultures rather than on the inherent capacities of technologies or humans. Given the vulnerabilities everyday cyborgs may face, building resilience becomes a key concern for people living with implants and medical professionals and is important to include in technology and ageing studies as well. As vulnerability, resilience should not be considered as pre-given or fixed. Whereas early psychological studies of resilience adopted an essentialist view in which resilience was conceptualized as a personality trait, constructivist approaches no longer consider resilience as static but as something that unfolds over a person's life time, as a multi-faceted process. This shift in approaching resilience is important because the essentialist perspective runs the risk of blaming the individual for not being able to cope with stress or trauma, and turns resilience into an extraordinary capacity of people who survive in times of crises (Graber et al. 2015).

The conceptualization of resilience as a process rather than a fixed personality trait provides an important heuristic for understanding what it takes to become a resilient cyborg. However, there is one conceptual hurdle to take because technology is largely overlooked in theorizing resilience. As I argued in Resilient Cyborgs (Oudshoorn 2020), we can distinguish two ways in which technologies matter. On the one hand, technology may contribute to resilience by making people aware of the vulnerability of human existence. On the other hand, technical devices may provide important resources that people can draw from to build resilience. Inspired by Noortje Marres (2012), I argue that technological objects make a distinctive form of resilience possible. Any understanding of what makes people resilient or not should acknowledge that technologies may provide important resources for adapting positively to potentially traumatic events and the risks people face in everyday life, including threats posed by technologies. A focus on the materiality of resilience thus enables us to go beyond the view that people living with medical implants are passive 'victims' of their implants. To do so I introduced the notion of techniques of resilience (Oudshoorn 2020). In addition to sensory experiences, techniques of resilience provide an important heuristic for understanding the agency of everyday cyborgs in coping with the vulnerabilities of their hybrid body.

But what about ageing? I suggest that adopting an age lens is crucial because older, everyday cyborgs may not have equal access to the resources that enable them to become resilient cyborgs. During my interviews with people living with ICDs I learned that older people may experience more difficulties in developing techniques to build resilience. Let me take one example. When heart cyborgs visit the cardiology policlinic for a yearly check-up of their device, technicians run several tests to investigate the non-human parts of the hybrid, including the lifetime of the battery. When it is empty, it cannot be charged from the outside: people have to undergo surgery again to get a new implant. Controlling the lifetime of the battery is crucial because heart devices simply fail to work when the battery is weak or empty. For people implanted with an ICD it may imply the risk of an untimely death because their implant does not have enough power to give a shock, or it will take longer to become active because of a longer charging time. When technicians notice that a battery will soon be empty, they tell patients to return to the hospital for an extra control visit within several months. However, the responsibility to detect empty batteries is not only delegated to technicians. Wired heart cyborgs are expected to monitor the lifetime of the battery as well. When the battery is almost empty, the implants will give beeps at a pre-set time, usually at 8 or 9 o'clock in the morning. These beeping sounds introduce new sensory experiences: bodies with ICDs (and pacemakers) can produce machine-like beeps. People have to learn to listen, in this case literally, to their hybrid bodies.

Detecting the alarm signals is not an easy task, because they need to be distinguished from the beeps of many other electronic devices in our increasingly densely populated technical soundscape. Most people I interviewed did not notice the beeps immediately because they thought the sound was caused by someone or something else: the cell phone of someone nearby, or an ambulance passing the home, or their own watch. However, wired heart cyborgs can also be very creative in developing techniques to detect the beeps. These resilience techniques included switching off all the electronic devices at home to make sure whether the beeps were not caused by another device, or going to more quiet places such as the bathroom to detect the beeps. Importantly, the sounds are not just a feedback signal of electronic devices that happen to be inside bodies. For wired heart cyborgs they create an awareness of the existence and vulnerability of their hybrid bodies that can cease to function if one does not detect the beeps in time and take the appropriate action. Whereas many wired heart cyborgs experience difficulties in detecting the alarm signals of an empty battery, but eventually learn the techniques to do so, elderly people may not be able to develop these resilience techniques due to hearing loss[15]. Because weak or empty batteries produce a rather quiet high frequency sound, many older people may not be able to hear them. Age-related hearing loss thus constitutes a serious constrain in building resilience for people living with ICDs and other medical implants that use beeps as signals for the proper working of the device.

This is just one example of the problems older people may face in keeping their hybrid bodies alive. Because older, everyday cyborgs may face other vulnerabilities as well and may engage in other practices to live with their technologically transformed bodies, studying techniques of resilience is an important theme for future studies of how technologies co-constitute ageing and later life.

4. Intersectionality: Gender, Age and Passing

An important contribution of feminist studies of technology is that age is not the only dimension that matters if we want to understand how technology shapes later life and vice versa. In *Graying the Cyborg*, Kelly Joyce and Laura Mamo (2006) argued that adopting an intersectional lens is crucial to understand how the meaning, access, and use of technologies is constituted not only by age but also by gender, race, class and sexuality. The intersectional approach, introduced by the feminist African-American legal scholar Kimberlé Crenshaw (1989), emphasizes that socially and culturally constructed categories such as gender, race, ethnicity, sexuality, and disability do not act independently of one another but interact on multiple levels. The intersectional perspective is important as well to understand how everyday cyborgs build resilience. In *Resilient Cyborgs* I describe how gender and age intersect in the ways in which women learn to live with pacemakers and ICDs. During my fieldwork I learned that scars resulting from the implantation of pacemakers and ICDs constitute a major problem, particularly for women. Although these heart devices are inserted under the skin, they leave their marks on the body. Pacemakers and ICDs are visible as a roundish quadrangular shape near the (usually left) collarbone, and scars may mark the site of the implant as well. After implantation, people are thus confronted with a visibly changed body. As scholars in medical sociology and disability studies have described, learning to live with a marked body can be very consequential because one's physical appearance is no longer how it used to be. Visible traces of surgeries and implants act as continuous reminders of the physically changed body, making it more difficult to forget what happened to your body (Slatman et al. 2016; Dalibert 2014; 2016; Pollock 2008).

Although all wired heart cyborgs have to learn to live with their marked bodies, women may face more difficulties because their bodies are more subjected to the gazes of others than male bodies (Bordo 1997). As feminist scholars have described, western cultural norms on femininity continue to mold women's bodies into idealized imaginaries of how a woman should look, emphasizing their smooth bodily contours (de Boer 2016; Dalibert 2014). Moreover, women's clothing makes it more difficult to hide the implant from the inquiring looks of others. In this respect, the very site of the implant, near the collarbone, reflects an unintended gender bias because the scars and the implant can be more easily concealed by men's than women's clothes. To conceptualize how women learn to live with their visibly marked bodies, it is important to expand the intersectional lens with the theory on passing developed by disability scholars. According to Jeffrey Brune and Daniel Wilson, passing is an important part of the everyday life of people living with disabilities. Passing refers to the ways in which "people conceal social markers of impairment to avoid the stigma of disability and pass as 'normal'" (Brune and Wilson 2013, 1).

As Robert McRuer (2006) has suggested, passing as normal is crucial because of the 'compulsory able-bodiedness' that governs Western culture in which able bodies are valued over other forms of embodiment. The preference for able-bodiedness constitutes a cultural and social imperative to conceal traces of disability and illness. Consequently, many people who deviate from what is considered normal engage in developing multiple techniques of passing in order to not be differentiated from others (Siebers, 2008).

Importantly, passing techniques are not restricted to physically disabled people but are enacted by wired heart cyborgs as well. Women living with pacemakers and defibrillators often engage in concealing their scars and the bulges of their implants, a practice that can be considered as a very specific form of creating resilient cyborgs. In women's accounts of how people respond to their visibly marked bodies, age emerges as an important trigger of reactions. Many women share their experiences with talking to people who simply don't want to believe that they are implanted with a pacemaker or defibrillator. Or as one of them described: "YOU have a pacemaker? Aren't you TOO YOUNG??" (Oudshoorn 2020, 165). It can easily be imagined that these kinds of questions from strangers are not particularly helpful for women trying to become resilient cyborgs because they emphasize the vulnerability of their bodies, which may make their lives more stressful. The casual remarks of strangers only add to increasing these anxieties and vulnerabilities because they impose a specific disability on women. Young women with scarred bodies implanted with heart devices are told that they are not able to conform to the cultural imperative of having a healthy body with feminine smooth bodily contours. Importantly, the remarks of strangers also convey age-specific messages about the pacemakers and ICDs themselves. Usually the comments not only address the age of the women but also refer to the devices as being only for old people. The example of pacemakers thus shows an intriguing dynamic of the co-constitution of gender, age and technology that creates the image of pacemakers as signifiers of old age[16].

Because women can become pretty desperate from explaining all the time what happened to their bodies, some of them decide to hide the visible traces of their implants. In the online communities I studied, women actively engage in sharing experiences about what they should do to make them less vulnerable to the gazes of others. Adjusting one's clothing is one of these techniques, for example not wearing clothes that show the site of the implant, such as strapless shirts or dresses, or low-cut blouses and tops, or concealing their scars with tattoos. Women use these passing techniques because they enable them to be in control of their bodies as visible objects. This "image management" (Slatman et al. 2016, 1620) is needed in a culture which resists female bodies that don't conform to the highly idealized imagery of femininity and beauty. Or, as Theresy Beery in her study of women living with pacemakers put it: "Can a woman be scarred and still be feminine?" (Beery et al. 2002, 20). Passing techniques can therefore be understood as a very specific way of enacting femininity as well. The pressure to conform to cultural norms about female bodies is particularly strong for younger women. Pacemakers and defibrillators thus constitute specific gender and age relations in which only older women are allowed to deviate from the cultural norm of healthy smooth bodies. Like other bodies, cyborg bodies are thus not outside the cultural norms of femininity, beauty, ageing, and compulsory able-bodiedness (McRuer, 2006; Dalibert, 2016).

5. To Conclude

My account of how people having medical implants learn to live with their technologically transformed bodies confirms one of the major arguments of feminist studies on graying the cyborg. As elderly users of external technologies, everyday cyborgs are technogenarians. Far from being passive consumers or feeble individuals, elderly women and men should be considered as "knowledgeable technoscience users" (Joyce and Mamo, 2006). In this respect there are no differences between the ways people relate to external or internal devices. However, studying the interrelations between humans and medical implants challenges us to develop heuristic tools to understand what agency may emerge when technologies don't delegate actions to their 'users', which is the case of many medical implants. In this article I introduced three perspectives that enable us to go beyond the view of everyday cyborgs as passive. The rematerializing-the-cyborg approach provides a very useful analytical lens by foregrounding sensory experiences as an important notion to conceptualize the agency of people living with technologies inside their bodies. Given the persistent and increasing presence of medical implants for older people, understanding the agency of elderly everyday cyborgs remains an urgent theme, not only for academic reasons. Ultimately, many medical implants constitute a crucial case for persons having these implants also because the proper working of these devices depends on their active engagement. To study this active participation, the techniques of resilience approach is an important heuristic because it enables us to account for the vulnerabilities of hybrid bodies without turning cyborgs into passive victims of their implants. Moreover, accounting for difference is important as well. I argued that a focus on intersectionality provides an important lens for grasping the ways in which age and gender interact and shape one another in building resilience. I suggested that combining the intersectional approach with the concept of passing enables us to understand how age and gender matter in the ways in which everyday cyborgs learn to cope with the vulnerabilities of their technological transformed bodies. Equally important, comparing and contrasting different age groups provides a very useful method to study the complex interactions between age, gender and technology. Although this article did not address other differences, such as race, ethnicity, sexuality, or disability, these are relevant to include in our research agenda as well.

Finally, I would like to suggest that it is important to include the last phase of cyborg life in ageing studies. Accounting for dying and death is crucial because the passage from life to death of everyday cyborgs is not the same as for those who live without internal devices. Medical implants may introduce new vulnerabilities and anxieties about whether implants should be turned off before death and/or removed after death. They may also make everyday cyborgs and their close relatives anxious about whether they will be able to die with an active implant. Equally important, medical implants may introduce anxieties about the kind of death everyday cyborgs will experience (Kaufman 2015; Oudshoorn 2020). Dying and death should thus be considered as integral part of future studies of ageing cyborgs.

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[1] The notion of the cyborg was framed as a technical term in the context of the space race during the cold war and referred to a literal fusion of human/animal and machine (Clynes and Kline 1960). See Markussen et al. (2000) and Bjorn and Markussen (2013) for a further reconstruction of the history of the term "cyborg".

[2] For a further elaboration of this approach see Peine and Neven (2019; 2020).

[3] Exemplary studies about how sociotechnical imaginaries construct specific meanings and practices of ageing and later life, include Joye and Mamo (2006); Joyce et al. (2017); Peine and Moors (2015); Peine (2019); Peine and Neven (2020); Higgs and Gilleard (2020).

[4] I borrow this distinction in three lines of research from Kelley Joyce and her colleagues (Joyce et al. 2017).

[5] Exemplary studies include Fischer et al. (2020); Östlund et al. (2015); Neven (2011); Peine and Neven (2011); Peine et al. (2014).

[6] A more detailed discussion of studies of the co-constitution of technoscience and ageing and later life is beyond the scope of this article, but see Joyce et al. (2017), Peine (2019), and Peine and Neven (2020) for an extensive overview and discussion of this literature.

[7] Bergschöld et al. 2020; Berridge (2017); Giaccardi et al. (2016); Gibson et al. (2019); Loe (2010); López Gómez (2015); Östlund and Linden (2011); Peine et al. (2015); Peine et al. (2017); Pols (2017).

[8] Joyce and Loe (2010); Loe (2010).

[9] Joyce et al. (2015); Peine and Moors (2015); Frennert (2020).

[10] For exemplary studies see Callen et al. (2009); Loe (2015); Mort et al. (2015); Oudshoorn (2011); Pols and Willems (2011); Schillmeyer and Domenech (2010).

[11] See Lock (1993) and Shim et al. (2008).

[12] See, for example, Bruno Latour's influential approach to human and non-human agency (2005), in which he used external technical devices such as car seat belts and door keys as key examples to theorize agency.

[13] Some of the more recently introduced implants delegate some agency to their users. Deep brain stimulation implants introduced for the treatment of Parkinson and spinal cord stimulation implants, developed for the treatment of chronic pain, allow patients to interact

with the device in order to raise or lower stimulation levels (Morrison and Bliton 2011; Dalibert 2014).

[14] See Dalibert (2014) and Verbeek (2008) for a similar criticism on STS and the philosophy of technology.

[15] Hearing loss is considered as the third most common chronic health problem in older adults (Newman and Sandridge 2004).

[16] This is in sharp contrast to the pacemaker implantation rates which indicate that women constitute 45,3 % (The Netherlands) to 49% (US) of the total number of pacemaker users (Boorsma and Zaadstra 2011; Williams and Stevenson 2017).

Participatory Ageing as Assemblage: Infrastructuring in Practice

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Abstract: Scientification and technification of later life have pushed the very notion of ageing, embracing materiality as one of the co-producers of a continuous process of becoming. In this paper, we want to explore the role of materiality in a mechanism designed to allow older people to develop arguments regarding digitalization to inform public policies. To achieve this aim, we will employ a concept that will unfold the layers with which theories of ageing are configured in practice: infrastructuring. In our particular case study, this will highlight the coordinated effort among different agents needed to identify, negotiate and prove who can be considered a legitimate older citizen. Along this path, we will face three instances where the theory is challenged by practice: 1) the very sense of what an infrastructure is; 2) the theory about what a consensus conference is; and 3) what the definition of older person is. To conclude, we suggest the necessity to switch the very question about who can be considered an older person to how in a certain context a heterogeneous assemblage of (human and non-human) actors defines what an older person is.

Keywords: assemblage; consensus conference; doing age; infrastructuring; older people.

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1. Introduction

Demographic ageing is a significant challenge that industrialized societies have already faced during the last decade and one that will only grow more influential in the future (Phillips 2011; Schuitmaker 2012). Since the attestation of this tendency, it has been broadly agreed that the response to

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this grand challenge should be provided by science, technology and innovation (Cagnin et al. 2012; De Smedt et al. 2013; Mort et al. 2012; Roberts and Mort 2009), even though the particular articulation of this movement and its effects are still a matter of discussion. It has been argued, for example, that, despite an increasing amount of studies in the field of ageing and technologies, a lack of theorization is apparent (Sixsmith and Gutman 2013). What seems clear is that scientification and technification of later life have pushed the very notion of ageing, stretching it out not only beyond the biological - ageing bodies (Baars 1991; Dannefer and Daub 2009; Marshall and Katz 2002) - but even beyond the social, as well into what has been called a socio-material constitution of later life (Endter 2016; Peine et al. 2015; Wanka and Gallistl 2018). Materiality, in that sense, is considered to be one of the co-producers of a continuous process of becoming (Urban 2017).

Within this context, the very question highlights the role that those concerned should play in these reconfigurations and the threats associated with excluding them from the instances where possible futures are drawn given that what is at stake is the way to connect scientific and technological production with democratic ideals (Callén et al. 2009; De Vries 2007; Mort et al. 2013). This query is particularly relevant when it comes to considering the elderly, a social segment that is continually in danger of being excluded from social and community participation (Everingham et al. 2009). Indeed, in many European countries, the public policies regarding the welfare of older adults have frequently been developed without any involvement of or input from their beneficiaries (Carney 2010; Mort et al. 2009).

In this paper, we want to focus on a mechanism designed to allow the elderly to develop arguments regarding digitalization to inform of public policies: the Citizen Conference of Barcelona's Older People about the Digitalization of Society, carried out in 2013. The initial aim of the organizing team was to carry out an adaptation of the standards of the Danish model of the consensus conference, to include a concerned collective. Accordingly, starting from the design of the conference, we will show the successive modifications needed to allow older people to engage in the experience under the most careful conditions. As we will see, the initial considerations of the organizing group of the conference, which took biological age as a statistical criterion to run the call for participation, soon faced other considerations regarding who can be considered as an older person. That is why we consider it to be more appropriate to investigate what an older person may be as a process towards the recognition of all the entities that take part in the identification, negotiation and proof of who can be considered to be a legitimate older citizen. We will develop a concept that will unfold the different layers where the theories of ageing are set in practice, called *infrastructuring*. Highlighting the coordinated effort needed among different agents to stabilize a specific collective. Along this path, we face three issues where theory is challenged by practice: 1) the very sense of what an infrastructure is; 2) the theory about what a consensus conference is; and 3) the meaning of what an older person is.

2. Doing Age: Infrastructuring Older People's Engagement in Science

Since there are many ways of ageing - according to a mix of cultural, class, gender or ethnic conditions - defining it is a complex task. In that sense, the institutional approaches to what an older person is are normally based on statistical criteria. Most countries have accepted the chronological age of 65 years as a definition of an older person, coinciding with the age when one can begin to receive pension benefits. Thus, this definition relates the condition of an older person to the absence of productivity (Ranzijn et al. 2002). Although the common use of a natural age to mark the onset of old age is the equivalent of using the biological age, it is generally accepted that the two are not necessarily the same (Burholt et al. 2020). In many parts of the world, the economic and social stratum or the urban condition to which a person belongs is much more relevant than the chronological age in the conceptualization of old age (Gorman 1999; Marston and van Hoof 2019).

Furthermore, the progressive scientification and technification of later life have acted as a call for academics - and non-academics - from different perspectives to open new ways of conceptualizing the relationships between people, mostly of advanced age and different materialities, mostly characterized as new technologies beyond chronological age. From telephonic companies to policy makers and from health professionals to bus drivers, it is difficult to find a collective alien to this new configuration. Notably, two propositions have obtained a broad consensus within the new contemporary approaches to age theorization: 1) age is a practical process that is being performed; and 2) human and non-human agents are involved in this process (Wanka and Gallistl 2018, 6-7). For all of these reasons, we consider ageing bodies and digital technologies as co-producers of continuous materializations and hence the construction of age itself. In this way, age is understood as an "interrelationship of societies and technologies" (Urban 2017, 3). Undoubtedly, one of the main reasons that have contributed to fostering this agreement is the shared rejection of foregrounding theoretical proposals that take the isolated subject as a hermeneutic being by itself. Age is not something that concerns only the subject. Indeed, John Dewey already pointed out the necessity to know "the ways in which social contexts react back into biological processes as well as to know the ways in which the biological processes condition social life" (Dewey, 1939, xxvi). In that way, if there is, at least, a subject result of the interaction between the biology and the social, it means that we have to apply a transitive character to age, turning it into constant ageing.

Although discourse generally directed at people, ageing would not be possible without the whole network of institutions, companies, social practices and technological developments (in a broad sense) that provide it with substance. Hence, we want to focus on those materials that allow subjects and discourses "to matter" in the definition of who an older person is or, more accurately, what an older person is. Accordingly, we consider it to be appropriate to introduce a notion that will help us explore the role of materiality in our particular study case: infrastructure.

The use of the term *infrastructure* is not a minor issue here. We consider the arrangements and configuration of the citizen conference as an infrastructure, since it is a properly designed setting that is crucial to the development of different practices and to the emergence of particular communities (Star 1999). Thereby, Star's conceptualization of infrastructure is not guided by a Marxian idea of infrastructure (Ferguson 2012) because the scope encompasses not only power relations and ideologies but also, above all, particular (human and non-human) modes of existence (Graham and Thrift 2007). In this way, a particular design directly establishes certain limits on the definition and negotiation of identities. However, we are not arguing that the infrastructure determines what an actor may become since the actors do not act within a backstage, where reality is hiding (Mol 2002). Instead, they configure particular collectives with the infrastructure. As Michael (1996) stated, we are inseparable from the things around us. Namely, identity is always formed in an assembled way. This is especially relevant when we take into consideration our particular case study since, when we discuss techno-scientific issues, we are debating at the same time what world we want and who we are as a collective (Stengers 2005). That is why we aim to turn the focus to the way in which we infrastructure this composition, stressing the acting part of the infrastructure in the whole configuration.

Linked to the idea of infrastructure, Star underlined the role of standardization as a normative process that sustains or excludes any object or subject of a particular assemblage (Star and Bowker 2002; Star and Ruhleder 1996). For that, and to emphasize the idea of the process and constant change, we can introduce a nuance with respect to Star's definition of infrastructure to expand its reach. Following Karasti and collaborators (Karasti and Syrjänen 2004; Karasti and Baker 2004), we use the term *infrastructuring*. As Helena Karasti (2014) states, they coined the term *infrastructuring* inspired particularly by Star and Bowker's article, *How to Infrastructure* (2002). The term emphasizes the processual, ongoing quality of infrastructuring activities and pays attention to the extended periods during which infrastructuring unfolds (Karasti 2014, 142). According to this perspective, infrastructuring could be considered as a particular participatory practice that provides socio-material resources and experiences by way of attachments to the constitution of collectives or communities gathered around common issues. The primary and distinctive feature of this concept is its openness. This ongoing process includes other previous infrastructure activities, so, as Le Dantec and Di Salvo (2013, 255) highlighted, "an important aspect of infrastructuring is recognizing that those attachments are dynamic; they will change, often in unanticipated ways".

3. Research Setting

3.1 Making a consensus conference with older people

The Citizen Conference of Barcelona's Older People about Digitalization of Society was the result of a broader research project carried out by the GESCIT research group (nowadays STS-b) between 2012 and 2015 - from now on identified as "organizing team". The outputs of several previous projects focusing on the crossroad between science, technology and older people suggested changes in the way in which Spanish society perceived the role of science and technology in the daily lives of citizens and showed the implications of expert knowledge and technical devices for ageing, identity construction, social organization and institutions. Considering these, one of the main aims of the project was to design and implement a consensus conference focusing on older people. The proposal was to test the strengths and weaknesses of the mechanism in terms of the capacity to join experts and older people in the same collective. At the same time, we were interested in allowing the members of this concerned collective to express their views regarding digitalization and even to assess public policies.

The existence of a concise manual systematizing all the standards needed to organize a successful consensus conference (Nielsen et al. 2006), as well as the related literature, brought clarity regarding the limits and scope of this participatory device (Einsiedel and Eastlick 2000; Fixdal 1997; Grundahl 1995; Kleinman 2000; Kleinman et al. 2011; Petts and Niemeyer 2004). Nevertheless, in placing a concerned collective, such as the older people of Barcelona, as the citizen panel of the mechanism, we contradicted one of the main principles of the original model, the one stating that the selection of the lay panel should be ruled by random representational criteria. The call for participation addressed only to older people, remained open from October to December 2012. Ultimately, from the people who applied to take part in the conference, nine men and four women were selected as members of the citizen panel. The places of residence of the final thirteen participants were relatively evenly dispersed across Barcelona, with at least one from every district.

From that point, we started to realize that some of the conditions imposed by the manual on the participants were quite demanding. The manual of the mechanism points out the need to introduce full and restrictive timetables to deal with a considerable workload, resulting on the decision to extend the whole process, adding more time than planned to make it less exhausting, from 9 January to 15 February 2013.

The first stage, considered as "preparatory", consisted of six meetings distributed across two non-consecutive weeks and carried out in a centrally located hotel in Barcelona. During this period, the participants in the citizen panel were to become familiar with the topic of the conference and select specific issues of interest, those being: economy and ICT, solitude and ICT, motivation and education, gender and ICT, administration and civil society, and health and usability. A recently retired professor in group dynamics - someone who was closer in age and interests to the participants - was responsible for giving the majority of instructions to the citizen panel. One important output of the preparatory stage was the formulation of questions to be answered by a panel of experts in the next phase.

The second stage was the public phase of the conference, held at the Contemporary Culture Centre of Barcelona (CCCB). There, the citizen panellists presented each topic of interest in an oral exposition, giving an account of the discussions that had taken place during the preparatory sessions and posing the questions that the citizen panellists had agreed to ask the experts. Then, several experts on particular technological issues replied to the lay participants' questions. This second stage took place on two days, 12 and 14 February 2013.

Finally, in the third stage, the citizen panel met for two more days — the first at the CCCB and the other in a municipal building - to produce the final document outlining its conclusions and recommendations. This document was subsequently delivered to the City Council at a public event attended by the organizers and the panellists (Citizen Conference of Barcelona's Older People about Digitalization of Society 2013).

3.2 Methodological approach

We began by realizing that the citizen conference mobilized not only people but also a multitude of things, such as institutions (the Barcelona City Council or the CCCB), materials, papers, wires, tables, Internet connections and so on. That is why we argue the necessity of following a device-centred approach to take into consideration not only the discourses but the whole range of materialities that are conjugated and shape the mechanism. This is an indispensable action to recognize the political participation of things in deliberative devices (Marres 2011; Marres and Lezaun 2011).

For our research, we adopted a methodological strategy able of dialoguing with the ongoing mechanism of the consensus conference. In that sense, we developed a multi-situated ethnography (Marcus 1995), exploring the different sites within the participatory mechanism, from its design to the public event where the final report was presented (city hall offices, older people's houses, meeting rooms, conference hall, etc.). In the context of this ethnographic study, we employed different techniques that allowed us to take into consideration three sources of data. Firstly, we considered the resulting fieldwork notes and video recording (Jensen 2005) obtained through participant observation as part of the organizing group of the citizen conference. Secondly, the interviews were carried out with different actors at different stages of the experience (Powell and Kleinman 2008): in the selection process, during the preparation stage and later, when the CC had finished. Furthermore, we proposed that participants should write a diary to register their own experiences, indicating that they could include any impressions, feelings or opinions about their condition of being panellists (Jacelon and Imperio 2005).

4. Assembling Ageing and Politics through Infrastructuring

In the construction of the citizen panel, several socio-material processes were conducted. In this analysis, we will show how the infrastructural aspects sustained a particular mode of doing age in a public engagement with science mechanism. Accordingly, firstly, we will show the process by which the selection of participants is infrastructured. Then, we will present the way in which the infrastructuring process supports the constitution and legitimization of the citizen panel. Finally, we will highlight the necessary care practices to hold the assemblage between humans and things.

4.1 Infrastructuring older participants

The question regarding who can be considered an older person arose at the very beginning of the citizen conference. This point should be clear when calling for participation in an experience meant to address older people. In that sense, the organizers should define it before launching the call for participation. The first parameter considered by the organizing team was age, which is a statistical criterion. Some national laws and norms (such as the Promotion of Personal Autonomy and Attention to Dependent People Law, in Spain) and several institutions concerning ageing (such as the Institute for the Elderly and Social Services, known by its Spanish acronym IMSERSO) establish a minimum of 65 years: people beyond this age should be considered older people. Taking this minimum into account as a standard, the organizing team prepared a call for expressions of interest addressing this particular population. Thus, in the distributed flyer, one could read, "Who can participate? People older than 65 who live in Barcelona". The call for participation remained open from October to December 2012.

Overall, after the call for participation, we received 28 applications - although we had expected around 50. After the applications had arrived, we interviewed the candidates to select the participants. The process by which a citizen panel is selected is always the focus of much debate (Irwin et al. 2013) since it supposes selection and judgement regarding acceptable behaviours (Laurent 2009). This already involved adding criteria to the configuration of our target older people beyond age. To be chosen, first, people had to be communicative and have the dialogical capacity to take part in situations of debate. This requirement casts doubt on the inclusive nature of the deliberative mechanisms based on traditional means of speech and on an ideal model of communication inspired by the Habermasian discourse theory (Cohen 1999) since people who do not have certain speech and communicative capacities have to be refused participation in this kind of mechanism. Secondly, the selection interviews worked as an opportunity to assess people's engagement: people had to have enough time to participate in all the activities of the conference. Hence, many women told us that they could not participate because they had to care for their grandchildren and husbands. Even though, after the first round of interviews, we made an effort to contact women from different neighbourhoods, we did not succeed in configuring a gender-balanced panel.

This shows that becoming a member of the citizen panel does not only concern age. To become an older citizen in this context, one also had to have the time to take part in a lengthy process - sometimes disregarding some care practices that one is expected to undertake.

During the selection interviews, it was made clear that not only the particular standards of the consensus conference or the logics regarding active ageing (Sixsmith and Gutman 2013) were challenging our early definition of older people. The applications of two candidates exemplify that enrolment was not a unidirectional act but a process in which every actor actively participated, manifesting particular interests and purposes to contest our initial assumptions. In that sense, these two candidates, who were younger than 65, considered themselves to be older people and deployed different strategies to become participants. In one of the cases, the applicant completed the online form and wrote in the blank corresponding to age that he was 65 - that is, he lied about his age. Later, in the selection interview, he revealed his real age. He justified his deception by arguing that, if he had given his real age, 63, he would not have been chosen. He added that he considered the limit of 65 to be unfair and discriminatory.

> It was said, "If you are older than sixty-five ..." in front of which I revolted and said, "Well, why this limitation? I am a person who is not looking for a job. I am completely retired. I have similar rights as a retired person in their eighties. I do not care! I will not look for a job... so, why this limit of sixty-five?" So, I revolted, and I applied as an act of rebellion. (Extract from the post-conference interview, Participant 4)

This excerpt shows that some strategies could be adopted to challenge the definition of who is an older person by adding other entities to it. That is why we consider it to be more appropriate to explore what an older person is than who an older person is since the definition extends beyond the individual. In particular, in this situation, we can tackle two aspects intending to define what an older person is. Firstly, according to Participant 4, taking part in a network aiming to exchange activities for money (as waged labour activity is) or, on the other hand, not being linked with this network (being retired) should be added as a criterion to delimit what an older person is. Secondly, every delimiting action of identity is an act of force that causes inclusion and exclusion effects. For Participant 4, being excluded from the elderly group is an unfair and discriminatory action. As a consequence of these two aspects, the initial definition of an older person became broader and more complex.

Another situation that challenged the organization's first assumption that being an older person involves being aged 65 or over involved a participant who merely wrote his real age in the blank - 63 as well. Given that the online form enabled anybody of any age to register despite the age limit, he could apply and was ultimately interviewed. What would have happened if that online form had been programmed with a drop-down list containing limited age choices? The option of the second participant would not have been possible; he would have been excluded from the experience or forced to change his strategy to take part. These assumptions are useful as they prompt us to think about how this kind of (software) infrastructure acts to define who can be enrolled in this kind of experience, showing the range of possible negotiation. Both applicants were finally selected and were able to participate in the experience, modifying the original age range of 65 and older.

As we can observe, identity involves not only people but also everything that comprises their daily life - that is, their material relationships and their variations. In that way, identity can be presented as a formation that actualizes a series of heterogeneous relationships (we are thinking of the actions and features that define an older person, as explained by Participant 4 for example). The definition provided by the organizers ("an older person is anyone over 65") can be considered as a master narrative of this participatory infrastructure (Star 1999) based on the construction of socio-demographic indicators. Given its standardized capacity, it erased, hid or, at least, put aside specific nuances written in minority narratives. Nevertheless, the participatory infrastructure allowed the possibility of contesting the master narratives and even promoted the emergence of new meanings regarding what an older person may be.

4.2 Infrastructuring older citizens

In spite of 13 participants being chosen through the selection process to take part in the consensus conference, after considering their availability and disposition to take an active role in the development of the conference, that recognition alone was not enough. Henceforth, they were supposed to demonstrate that they could effectively become a constitutive part of the citizen panel. Accordingly, although participants were recruited as virtual citizens (Levy 1998), they should prove the civic capacities needed to be considered legitimate citizens (Powell and Kleinman 2008). This can be shown by one of the most recurring demands requiring an active role of participants to be engaged in collective discussions:

> In the debates, there are people who want to demonstrate expertise in new technologies and explain the devices they own. On this subject, others remain silent. (...) I surprised myself by interrupting people who were speaking. (Diary excerpt, Participant 1)

In that excerpt, we can see that, even though some of the participants were not familiar with the use of some technologies, they were asked to talk about them. Despite their initial concerns about not being able to take part in the discussions, many participants turned their worries into active engagement in the very early stages. Step by step, many of the participants earned a deep sense of self-trust until they gained the impression of being able to engage in discussions with experts on equal terms. This can be shown by the next excerpt, in which one of the citizen panel members expresses her impressions of a meeting where the citizen panel held a discussion with five members of the steering committee (a group composed of researchers, members of civic associations, entrepreneurs and so on). This took place during the last session of preparation and, apart from fostering the encounter of the two groups, the meeting served as a rehearsal for the group since it would be the first time that they would face experts:

> Five collaborators were presented from different fields and then we presented our questions and our conditions. They have explained things, each within their knowledge. (...) It was interesting to see how people inside the issue have a vision not so different from ours and that they do things to improve the quality of older people's life. (Diary excerpt, Participant 9)

To "have a vision not so different from ours" is a good summary of the attitude the panellists had towards the specialists. They enquired when they felt they had to, showed their positions and developed a dialogue. That is, they were able to discuss issues on equal terms with the specialists. This success was because of the constant efforts made by the participants to meet the requirements of the organization and the infrastructure as a whole. This work not only encompassed dialogical skills in the preparation stage but also continued through the public phase of the conference (and even in the days between the two instances), during which they were asked to perform practical material tasks:

> Several hours have been devoted to preparing the presentation. Besides preparing the PowerPoint, I have devoted time of my life to prepare the text, indispensable for that. Besides these tasks, I have attended other commitments. These have been crazy days due to Laura's emails (a member of the research group) because her suggestions made me change my writing ... words, phrases, size of text, and so on. It was something positive, thanks to her tips, work has been pretty good. (Diary excerpt, Participant 7)

The described actions give an account of the participant's work to prove her commitment and determination to complete the required tasks. This situation puts in evidence an affected older person who responds as such. As we have shown, dialogical skills are an indispensable component of involvement as an active member of the citizen panel. Nevertheless, a wide range of other requirements had to be met to demonstrate that the elderly can be considered legitimate citizens. There are material requirements, such as the ability to produce a PowerPoint presentation or to write a coherent speech, but the competence to deal with stressful situations is necessary as well. Those components give form to a particular way of becoming an older citizen in this configuration.

Nevertheless, becoming a legitimate citizen is not only related to individuals' capacity to overcome certain requirements or to move beyond themselves. As argued previously, a complex infrastructure has to be put in place and sustained to endure this achievement. For this aim, it is not enough to design the network *a priori*. Meticulous caring practices are needed to hold the assemblages in a constant process of infrastructuring. Those are the practices that we will present in the next section.

4.3 Caring about becoming as a mode of infrastructuring

The actions described so far have given an account of the participants' particular efforts to cope with the mechanism's demands. As seen, the constant challenges posed by the organization affected the participant's bodies from the beginning. Nevertheless, we have also seen how the organizing team was present to support and sustain the possibility of achieving the demands. In that vein, anxiety became more evident when the public stage of the conference was about to start. That is why affective support - as well as a multitude of other activities connected to taking care of the participants - emerged as a key component of the sustainment of the whole infrastructure, which was as important as anything else. The next excerpt exemplifies the nature of this additional support:

> Today, I do not know if by insecurity or jitters, or to know how to situate myself in the place where the conference will be carried out, or by the onset of all my concerns ... the fact is that at 8:30 AM, I was already at the CCCB where the young students were getting everything ready. I could test my presentation on the laptop with Laura. I could see if it looked good on the screen, and so on. This has helped me to relax a little bit and to wait more peacefully for my intervention. (Diary excerpt, Participant 7)

The lack of development on this issue through the literature is - at least - surprising. Within the consensus conference manual, for example, the authors talk about issues such as providing a comfortable venue, but the concerns about participants' care are reduced to comfort. However, a whole range of other care practices should be highlighted. For example, breakfast is one of the spaces intended for nutrition within such care but is also a point of socialization during which researchers and participants interact, transferring affections that are more than necessary to achieve the comfort of these bodies.

> Breakfast also lets us meet students who give us so much support. They want to be hidden, but they also have an active role. I must say they are very friendly. (Diary excerpt, Participant 3)

Likewise, it is essential to equip these bodies with the basics like food, water, shelter, and accommodation, but the care practices need to go further than that. In that sense, the existence of the citizen panel depends, among other elements, on how the facilitation work is developed. To sustain the panel, it is necessary to undertake articulation work that enables 13 people to become a collective:

> The collaborators have made efforts to ensure logistical processes work and to assist everybody. Particularly, I found very interesting the performance of the facilitator. She has allowed people without common interests, in a short time, to be able to debate issues and to arrive to definitions and conclusions. (Diary excerpt, Participant 3)

The preparation stage was a key component of the achievement of this aim, not as a simple activity of knowledge transfer in a unidirectional mode but rather as careful work to produce changes in such a composition, going from the sum of individuals to the citizen panel as a whole. In that respect, the duties of the organizing team extended beyond just transmitting a repertoire of conceptual and informational tools to the participants. As a participant expressed on the fourth day of the preparation stage:

> They gave us a working document discussed in groups of three. Then we were all working together point by point. It seems that this document is the result of the previous three sessions. It is intended to show the experts to explain the points we have recently solved and the session ends to continue in the next, discussing the document. (Diary excerpt, Participant 9)

Documents, prepared by the organization, acted as summaries of other moments (events that have already occurred and reappeared again), giving continuity to the process and highlighting a tendency for repetition. Between one session and another, the bridge that unites them is a document, a mnemonic infrastructure used to record what happened, to give continuity in time and relevance as well as to introduce new elements.

As we have shown, a multiplicity of care practices had to be carried out during the process of infrastructuring our experience. However, the main purpose of highlighting them is to realize that care is a living technology with vital material implications for human and non-human worlds (Puig de la Bellacasa 2011). Constant attention to detail was required to assure the sustainability of the mechanism, but these care practices concerned humans and the materiality in itself symmetrically. As a result, we can appreciate how taking care of participants means taking care of the political infrastructure and how caring for the political infrastructure involves caring about the participants. That is, they are two sides of the same process: to hold the assemblage (Denis and Pontille 2013).

5. Discussion and Conclusions

When we refer to technology, we usually think of complex machines or ICT, among other things. However, in the examples that we presented, we could see the diversity of technologies, such as documents, tables, projectors or computers, which, due to their everyday use, have become naturalized but overall, we could see their interactions. This wide set of technological relationships were assembled throughout the process to make a peculiar consensus conference possible. The interaction of these components made the emergence and sustainability of a particular kind of subjects attainable: the panellists of this conference as older citizens engaging in technological issues. This brings two crucial aspects to the scene: first, it reinforces the idea that one becomes older in an assemblage (in our case, making a political exercise of these citizens possible) and, second, political practices require certain infrastructures, decentralizing the politics of the primacy of language. Along this path, we faced three instances in which theory was challenged by practice.

The first concerned the very sense of what an infrastructure is. While Star (1999) stressed its relational character, studies on infrastructures have focused on large infrastructures that connect and articulate different communities of practices. What infrastructures a practice, far from being reduced to those large groups such as a bridge (Suchman 2001), a drinking water distribution network (Wakhungu 2019) or a wired network (Wuebben 2017), it can be configured from the interaction of a myriad of things that support the development of a specific practice in a particular situation. The concept of *infrastructuring* contributes to providing this nuance by accommodating the appropriate ductility to deal with certain contextual events, emphasizing the immanent coordinated character of the relationships needed to stabilize and fix collectives and enable them to last (Karasti 2014). The experience that we related taught us about the continuity between what supports our vital practices and the practices that make us emerge as singular individuals, between the stages and the actors, and also between the tables with microphones and the citizen panels. Infrastructures are nothing more than the continuity of our bodies by other means, a way of doing-with-the-world regularly. While it is true that the stabilization of an infrastructure can be a decisive element for the exclusion of certain subjects from a network (referencing the case where our software could have excluded a participant), it is also true that it is an indispensable element for the connection and sustenance of collectives. However, that connectivity is subject to constant production that involves the set of relationships that make up a particular assembly. Thus, we could think of unstable infrastructures, their instability being precisely what allows them to give consistency to a set, in this case a consensus conference.

Secondly, the theory was challenged by practice regarding how a consensus conference is meant to be carried out. However, from the beginning, interventions were made for its adaptation, and along the way it required several minor, handcrafted adjustments to enable the realization of the participatory mechanism, and its adaptation to those who took part. As a result, even though the mechanism was conceived as a stage for giving voice to older people, in practice it became the production of a new way of conducting politics and ageing. The unexpected emerged in the production of the experience itself. It emerged when met with the diversity of human and non-human groups that were part of the process. Along those unexpected lines, we could see how different actors - human and non-human - interweave, forming the heterogeneous collectives necessary to make the political process possible. Even the adapted arrangement of the space acquired a primary role. In that sense, a whole range of care practices needed to be tailored to both the participants and the materials. Thus, only by paying attention to these practices, whereby twilight entities that reach beyond what is expected are enacted, can we explain the fluidity of the political component and its achievement. In this particular, a citizen panel extended beyond what was established by the manual. The identity of the citizen panel would not have been kept without the participation of the organization. However, the facilitator of the experience or the panel of the experts is indispensable as well. They are also needed to shape and stabilize the citizen panel. If we push the argument to its last consequences regarding our particular target, we will see how the citizen panel represents far more than an aggregate of thirteen people.

Experts, facilitators, and organizers are indispensable components of the assemblage, as crucial as venues, documents, agendas, flip charts or breakfast. If we shift the focus from the subjects to the assemblages (Sayes 2014), we will see actants appear (and disappear), being everywhere and nowhere at the same time; “sometimes [as] a particular node, sometimes

[as] an entire network, (. . .) sometimes absent, sometimes interchangeable" (Mialet 2009, 459).

Lastly, the meaning of what an older person is was challenged. Even though we can establish clear definitions of who can be considered an older person in an abstract plan, from an academic or institutional point of view, this Citizen Conference has shown us that the processes by which age is addressed in a particular situation need to be explored through a contextual approach. That implies recognizing the political, technological or social entities that are taking part in the definition. That is why we suggest the need to switch the very question about who can be considered an older person to how in a certain context a heterogeneous assemblage of (human and non-human) actors defines what an older person is. As presented, singular modes of ageing are updated and activated as a result of an assemblage composed not only of older people but also of academics, young researchers, documents, microphones, lunches, laughter or conversations. We were able to tackle this reconfiguration from the initial assumptions of the organizing team. Which took the biological age of 65 and beyond as a statistical criterion to call for participation. Through the considerations made for two potential participants who were willing to take part in the mechanisms despite being aged under 65 or within an extended variety of logics, such as those configuring active ageing and public engagement with science mechanisms.

In sum, this experience overall supposed a paradigmatic case to apprehend how age is approached in practice since what was constantly at stake was the identification, negotiation and proof of who can be considered a legitimate older citizen. Accordingly, we have pointed out the concept of *infrastructuring* as a pertinent mode to unfold the layers by which theories of ageing are configured in practice, highlighting the coordinated effort among different agents needed to stabilize a specific assemblage.

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Ethics by Other Means? Care Robot Trials as Ethics-in-Practice

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Abstract: Recently, socially assistive robots (SARs) have entered care work to tackle the care deficit for ageing populations. Previous research on care robot ethics has emphasised design processes and ethical guidelines. In contrast, this paper employs an empirical ethics approach to investigate how ethics is co-constituted in care practices. Drawing on ethnographic research on an SAR's dementia-care usability trials, the core research question is "What therapeutic gains does human-robot interaction achieve for older users?" These usability trials were underpinned by the optimistic 'ageing-and-innovation discourse', which frames how 'the good' and 'therapeutic gain' are perceived. Furthermore, this article contributes to science and technology studies (STS) on older users by studying user figuration as a site of 'ethics by other means'. It argues that the ethics of care robots should not be contemplated only as ethical frameworks, guidelines and imperatives but, rather, as situated and relational normativities that stem from care practices.

Keywords: ageing-and-innovation discourse; empirical ethics; figuration; human-robot interaction; socially assistive robot (SAR).

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1. Introduction

The ethics of care robots has recently become a major subject of public and academic discussions. In Europe, the European Commission (2019) has defined ethical guidelines for the development, deployment and use of artificial intelligence, such in the case of automated assistive technologies and, among them, care robots. These guidelines are summarised as four ethical principles rooted in fundamental human rights: i) respecting human autonomy (i.e. ensuring human self-determination and freedom); ii) preventing harm (i.e. protecting human dignity, as well as mental and physical integrity); iii) fairness (i.e. equally distributing benefits and costs); and iv) explicability (i.e. using transparency as the basis for building trust). Universal human rights, such as autonomy, are evident in both the guidelines presented by the European Commission and the extant literature on care robot ethics. This literature stresses that designing assistive technologies for older adults should account for ethical principles, such as protecting privacy, ensuring dignity, preserving autonomy and respecting the values of independence, enablement, safety and social connectedness (Burmeister 2016; Diaz-Orueta et al. 2020; Sharkey 2014; Sorell and Draper 2014). The same values are evident in more critical assessments, in the fear that care robot implementation may lead to a reduction in human contact and a loss of privacy and freedom, as well as potential deception (Bennett et al. 2017; de Graaf 2016; Sharkey and Sharkey 2012; Sparrow and Sparrow 2006). In technology development and design, ethical frameworks are usually grounded as moral rules that should be accounted for in the process of "value-sensitive design" (van Wynsberghe 2013).

Previous studies on care robot ethics (Bennett et al. 2017; Burmeister 2016; de Graaf 2016; Diaz-Orueta et al. 2020; Sharkey 2014; Sharkey and Sharkey 2012; Sorell and Draper 2014; Sparrow and Sparrow 2006; van Wynsberghe 2013) have heavily relied on deontological moral theory, that is, on the need to set ethical guidelines as moral imperatives to be followed in technology design, implementation and use. However, this approach leaves open the question of whether the complexities of care in practice contribute towards the constitution of an ethics of care robot usage in any way. A deontological framework cannot fully grasp the ethical complexities actualised in care practices. Although deontology is not represented, in the extant literature, as the only way to "do ethics", it seems to be the most dominant moral theory in debates on care robots. Addressing this limitation, this article strives to rethink care robot ethics not from the viewpoint of universal human rights-centred deontology but, rather, through an empirical ethics approach (Mol 2008; Pols 2015; 2017). This approach regards "normativity", that is, the different forms of "the good", as the outcome of situated practices. In contrast to deontological ethics, whose interest lies in whether or not moral imperatives are followed in design and beyond, the empirical ethics or "ethics-in-practice" approach stresses the availability of multiple ways to achieve 'the good' and emphasises that good care is co-constituted in practices where people, technology and discourses meet.

By adopting this approach, the article draws on ethnographic material collected during usability trials for a socially assistive robot (SAR) in a dementia care unit in Finland. The term "SAR" refers to interactive robots that provide assistance and companionship while assisting in convalescence, rehabilitation and learning in cognitive, affective and physiolocal therapy (Abdi et al. 2018; Feil-Seifer and Mataric, 2005). In this case, the idea of a care robot is linked not to a type of artificial intelligence but, rather, to the "ageing-and-innovation discourse" (Neven and Peine, 2017). This discourse frames ageing as a crisis for societies that struggle with insufficient healthcare resources and rising costs. Within this discourse, innovative technology is offered as a solution to this crisis, and when technology is implemented, it is said to have only positive outcomes, identifying a "triple win" for individuals, societies and economies. According to this discourse, the aged individual wins as they receive better-quality care. Society - that is, governments, municipalities and taxpayers - wins as healthcare costs are reduced. Finally, economies win as marketable and exportable technologies are produced, resulting in new jobs and economic growth. Of course, these three "levels" are interlinked. Nevertheless, various actors involved in national and global healthcare policy and the welfare technology industry sector tend to refer primarily to these three winners and to use this rhetoric as a tool to galvanize the development of new technologies (Neven and Peine, 2017). The ageing-and-innovation discourse strongly affects the development of care robots, and these effects are evident in the context of SAR trials.

In this case, the ageing-and-innovation discourse offers a background against which to examine why and how robots are trialled in dementia care. In these trials, the discourse is mainly performed by two stakeholders: the testing group, which represents an innovation company that develops digital solutions for future 'smart cities', and the administration and employees of the care unit, which rehearses the future of ageing through technology pilots. The usability trials studied in this article exemplify the promises of the discourse in three ways. Firstly, the SAR was trialled as a therapeutic device that increases older users' wellbeing. Secondly, robot technology emerges as a way to lighten the caregivers' workload and, thus, as a means of tackling the demographic "care deficit" that ageing populations bring (see also Abdi et al. 2018; Kriegel et al. 2019). Thirdly, the trials were part of a multinational series of pilots conducted to induce the creation of a start-up enterprise in the European Union and, thus, new jobs. Because the ageing-and-innovation discourse presents three different "goods" that care technology can achieve, it is inherently normative in nature.

By applying an ethnographic approach, this article examines how the ageing-and-innovation discourse is performed in usability trials. In line with user research, I am interested in what "good" care robots achieve for older users. Because SARs offer cognitive, affective, and physiological 'therapy' for the elderly, I term the individual good a "therapeutic gain". My research questions are as follows: *what kind of ethics is enacted during the trials? What 'therapeutic gain' does human-robot interaction achieve for older users?* I argue that care robot ethics should not be framed solely by deontological claims that emphasise design processes, but also by the ethics-in-practice perspective. In the SAR trials, this perspective does not affirm such 'universal' values as autonomy but, rather, the emergent ethics of care, which stresses the normativity of multilateral interdependencies (Puig de la Bellacasa 2017; Sevenhuijsen 1998; Tronto 1993).

I will begin by presenting the theoretical framework and my contribution to science and technology studies (STS). I will then present the methodological principles and the context of the case study in more detail. In the analysis section, I discuss the figuration of different users and ethics. Before concluding, I discuss how the trials were deemed a success by the stakeholders involved, in spite of evident problems, contradictions and ambiguities.

2. Empirical Ethics and User Research

This article contributes to user-oriented STS in two ways. Firstly, ethics has been overlooked in recent research on technologies for older users, which has, instead, highlighted older persons' agency in the face of ageist, paternalistic and stereotypical technology designs and design processes (Compagna and Kohlbacher 2015; Cozza et al. 2020; Frennert 2016; Hyysalo 2004; 2006; Neven 2010; 2015; Peine et al. 2014; Östlund et al. 2015). Secondly, usability trials have not been examined as a site of ethics-in-practice. I argue that usability trials are not solely concerned with configuring technology or users, or how the designer's image of the user shapes and constrains possible users (Woolgar 1991), but also with ethics. In trials, possible ways of achieving 'the good' for older users are assessed. Thus, SAR trials offer a gateway via which to examine the ethics of care robots.

To understand the benefits of the empirical ethics approach, I will briefly locate its genealogy in STS. The empirical ethics approach relates to both the material semiotic tradition and the ethics of care discussions (Thygesen and Moser 2010). In material semiotic user studies, the concept of a "script" has been important. Scripts concern the anticipations based upon which users act when facing a technology, and they are inscribed in a technology's materiality and design (Akrich 1992). Script analysis stresses the dynamic co-configuration of technology and users (Van Oost et al. 2009). Concerning older users, "age scripts" - the ideas and discourses of old age - have been shown to lead to stereotypical images of the aged population (Neven 2010). However, scripts do not determine the user (Pols and Moser 2009). Although the "processes of configuring and scripting are expressions of power and may cause dynamics of exclusion or marginalisations" (Cozza et al. 2020, 273), the semiotic approach has been criticised for emphasising the designer's role and assumed intentions (Mackay et al. 2000; Oudshoorn and Pinch 2008).

The material semiotic approach addresses ethics by emphasising prescriptions. For example, Latour (1992) has described how the imperative for car drivers to slow down is inscribed into speed bumps. Thus, police officers' responsibilities are delegated to material artefacts. In contrast, Verbeek (2006; 2011) has incorporated script analysis more explicitly into normative ethics by studying how engineers do "ethics by other means" by "materialising morality" into technology. Both Latour and Verbeek highlight that the outcomes of relationships with technology are not predetermined. However, in this body of research, ethics easily becomes "top-to-bottom" rules inscribed by the human designer into technology. This view reinforces the idea of ethics as deontological imperatives. However, it is not only designers who do "ethics by other means". The constitution of ethics in everyday use of technology is just as important as the ethical prescriptions inscribed in its design. Also, as Ludwig Wittgenstein (1958) has shown, a prescription or rule does not include unambiguous instructions for applying that rule. Thus, although morality is inscribed in technology, there is no one correct way to "follow the script". For this reason, I turn to studies on empirical ethics that build on the material semiotic tradition and Wittgenstein's later philosophy (see Pols, 2017).

Studies in empirical ethics have examined how normativity is performed in practice (Pols 2017; Pols et al. 2018). In consensus with the ethics of care discussions in feminist theory (e.g., Puig de la Bellacasa 2017; Sevenhuijsen 1998; Tronto 1993), the empirical ethics approach stresses situated interdependencies and dynamic relations. Rather than emphasising norms and values as prescriptions in technology, normativity is seen as the outcome of interactions between humans, technologies and discourses. A focus on empirical ethics does not imply that ethical guidelines do not matter. Rather, it suggests that an ethics is not determined by design and engineering but is, instead, an ongoing process. Caring practices have been a major site for adapting the empirical ethics approach because they deal with how to accomplish good care in its various forms (Lydahl and Löfstrand 2020; Mol 2008; Pols et al. 2018; Thygesen and Moser 2010; Willems and Pols 2010). This approach emphasises situatedness, practices, relationality, and thus the importance of ethnographic research, which is well-suited to grasping these aspects of care. Following this line of thought, this article examines how users and ethics are co-constituted in dynamic relationships between humans, technology and discourses. In this view, robots are not expected to enact any moral rules, such as respecting autonomy. Instead, they are seen as co-constituting the local, practical and multiple ways of achieving the good.

According to this theoretical framework, I use the concept of "figuration" as a theoretical-methodological tool with which to contextualise the usability trials into the broader politics of contemporary healthcare. Here, figuration is an umbrella concept that links user configuration, ethics-as-practice and the ageing-and-innovation discourse. It has two advantages when contrasted with "configuration", which is a much-used concept in semiotic user studies (e.g., Neven 2010; Mackay et al. 2000; van Oost et al. 2009; Woolgar 1991). Firstly, figuration does not only illustrate the configuration of users, nor does it only emphasise the ethical intentions of designers; rather, it focuses on the co-constitution of users and ethics in usability trials. Thus, figuration refers both to the various user "figures" and the normativities enacted in human-robot interaction. Secondly, figuration identifies users as embedded and embodied subjects, as "material and semiotic signposts for specific geo-political and historical locations" (Braidotti 2019, 34) - in this case, in the Nordic welfare state of Finland - as well as the promises of technology evident in the ageing-and-innovation discourse. Before putting this framework into action, I will discuss the context of the trials and methodology.

3. Materials and Methods

This paper is based on an ethnographic project that examined the usability trials of a SAR prototype in dementia care in Finland. The care unit provided in-patient care which consists of long-term residency, specialised staff and constant supervision, with social and medical services, meals and accommodation provided (Kriegel et al. 2019). The research material was gathered over three weeks in 2019. The material is comprised of field notes from participant observations and a number of informal engagements with the testing group and the staff of the unit which equated to roughly five ethnographic interviews. Through these, information on the robot's design and purpose was gathered. The field notes consist of observations and verbatim notes on the users', testing team's, and robot's spoken interactions. The care unit was also observed during the daytime. The interviews were informal, and they were not recorded. Instead, notes were taken during the interviews. An ethnographical approach allows to ask "how technologies are embedded, evolving, and impactful in our personal and social lives, and how these tie into issues of social control" (Van den Scott et al. 2017, 509). In this case, ethnography is an invaluable way to see how SAR technology affects dementia patients' lives and how usability trials act as part of the optimistic technological determinism implied by the ageing-and-innovation discourse. The ethnographic approach also reveals ethical complexities that do not resolve into concerns about guidelines, imperatives, prescriptions or design.

The robot in question (Fig.1) is a socially assistive and autonomous robot, Sanbot Elf, developed by "Qihan Technology Co. Ltd." and modified with applications and automated navigation. Figure 1 illustrates the robot's appearance. The SAR has humanlike features, and it stands at approximately 145 centimetres tall. The SAR's graceful white body bends forwards slightly, evoking a user who sits in a wheelchair. A touchscreen on the chest serves as the main tool with which to control the robot's functions. The robot has a soft pre-recorded voice (the voice of one of the testing team). The SAR can engage in short discussions in Finnish. This ability helps with the robot's interactions and in achieving the goals of robot therapy (Abdi et al. 2018; Tuisku et al. 2019). Lacking "intuitive, reflective, and/or critical thinking skills" (Huschilt and Clune 2012, 17), however, the robot is unable to respond dialogically or become sociable in any authentic sense (Jones 2017). "Let's do something fun together!" the robot suggests. It also asks questions, such as: "Do you have any pains?" and "Have you taken your medicine?". It often replies to the user's (presumed) answer with an uplifting "right!" These prefigured lines suggest that everything is going well - the robot's answer is always the same, whether or not the user has taken their medicine.

Figure 1. The socially assistive robot (SAR) prototype "Sanbot Elf".

Four different applications were tested: short stories, a memory game, a "musical journey" and physical exercise. The minutes-long stories were about Finnish presidents, a nearby pond and a folk poem. The SAR narrated them while showing accompanying pictures on its screen. In the memory game, the touchscreen with the robot's 'ears' and 'arms' changed colour, and the robot urged the user to answer, asking with an uncanny voice, "What colour is this?". In this application, the warm human voice changed to a non-gendered and monotone "robot voice", which was unsettling for the trials' participants and spectators. In the "musical journey", the SAR played popular music based on the birth year of the user. The music was introduced along with pictures and stories about urbanisation and wartime, when “gramophones changed to vinyl records” and movies “turned from silent to talkies”. In the exercise app, the user could execute either an arm or leg exercise while sitting down. When the user chose an option, a video began playing featuring a physiotherapist who showed the moves and explained how to do them. The SAR’s role as “therapists, companions, and educators” (Huschilt and Clune 2012, 15) to people with dementia prevailed in the test applications. The exercise application was a form of physical therapy, and the memory game and stories offered cognitive stimulation. The applications were chosen during project meetings and interviews with the facility’s staff. This process shows that the developers and providers of the robot were more interested in care employees’ evaluations and how they imagined the user than in actual users’ genuine participation (Compagna and Kohlbacher 2015; Cozza et al. 2020).

The trial’s participants were residents of a public care home for dementia patients in Finland that is accustomed to technology pilots. The trials were conducted as part of the unit’s everyday routines. During the trials, 75 interactions with 18 residents (seven male and eleven female) were conducted. Consent was required for participation. I observed 26 sessions, which lasted approximately 20 minutes each. In addition to the residents, the robot and myself, two representatives of the testing group - one of whom controlled the robot’s movements - were present during the interactions. The nurses seldom oversaw the sessions, which started with the testing group presenting the potential activities. The trial team’s intention was to test all of the applications, and the team’s “sales pitches” sometimes had a major impact on a resident ultimately agreeing to use the robot, even when they were initially hesitant. After the sessions, the teams asked the users questions about the robot’s appearance and usability. I did not participate in planning the interaction setting. Although I participated in some of the unit’s routines, which I discuss in the analysis below, during the sessions my role was mostly that of a spectator. My ethnographic approach was aligned with the principles of the empirical ethics approach. This kind of methodology can be called “uncontrolled field studies” (Pols 2012), in which the object of the study is approached without preconfigured frames of analysis. This approach resulted in my seeing the interaction itself not as dyadic but as multilateral - as a “crossroads” in which people, technology and discourses meet - and such relationships cannot be predetermined.

The trials faced many challenges. The robot and its functions constantly changed because of updates, added content and malfunctions. The musical journey application, for example, was added to the robot during the trials. The changes caused delays, and because of these, it sometimes became unclear what was actually being tested. For example, the photo show was a preliminary application, but it was only tested from a laptop, instead of the robot itself. Somehow, the results were deemed applicable to the robot by the testing team. The robot was also expected to distribute medicine, but this task ultimately proved too difficult. However, to stay true to the research design and, more importantly, to please the financiers, the robot was used very briefly as a transport trolley for medicine. Also, although a great deal of effort was invested by the team into the robot's automated navigation properties, they were not used in the trials.

The SAR usability trials exemplify how care technologies aspire toward "the good" for individuals, economies and societies. Below, I will examine how various user figures and forms of "the good" for the older users were co-constituted in the trials.

4. The Figuration of Users and Ethics

I have identified four different figurations that emerged during the Sanbot Elf trials. The figurations refer both to user types, the "figures" of enabled, disabled, dismissed and subversive users, and the related normativities. I discuss these figurations along with short ethnographic stories. Because the SAR offers cognitive, affective and physiological therapy, I refer to the aspiration toward good as a "therapeutic gain". What this 'gain' turns out to be, however, depends on the situated human-robot interaction. Figuration calls into question any stereotypical or one-dimensional images of older users. None of the residents in the trials, however, enacted only one figure. Different contexts could enact different kinds of users between and during sessions. Thus, my focus is not on fixed states but on continuums. I argue that the usability trials illustrate not a set of universal moral values to be accounted for in design processes or otherwise but, rather, normativities that are situated in the relational outcomes of human-robot interaction.

4.1 The enabled figure

The enabled figure exemplifies how the promises of the ageing-and-innovation discourse were affirmed. A spontaneous session with Maria, a resident during the Sanbot Elf trials, illustrated this process. Before the session, Maria had repeatedly mistaken me for her son, who is "also tall", showing signs of trouble with recognition. Though my judgement is not that of an expert, I believe that dementia could also be seen in her actions when she was unable to recall that her clothes were her own and attempted to return them to the staff. Such behaviour is not unusual to the facility's employees who, on another similar occasion, had been reluctant to "call the police" and report the alleged "theft" of another resident's clothes as the resident had requested. Maria also needs assistance when moving. Once, she asked me to walk her to the nearby couch, which I gladly - albeit cautiously - did. Despite these 'frailties', Maria is one of the more active residents, engaging in discussions with others in the shared facilities.

Although Maria needs the care that the unit provides, this session with her illustrates how interactions with the robot can affirm and expand the residents' abilities. The session started when Maria was drawn to the testing place by the robot's presence. She was not part of the day's schedule, but it was "okay" with the testing group if she wanted to listen to some music. The 'musical journey' application was then tested. Maria sat down and touched the screen. A classic Finnish waltz from the 1950s began playing. Maria felt like dancing and swayed to the music. She commented on the pictures shown onscreen. A moment of applause and many thanks from Maria ended the songs, of which she seemingly never tired. When the scheduled resident arrived, Maria stayed and listened to the tunes. However, she soon fell asleep.

Like Maria, most of the residents found the robot and its applications favourable. These residents perceived the robot to be safe, calling it "benevolent" and "beautiful". In addition to "dancing", the musical journeys induced physical "exercise" and abilities, such as stamping one's feet to the rhythm and singing along with the songs. Although the musical journeys were especially successful, the short stories also earned positive appraisals. The short stories aroused memories and associations of past experiences, which seemed appropriate (that is, "positive") in the context of the applications, evoking responses in the user which seemed happy, joyful and excited. In addition, residents recognised the historical contexts of the short stories and musical journeys. Stimulating nonverbal and verbal communication, promoting positive emotions and evoking past experiences are some of the desired aspects of "robot therapy" (Huschilt and Clune, 2012, p. 16). Based on these positive reactions, the testing team and the unit's staff considered the robot a success.

The ethical framework established by Sorell and Draper (2014) and discussed in the introduction outlines enablement, independence, autonomy, social connectedness, safety and privacy as important values. The enabled figure exemplifies how these values can be achieved in some sessions. The enabled figure likes applications that arouse memories, satisfaction and discussion, offering a chance to enforce independence, autonomy and social connectedness. When the SAR is not perceived as frightening, the value of safety is evoked among the residents. When the user could use the robot without assistance, privacy was enforced. How this kind of therapeutic gain aligns with the optimism of the ageing-and-innovation discourse is important. Here, the robot works as a therapeutic companion to the user. It achieves a normativity of enablement that respects the aforementioned values. Still, other figurations were present during the Sanbot Elf trials. In addition to enablement, disabilities were also enacted. Thus, such usability trials become *(us)ability* trials, in which, instead of the usability of the technology, the abilities of the user are tested.

4.2 The disabled figure

The outcomes of care technology implementation often differ from politicians' and designers' hopes (Pols 2017), which in this case means the expectation that robots can act as helpers and therapeutic devices. The disabled figure stands in contrast to the promises laid out by the ageing-and-innovation discourse. A story involving Helena, an always-smiling female resident, best exemplifies how disabilities were co-constituted in interactions with the robot. In her session, Helena tested the physical exercise application. When starting the app, the SAR invited Helena to keep herself fit by saying, "Let's do some exercise!" Helena chose the upper-body exercise. When the video started, the onscreen instructions seemed difficult to follow. Helena sat quietly, attempting to understand the video. To assist the robot, a member of the testing group performed the moves. At first, this intervention did not help either, but finally, with a human example, Helena accomplished "hugging herself", which was part of the exercise. Nevertheless, doing both parts of the exercise was problematic, requiring Helena both to hug and to let go. Her arms were left behind her back, which seemed uncomfortable. After the video, Helena felt "tired" and wanted to stop the session for the day.

During the trials, it became clear to the testing team, the users, and me that the exercise was difficult to follow. None of the users were able to do the moves "until exhaustion", as suggested by the robot, with or without human assistance. Sensory disabilities were further enacted when hearing, watching and touching the robot. It was sometimes difficult to see and understand the onscreen symbols. For example, one resident, Veikko, could not choose between the green and red options offered because he was colour-blind. Disabilities are not merely 'essential' qualities of a user which technology passively reveals. Instead, technology co-constitutes disability as the outcome of the user's interactions with it (Moser 2000; Moser and Law 1999). Thus, colour blindness is co-constituted in human-robot interaction as a deficiency when only red and green options are provided. In addition, the touchscreen was extremely difficult to use. Only a few residents could use the screen by themselves; for others, the testing team controlled the robot. The more any expectations inscribed in the applications were nullified by the actual users, the more improvisation was needed to achieve smoother, albeit still awkward, interaction. This effect meant that the idea of the robot as a therapeutic helper did not hold. Instead, the robot itself constantly needed help.

In comparing Maria and Helena's stories, it is interesting that interactions with the same technology can both affirm and deny ability in different situations. When disabilities were affirmed, help from the testing team was needed for residents to use the robot, as was the case with Helena. This need for help can result in a human example of "doing an exercise" or assistance with the touchscreen. In this kind of normativity, vulnerabilities lead to interdependencies. In terms of therapeutic gain, robots that co-

constitute disabilities instead of affirming abilities are probably not desirable. However, the disabled figure does not necessarily contradict ethical guidelines that highlight the affirmation of abilities. Vulnerabilities call for social connectedness. In this way, the possibilities of belonging, being accounted for and being cared for remain. Thus, enacting disabilities is less an ethical disaster and more a chance to re-examine the trials' complexities. Although enablement has been stated as an important imperative for designing care robots (e.g., Sorell and Draper 2014), the disabled figure partly questions this assertion. Vulnerabilities, not enablement, are the precondition for residents receiving care in the first place. Next, I discuss further the situations in which the issue of interdependencies arises.

4.3 The dismissed figure

When the robot's overly optimistic "attitude" and "negative" associations clash, the user is figured as "dismissed", with hardly any therapeutic gain from the encounter. A session with Liisa provides an example of the dismissed figure. Before her musical journey, Liisa told us about a close relative who "died while cycling". It is difficult to say whether the robot aroused these associations. It certainly seemed to have. The SAR introduced the next song, an evergreen melancholic love song from the 1940's. This choice differed from Liisa's wishes. She would have liked classical music; someone close to her had worked in the opera. While the music played, Liisa again spoke about the person who died. During the next song, Liisa recounted how someone "started drinking". The melancholy post-war songs being played were sad, and I too was beginning to feel blue.

The music application does not include classical music, which is Liisa's preference. Instead, for the robot, melancholy pop tunes seem to suit everyone. However, Liisa does not fit this kind of image of the user and, thus, was dismissed; her personal history of opera lovers and dead family members was not responded to. Providing stressful information about death, alcoholism and loss is not new to SAR implementation (Sabelli et al. 2011), and of course, therapeutic interventions often involve facing traumatic memories. However, it is difficult to consider Liisa's story as a form of robot therapy when it is contrasted with the idea of 'everything going well', which is inscribed in the robot.

A session with Pentti clarifies this tension. Before the session could begin, the SAR needed to be restarted. Pentti uses a wheelchair and has many concerns. He began a discussion by explaining that he had hurt his fingers. I could see that they had turned black. Although he seemed spry, Pentti talked about his problems with insomnia. In his opinion, the melatonin the doctor had given him was a dosage "for little children". He also felt hesitant to talk to the nurses, who "do not speak Finnish well". When the SAR rebooted and started asking questions, Pentti answered that he had taken his medicine but still had pains. Today "is not a good day", he said. “Right!” the robot replied, ending the small talk.

The dismissed figure produces ethical ruptures. The anxiety that sickness and injuries bring arouses critiques of the nurses’ and doctors’ capabilities. Pentti was critical of his dosage of melatonin, which in his opinion, did not help. Furthermore, he was unsure whether the nurses with immigrant backgrounds could understand and respond to his worries. The SAR, however, dismissed all these anxieties. As with Liisa, the robot’s overly optimistic and preconfigured “attitude” clashed with the associations that were raised during Pentti’s session. This is problematic. The way the SAR functions nullifies any call for responsiveness - users like Liisa and Pentti are left alone with their worries and troubles. In contrast, the unit’s nurses stressed the importance of always answering the residents, no matter how repetitive they are.

It was also clear that the care provided in the unit was, in addition to responsiveness, about empathy. The need to ground care in an empathetic relationship is evidenced by the critique articulated by Pentti: he spoke it not for the robot to hear, but for us - the trial’s spectators - in the hope of recognition and response. As Tuula, who tested the robot in many sessions, put it: “It would be nice if it were human.” Discussions with people were preferred to discussions with the robot. If the enabled figure illustrates how technology can be a joyful companion, relationships that produce dismissal, in contrast, enact the distinction between “cold” technologies and “warm”, human-centred care (Pols and Moser 2009). An unempathetic robot is a cold companion. The SAR’s empathy ends with its inability to run people over, an aspect the testing group stressed when a resident was unsure whether the robot could be trusted not to run over her feet. However, the normativity of responsiveness and empathy cannot be dismissed in care practices. Because the robot was unable to answer or act empathetically - that is, to care - this responsibility was distributed to the trials’ spectators. When one resident asked, during a session, if her husband was dead, the testing team and I had to answer without knowing the right answer (the robot certainly did not have the answer) or knowing the right *way* to answer; we had to improvise. In these situations, the roles changed: suddenly, *we* were being tested as to whether *we* knew how to care.

It became clear that the robot’s users were constantly assisted, which calls the idea of independence into question. When a user’s independence is removed, interdependencies are put into action. Interdependencies are linked not to moral contracts to be executed but to the situated practical “tinkering” that is caring (Mol et al. 2015). Empathy and responsiveness are not universal moral values or imperatives; rather, they are situated and relational ‘goods’ that emphasise neither idealised images of love and recognition nor the ideal of ‘everything going well’ but, instead, a troubling awkwardness and improvisation. In contrast to the enabled and disabled figures, the dismissed figure illustrates how the possibility of therapeutic gain in these trials gradually disappeared. The session with Pentti already showed the criticism the robot could elicit. However, the user was also figured as subversive in many other ways, which I will discuss below.

4.4 The subversive figure

In the ageing-and-innovation discourse, old age is viewed in the negative, as a problem and a lack (Neven and Peine 2017). This results in identifying special ‘needs’ for the aged that the young and healthy do not have. Problems with memory call for memory stimulation and rehabilitation, for instance. Thus, short stories, ‘musical journeys’ and a memory game were installed in the robot, as mentioned above. However, some of the older users were reluctant to position themselves as old and frail or, indeed, to accept the relationship between old age and the ageist inscriptions in technology (Neven 2010). During the trials, verbal, nonverbal and silent opposition emerged. The best example of verbal opposition in the Sanbot Elf trials was a session with Tauno, a man born in the 1920s who followed and understood the applications easily. He commented on them with indelicate remarks, clearly unsatisfied. After the memory game, in which he deemed the colour red to be the “colour of a commie”, the observing group member declared Tauno the “winner”. The man asked in response, “What was there to win in that?” As a concluding remark for the session, Tauno stated that the robot “needs a hell of a lot of improvement”. He said he “is not going to stay here looking at this kind of toy” and further insisted on “getting rid of that computer”, which is “not much good at bullshitting”.

Opposition was not always this striking; sarcasm is one example of this. In one session, when the robot asked Helena’s gender, the ironic reply was, “Guess.” Another example came when testing the memory game: the user stated that the colour was “mostly blue”, emphasising “mostly”. At times, in the Sanbot Elf trials, the robot was a source of humour for participants, something to laugh at. Such was the case with the memory game, especially. Even the testing team deemed it “horrible”, too simplistic, easy and non-activating. At other times, the users were cooperative but seemingly chose not to answer the robot’s questions or follow the testing team’s instructions. In earlier user studies, reluctance and incapability to enact the expectations laid on the user have been conceptualised as “re-configuration” (Mackay et al. 2000), “non-use” (see Oudshoorn and Pinch 2008) and “innosumerism” (Peine et al. 2014), for example. However, these concepts frame older users too narrowly within the perspective of active and critical consumerism (see also Compagna and Kohlbacher 2015). Silence and refusal offer slender opportunities for future innovations and reconfigurations. For this subversive figure, no therapeutic gain can be achieved in terms of the ageing-and-innovation discourse. Instead, the subversive figure illustrates that the individual good is missing. What is present, however, is criticism that calls for alternatives.

So why did the stakeholders deem these trials a success in spite of the ambiguities and the subversive users discussed above? I claim that this is because the trials were performed under the logic of the ageing-and-innovation discourse. Future-orientation and promises of high-tech innovations are important facets of this discourse (see also Crabu 2014; van Lente and Rip 1998). Thus, criticism in the present might be offset by the hope and optimism placed in future improvements. Indeed, the testing team highlighted a future-orientation: the robot was introduced as a tool to gather data for improvements. Although the inactivity and opposition that the subversive figure illustrates could be seen as negative effects of interacting with a currently underdeveloped robot, these kinds of "failures" can always be framed as desirable, and thus justified, regardless of whether they result in any actual improvements. Some of the nurses, too, were happy when the robot had any activating impact on users. This "everything goes" rationality echoes the pervasive ageing-and-innovation discourse, in which technology's mere presence is more important than how well a technology executes its tasks (Neven and Peine 2017). Although care robots are designed according to moral imperatives and "universal" values, they are implemented in care practices under the rationality of 'everything goes' which questions the idea of ethics as guiding principles.

5. Conclusion

This article has presented care robot trials as a site of ethics-in-practice. Instead of a deontological ethics approach, which is the norm in ethical discussions of care robots, an empirical ethics approach informed by the concept of figuration was conducted. This approach resulted in identifying four different user figurations: the enabled, disabled, dismissed and subversive. In turn, all of these figures have illustrated what kinds of therapeutic gains are (or are not) accomplished for older users in human-robot interactions. In the trials, normativity in action meant a clash between abilities and disabilities, dismissal and responsiveness, and independence and interdependencies. When disabilities, responsiveness, and interdependencies were enacted, an ethics of care came to the fore. This kind of ethics is based on care practices that stress improvisation and tinkering. This formulation of ethics is not usually included in ethical discussions on SARs or the present state of the robot, because the discussion is too firmly focused on deontological ethics and design processes.

The article's findings question the idea that "universal" moral values, such as autonomy, enablement and independence, should be central in ethical assessments of care robots. The trials do not resolve into the normativity of enablement which stems from the ageing-and-innovation discourse. Indeed, only the enabled figure enacted these values and fully realised the optimism of the "triple win" rhetoric. Because the SAR enacts the interdependencies of care, rather than the independence of the care receiver, its role as the liberator of the workforce and saviour of a demographic is questionable. The contradiction between the ideal of an autonomous, independent user and the actual and dependent residents connects to neoliberal healthcare reforms that, in the care unit discussed, had been introduced, for example, in the form of an imperative to refer to residents as 'customers' in order to respect their autonomy and freedom of choice. The need to address dementia patients as 'customers', and the independence expected from them as users, exemplifies the kind of user that is imagined as desirable and ethically justified in contemporary care practices, that is, a 'customer' who is in need of cognitive and physical therapy but is nevertheless active, autonomous and able (see also Frennert 2016). In practice, though, "the logic of care" (Mol 2008), functioning not on the independence of the customer but rather on interdependent relationships, came to the fore in these trials.

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Co-production of Peer-to-Peer Care Practices

The Case of a Social Innovation in Elderly Care

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Abstract: This study analyzes the co-production of peer-to-peer interactions as a social innovation that utilizes older people's resources as a means for providing public care. We ethnographically explore an initiative named Give&Take that aims to establish peer-to-peer care among older people. We draw on a practice perspective with respect to care and its organization while also being influenced by the conceptualization of sociomateriality. The study illustrates the co-production of peer-to-peer care within a social innovation at the intersection of formal and informal care. We show how care practices and their specificities clash with institutionalized logics in the co-production of care. In conclusion, we argue that considering how care practices are shaped by a set of institutionalized logics in public innovations enhances our understanding of the co-production of care that draws on older people's resources. These findings are of importance to innovations following EU policies on co-production and active aging.

Keywords: care practices; peer-to-peer care; ethnography; aging; sociomateriality.

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1. Introduction

Studies of innovation in public welfare often investigate digital means used, for example, to register, store, and handle data. In contrast to these studies, this article explores an initiative aiming to innovate older people's opportunities to socialize and care for each other (also called peer-to-peer care) as a means of public care. The innovation in this study resembles other Scandinavian innovations that aim to create specific active aging activities through co-production involving both technology and older people's resources (see Lassen et al. 2015). These "welfare technologies" (Östlund et al. 2015) resonate with the European Union's (EU) active aging and welfare policy frameworks (see European Commission 2011).

Concerning public services, co-production is a measure that involves citizens in the design and implementation of services to enhance their delivery (Brandsen and Honingh 2018) by, for instance, tapping into users' (or citizens') expertise and pairing it with professionals' competence (Osborne and Strokosch 2013). Hence, co-production contrasts to viewing older people as passive receivers of public services.

Innovations in elderly care aim to delay older people's needs for formal care by utilizing older people's resources to self-care (Pols 2012). Care solutions that delay such needs also have to be flexible and have the ability to adjust to person-centered requirements, making co-production involving both the public sector and older people crucial. Meanwhile, a lack of understanding of the constitutive aspects of technology and aging (Wanka and Gallistl 2018) and an emphasis on interventionist (Peine and Neven 2019) instrumental logics (Cozza et al. 2020) often lead to the construction of doable problems (Lassen et al. 2015, 17), which are said to contribute to the failure of many innovations (see Peine and Neven 2019; Wanka and Gallistl 2018; Östlund et al. 2015). Furthermore, older peoples' acts of resistance within and towards innovation projects are often overlooked, creating tensions and paradoxes (Yndigegn 2016).

Innovations in public care constitute specific arrangements that provide complex conditions for co-production where different interests (often involving both business and the common good) have to be reconciled. Such innovations need to align with not only the economic values of efficiency and effectiveness, but also the administrative values of the appropriateness underpinning legitimacy (Bekkers et al. 2011). In addition, if we follow what may be referred to as the specificities of care practices (Mol et al. 2010) and try to tap into citizens' resources to care for themselves and others, it is easy to understand that innovations that submit the care of older citizens to the rules and regulations of public discourse (in line with the logics of effectiveness and appropriateness) risk losing the efficiency and strength in the care they set out to utilize.

Understandings of innovations in care are often based on evaluations of single projects and pre-defined effects, which are produced by the outcomes of an innovation itself (Mol et al. 2010). Less research has focused on how this type of complex arrangement of material technologies, fostering common good, shapes and diffuses into practice in social innovations. Viewing innovations as specific arrangements, we may talk about them in terms of “arenas” for wider interaction that co-produce practices (Peine and Neven 2019). Our understanding of the conditions of co-production of care in social innovations that link to broader policy arrangements and the tensions that may emerge between different logics thus needs further attention.

A sociomaterial perspective allows us to better understand the co-production of care for older people. For this purpose, we ethnographically explored one specific case: the EU-funded innovation project Give&Take. Through social and digital innovation, this project aimed to empower older people’s independence by helping them realize their unmet potential to carry out tasks in the realm of public welfare. The Give&Take project is, in many respects, a typical co-design innovation following a Scandinavian political agenda of “welfare technology,” as described by Östlund et al. (2015). Therefore, it is a good opportunity to explore the constitution of care practices and what tensions occur in this kind of social innovation. Our paper focuses on one of the project’s Danish sites.

To develop the understanding of the sociomaterial arrangement of the co-production of peer-to-peer care practices within social innovations, this study had two main questions: (1) How do the sociomaterial arrangement of the Give&Take innovation co-produce opportunities for older people to care for each other?, and (2) What tensions emerge within the co-production of peer-to-peer care, and how do actors navigate these?

This study illustrates the co-production of peer-to-peer care within a social innovation at the intersection of formal and informal care. It emphasizes two actors within the social innovation: the digital technology (a peer-to-peer platform) and the older people who participate in the innovation. We postulate how theory regarding care practices may enhance understandings of the co-production of care in social innovations linked to broader policy arrangements concerning public care and the common good.

2. Understanding the Co-production of Care in Social Innovations

To understand the constitution of (peer-to-peer) care in social innovations, we draw on a practice-based perspective (Gherardi and Rodeschini 2016; Mol et al. 2010). Taking practices afforded by both human and material actors as the central unit of analysis brings together traditions of

Science and Technology Studies (STS), design (Shove 2014), and, we argue, studies on care practices. This enables us to understand how and under what conditions care is enacted. We explore how the workings of different logics enter the constitution of sociomaterial practice by creating opportunities for action, and how these logics unfold in practice. With logics, we refer to arrangements of norms and values that link institutions and actions. In their practice, actors are able to enact and adapt institutionalized logics to specific conditions (Boltanski and Thevenot 2006; Rolandsson 2020).

We are influenced by sociomaterial perspectives that recognize the contribution of material artifacts on different types of interactions between an actor and material objects. That is, emerging sociomaterial arrangements involve different affordances that precondition activity (Gibson 1977). These affordances are not the outcome of the artifact alone nor of the actor alone; they are part of a broader sociomaterial construction both shaping and being shaped in complex interactions between multiple social actors and material objects (Orlikowski and Scott 2008). Our focus has thus been broadened to include both things and humans as part of the care arrangements that make up social innovations. To understand the constitution of peer-to-peer care, we consider the sociomaterial arrangement that arise as part of a broader policy dimension related to the public good and public care (for further discussion, see Hultin and Mähring 2014). In this view, the healthcare organization, a specific technology (in this case, the Give&Take peer-to-peer platform), and users (here, older citizens) are three dimensions of a broader interaction of things and humans that constitute possibilities for the enactment of care.

Innovations aim to find solutions through new ways of organizing, which involves making use of new ideas or inventions in practice (see Sørensen and Torfing 2011). Innovations are arenas for the creation of shared definitions of phenomena and practices linked to aging, thereby reframing the norms and practices of aging (Peine and Neven 2019). In the public sector, innovations attempt to overcome different logics and provide conditions for actors to co-produce network arrangements that may pick up “wicked policy problems” (Bekkers et al. 2011, 8). The Give&Take platform exemplifies the reframing of norms and practices in conjunction with digital technology in public care services, intending to activate older citizens to co-produce solutions to welfare problems.

Social innovations aim to achieve socially recognized goals in innovative ways (Manzini 2013). The empirical case in this study aimed to design co-production between older people and care professionals. Bringing the expertise of service users and professionals together is a common goal in co-production to enhance the delivery of public services (Osborne and Strokosch 2013). Further, this study assesses co-production at the intersection of formal and informal care that involves professionals and encourages older people to participate in public care delivery.

Such innovating has been portrayed as problematic by, for example, Brandsen et al. (2017), who argue that governments encouraging citizens to participate through, for instance, self-organization of spontaneous citizen initiatives, easily manufacture conditions that undermine the essence of such initiatives.

Public care organizations are guided by values of efficiency, effectiveness, appropriateness, and the logics of consequence. In contrast, Mol (2008) and Mol et al. (2010) point out that what is "good" in care practices, such as attentiveness or specificity, is not necessarily efficient or appropriate. Furthermore, when shaped to fit into a public framework and made public, the specificities of care risk being lost, together with its capacity and strength. As Mol and Moser (Mol et al. 2011, 84) state about defining or setting boundaries around care practices, "Where objects are tinkered with, where ways of working are developed, boundaries get contested, unstable, take a variety of shapes." Prioritizing specific definitions and aspects of care and aging, and making these targets for innovative measures, may mask why people need care in the first place, as well as cause additional work rather than efficiency in care provisions (Pols 2010).

Care is as an ongoing sociomaterial accomplishment that can be traced in various practices (Gherardi and Rodeschini 2016, Mol et al. 2010). Such styles or workings are not innate human capacities, and technologies are not passive in care practices, even if they do not act on their own. Technologies may be, for example, normative actors, as they help enact different sets of problems that influence care practices (Mol et al. 2010). As argued by Mol et al. (2010, 11), "A noisy machine in the corner of the room may give care, and a computer can be good at it, too." In this view, care practices are the enacted possibilities offered by sociomaterial arrangements in the shape of humans and objects as an open set, which arise as part of a broader policy dimension.

The analytical implications of this perspective involve observing how care is enacted as part of the sociomaterial arrangement of a specific situation; that is, we look for potentials or opportunities for care fostered in and by assemblages of technology and humans (cf. Orlikowski and Scott 2008). The "art is to compare and contrast different situations of care and to wonder which lesson might transport between them" (Mol et al. 2011, 86), leaving care practices and words "unbounded enough to adapt them to local needs and circumstances" (Mol et al. 2011, 84). Attending to the specificities of one particular social innovation (in our case, the Give&Take project) at the intersection of formal and informal care may develop our understanding of how sociomaterial arrangements co-produce opportunities for the enactment of care, what tensions emerge as part of such co-production and how actors navigate these.

3. A Study of the Co-production of Care Practices as a Social Innovation: The Give&Take Project and the Walking Groups

The Give&Take project (Give&Take 2019) was a three-year (2014–2017) interdisciplinary co-design project funded by the EU Ambient Assisted Living program (AAL). The project involved collaboration between three research institutions in Denmark and Austria, a Danish municipality, and two private companies based in Denmark and Portugal and aimed to develop a digital peer-to-peer platform (the Give&Take platform) for older people. These actors designed the platform to support and organize the sharing of favors, things, and services among older people. In Denmark, where elder care is mainly a welfare state responsibility, the state has set out to provide a stronger user orientation in the provision of care, calling upon the participation of older people in developing new health concepts. Therefore, there has been an increased amount of innovations aiming to strengthen older people's capabilities through innovative welfare technologies and collaborations with citizens (Lassen et al. 2015). Hence, Denmark is an excellent case to explore this kind of co-production innovation.

The empirical site of this study was a walking group, one of the project's local contexts or "living-labs," where the innovation was developed. The walking group started as a public initiative that followed a municipal policy to create new and complementary welfare solutions through co-production involving older community members. We consider, in retrospect, how the Give&Take innovation developed since its inception in 2014 and its situation as of 2019.

The municipality's idea behind the walking group was that the group would self-organize after a few months of public support. The Give&Take platform intended to address the absent linkage between the walking group's participants and the municipal services. It also aimed to sustain the walking group's activity, which the municipal staff from the beginning worried would dissolve without their support. Over six months, the Give&Take project worked to adapt and integrate the platform into the group and provided the walking group a community page, as well as trained its members to use the platform.

To get an insider's depiction of how care practices among older people were co-produced in this specific milieu, we adopted ethnographic tools and techniques (Emerson et al. 2011). We conducted fieldwork for eight months from May to December 2019, which included five instances of participatory observations of the walking group's events, informal conversations with the walking group's participants, 60 hours of observing activity on the Give&Take platform, and conducting three individual interviews. The first author (ES) interviewed two older persons who were using the Give&Take platform and one municipal staff member who initiated the group. In the interviews, which were audio-recorded, transcribed, and lasted up to 60 minutes, we used interview guides with open-ended question sets that followed our emerging conceptual ideas to direct the conversation. ES also analyzed five individual interviews previously conducted as part of the Give&Take project, as well as written and visual materials (both pictures and videos) linked either to the Give&Take project or the municipality's care services. One author (SY) also participated in the Give&Take innovation and conducted participatory observations in the walking group when the innovation project took place (during 2014–2017).

To guide our ethnographic exploration, we adopted the principles of grounded theory (Charmaz 2014). We gathered empirical materials and continuously carried out analyses by letting codes and ideas about them pinpoint directions for further empirical and theoretical exploration. ES gathered and analyzed the data, but all authors took part in a critical discussion to reflect on ES's and SY's ethnographic observations, as well as the analysis of the empirical material. ES coded the materials using a constant comparison method (as part of grounded theory) to search for meanings and actions associated with the co-production of care in this specific social innovation, as well as what tensions emerged and how the actors navigated them. Throughout the analysis—especially when creating conceptual categories and theories—we theorized the shapes of possibilities, established connections, and asked questions about the data. Moreover, ES assembled her experiences and observations by composing field notes and memos. All authors participated in finalizing the manuscript.

Before the participatory observations with the walking group took place, ES informed the participants about the study's research intentions and project, and that interaction with the researcher implied the potential gathering of data for the current study. All participants agreed to have ES conduct participatory observations. Before the interviews, ES collected informed consent from the participants. The participants were also notified that their observations and activity on the digital Give&Take platform might be observed by ES and SY during the participatory observations. Those persons with access to the Give&Take platform agreed to have ES observe their activity. Regarding the analysis of material gathered at previous occasions as part of the Give&Take research project, informed consent from the participating researchers was gathered. This study follows the principles outlined in the Declaration of Helsinki.

4. The Sociomaterial Arrangement of the Co-production of Peer-to-Peer Care within Give&Take

In this section, we portray the sociomaterial arrangement of the Give&Take project, how care was co-produced by different actors, and what tensions this co-production gave rise to, as well as how the actors handled these tensions. We focus on the opportunities fostered in particular by the Give&Take platform and the interactions of the participants.

4.1 The Give&Take platform and how it shapes care practices in the walking group

Routines and artefacts are part of the enactment of peer-to-peer care in the walking group. For example, the care center where the group met up, which allowed the participants to sit down after the walk to chat, and the coffee machine that ensured there was coffee for these occasions, were essential for the enactment of care. The local walking routes, the abled bodies (those who can walk), the older peoples' relationships with each other, their integrity as a group, and their undertakings to self-care were other vital conditions for these care practices. The participants noted that the walking group was about "more than just walking." One member even described it as "therapy." While walking two-by-two or in smaller groups, conversations spanned different topics, including difficult ones, such as loneliness:

> "Yeah, on Monday walks there is someone who supports me. At home, I am alone and do not have anyone to talk to other than myself. Therefore, it is always nice […] because there is someone to talk to while walking and when having coffee together. It is actually the best day." (Noah, 86 years old)

The Give&Take platform was yet another dimension of the sociomaterial arrangement that shaped (and continues to shape) the care practices in the walking group. The platform allowed social relationships to intensify, the activities of the participants to be traced (thereby allowing the municipality to supervise the co-production and self-organization of the care service), the walking group's attendance to formalize, and for distributing responsibilities concerning the walking group's organization and the care for other participants. Below, we elaborate on these opportunities afforded by the platform.

4.1.1 Intensifying social relationships and allowing for care among participants

The Give&Take platform's member page encouraged everyone to upload a profile photo and brief information about themselves, along with their preferences for helping and being helped by other members. This enabled all participants to connect faces and information to others within the group. When the participants were introduced to the Give&Take platform, this enhanced their familiarization with one other. At the point of implementation, the older people had been attending the walking group for only three months, so not all of them knew each other by name. By sharing information about themselves—such as pictures of their grandchildren or information about their wedding anniversaries—via the platform, the participants got to know more things about each other. These actions opened up additional subjects for conversation during their weekly walks and allowed the members to become more familiar with one another, thereby permitting greater involvement in, and concern for, each other's daily go-about.

The Give&Take platform also expanded the opportunities to care by encouraging communication about and participation in activities outside the walking group. For example, three people in the group participated in another weekly event together outside the walking group, which one of the members declared made them closer to each other:

> "[…] because we talk more often, and sometimes we accompany each other back and forth [to the walking group or the other activity] and stuff like that." (Lily, 83 years old)

Moreover, the platform allowed care to occur outside the weekly activity and from a distance; for example, one participant discussed sending greetings to another member who had been through surgery and therefore did not attend the weekly walk:

> "I wrote to Emma, who had surgery due to cataracts, and wished for her to get well soon. I wrote that I had the surgery myself, and it went well. I also wrote to Anne when she had a plastered arm and wished for her to get better." (Margaret, 84 years old)

The platform constituted part of the sociomaterial arrangement that allowed for and shaped the group's endurance and stability (i.e., through the intensification and expansion of their social relationships, especially in the beginning); however, these relationships may have evolved under other conditions, too.

4.1.2 Traceability of the walking group's activity

During the implementation of the platform, one participant was encouraged to upload a screenshot of the walking tour and attach a comment to it. The screenshot showed the data tracked via GPS during their weekly walk, including the route, distance, and speed they walked. The comment provided information on the group's experience of the walk and noted anything extraordinary:

> "We had a nice walk through the cemetery. Today, we were a large group of about 15 [people]. The conversations were lively […]. We had guests from a Christian daily newspaper with both a journalist and photographer." (Excerpt from The Give&Take platform)

The platform thereby allowed the municipal staff to track the activities of the walking group, as well as the older people's attendance. These forms of visualization allowed the staff to steer the walking group into a format that aligned with the municipality's perspective of the group's functioning in terms of, for instance, effectiveness and efficiency. For example, the municipality could follow the development of the group's walking activity and compile the information to see if the older people made any progress concerning their physical health. This visualization also allowed the staff to follow whether someone was not attending the walks, for example, whether there was a risk of a person dropping out and needing extra support, and simply to keep track of how the innovation worked.

4.1.3 Formalizing attendance and distributing responsibility

While the platform intensified familiarization between the participants and expanded their care relations beyond the boundaries of the weekly walking activity, it simultaneously helped formalize their involvement in the group. This formalization was supported as they were provided their own Give&Take community where their roles as members were visualized. Similarly, by enabling the municipal staff to communicate with the group as members of a community, the staff could promote the formality and appropriateness of the group's activities. For example, they could ensure that the group included all older people, no matter if they had close relationships with others in the group, and keep the group open to necomers. As one participant explained, even if a person did not know the others, this person could communicate via the platform:

> "It is really helpful in case you don't have anyone's phone number or there is no one you can call. Then you just enter [the platform] and write that you are not coming."(Lily, 83 years old)

The platform enabled the municipal staff to distribute responsibilities for care and support a particular format of the walking group's practices. As previously mentioned, the group was encouraged to upload a screenshot tracking their route with GPS. This occurred after the municipal staff posted a request on the platform asking if anyone could take on the responsibility of uploading their route's GPS tracking:

> "Dear walking group, I want to ask you if you would care to be part of a little experiment. Could you document the length of your Monday walks to see if there is any development? […] I imagine that it could be nice for you to see how long you have walked and if you have possibly made progress. […] I hope you have the guts for it?"(Excerpt from The Give&Take platform)

One person was already tracking the walking route via GPS, so she took on the task. The other participants rarely wrote or uploaded anything to the platform. By uploading the GPS tracking each Monday, the participant took on the task of securing content to the platform. She was aware that the others saw her posts and continued to do so out of concern for the other participants:

> "We were asked if we could document the walk, and I said I could do it. […] I don't really care if the route is uploaded to the platform, but then, I've asked if we shouldn't stop uploading it, but the [other participants] are like, 'No, it is so much fun to know where you have been walking when we are not attending the walk' [laughs]. We walk almost the same route every time." (Irene, 80 years old)

4.2 The older people's resistance to formalization

The platform's distribution of responsibility and the formalization of the participants' membership in the group met some resistance from the participants, who emphasized their integrity and control over the group and their activities, as well as guarded their boundaries concerning more formal responsibilities regarding organizing the group or caring for other participants. While they were happy to help and did care for each other, the participants argued that participation in the group was supposed to be highly voluntary and without formal obligations. As one participant declared:

> "I feel like this 'walking group thing' should be for me! […] and for me to take part whenever I feel like it. I really want to be part of the group, but not all sorts of other things. But, I mean, I really want to be of help […]." (Irene, 80 years old)

As an example of this voluntary help, the municipality encouraged new participants (i.e., vulnerable older people recruited through home visits) to join the group. One day, when an older man attended the group for the first time, one participant gave her number to the man in case he needed to get in touch with someone about the walks. In other words, she willingly took on responsibility through her own initiative, but resisted being obliged to do so in a more formal way and per the instructions of the municipality. We now elaborate on how the participants took part in co-producing care.

4.2.1 Emphasizing control over the walking group

The older people's attitudes toward the municipality and the Give&Take project were rather halfhearted. Their care practices connected to self-care and familiarity with other participants, routines, and artefacts, such as the key to the care center where they met up or the coffee machine there, rather than the cares or concerns of the municipality. From the participants' perspective, their routines maintained the walking activity. These routines consisted of a particular time and day that the group met, as well as a set place to meet. The group always walked, regardless of the season or weather. As one of the members noted,

> "We have one rule, and that is that we always start walking at 1:30 pm." (Noah, 86 years old)

When asked if they could manage without the platform, one participant of the walking group declared:

> "Yes, of course. We have! We had a walking group, and then Give&Take and the municipality came and were really keen on developing their thing […]." (Lily, 83 years old)

However, the walking group did result from the municipality's initiative, as directed at policies involving citizens' co-production of care services, and when the participants were invited to start using the Give&Take platform at the end of 2015, they did not have the same routines implemented in 2019.

Furthermore, the key to the care center where they met up and the coffee machine there (both crucial for the care activities to take place and to link the older people to the walking group) were provided by the municipality.

4.2.2 Safeguarding one's own boundaries

The older people were also keen to maintain the boundaries pertaining to their involvement in the group and with the other members. Although the Give&Take platform (and the older people's use of it) intensified their relationships, they withdrew from invitations that entailed "fixed" interactions. One example was to meet outside the walking group "just for a coffee," as the Give&Take project intended. As one participant explained, this could entail more than "just a coffee":

> "To have coffee or lunch together with someone from the walking group. That was really the idea of Give&Take, that you should organize that kind of stuff if people wanted to go to the movies or such, but we don't do that. […] I try to stay out of that because I'm afraid to be caught up in the situation and that the other person might become too dependent on me." (Irene, 80 years old)

Here, the specific type of interaction aimed to intensify the participants' relationships was linked to a risk of being drawn into taking on unwanted care responsibilities. While the participants allowed for closeness in their relationships, the walking group setting created some boundaries for this closeness, as well as for the responsibility of others and the walking group as a whole. The meetings on Monday at 1:30 p.m., the walk, and the coffee after, which always ended at 3:00 p.m., framed a start and end of the walking group activity. It was very rare that these lines, which safeguarded the participants and that the platform attempted to loosen, were crossed.

4.2.3 Caring without taking on personal responsibility

The participants cared deeply about their walking activity and through it about each other, such as through the procedures attached to it. The group was firm on not deviating at all from their established routine unless everyone was willing and able to take part in the change. They always made sure that they included everyone—and that no one took on personal responsibility for their decisions on, for example, where to walk:

> "We tend not to go anywhere else besides the usual walking group or the walking route. […] If you don't agree or not everybody thinks it is a good idea, we don't go there. Then you have to go there on your own." (Noah, 86 years old)

If they wanted to walk at another location, they still met at the same place and took the bus together from there. They did not want anyone to miss the trip because they made changes. On one occasion, a participant reported pain in her foot and had to stop during one of the walks; however, she insisted,

> "No, I'll keep walking, or I'll just turn back. You should keep walking!" (Lily, 83 years old)

She ensured the walking activity would be maintained and that no one else assumed responsibility for her. By taking responsibility for themselves but not for the group or others (unless voluntarily), and expecting this from others, the participants cared for the walking activity without having to take on personal responsibility for each other.

5. Tensions Regarding the Co-production of Care: Effectiveness, Efficiency, and Appropriateness

The sociomaterial arrangement of the co-production created opportunities for peer-to-peer care between the participants to take place. The arrangement included the older people's ability to meet, be together, and get to know each other; the care center where they met to walk and have coffee afterward; their routines and independence; and the flexibility and voluntary character of their attendance. However, tensions occurred regarding the effectiveness, efficiency, and appropriateness of the activities that made up the care service. While the older people stressed control over the group, the municipality emphasized its need to ensure the walking group's alignment with the municipality's principles. As one municipal staff member explained regarding the "loose" format and setup of the co-production:

> "[…] This peer-to-peer model is very loose; it is much more difficult to manage the result to develop in the direction you want it to, and it requires that you have a much looser working frame to work within. […] This group is more such a 'we all do it together ad hoc' group […] so who is it really that we can go to if there is something that doesn't work?" (Alex, municipal staff)

For the municipality, it became an issue of who was to take on the responsibility to ensure, for example, the walking group's appropriateness. The goal of the co-production as part of the Give&Take project was to create conditions for a new welfare service by supporting older citizens' ideas concerning activities enabling them to meet and be together. One necessary condition was the group's ability to self-organize, which they did, for example, by maintaining their walking group routines. However, in the municipality's view, their self-organization was problematic. The municipal staff member explained that,

> "When they have walked together for some time and if they are not that big of a group […] they might become tighter and close themselves as a group. That is all right if there are four people who are personal friends, but then that is not a group that we should cooperate with because that you cannot support [as a municipality]." (Alex, municipal staff)

To the municipality, the group had become inappropriately bound by close relations between the participants. Attempts to make the group less informal by formalizing their attendance through the Give&Take platform failed. The older people did not share this view and believed they were open to newcomers. However, the older people's unwillingness to take on more formal responsibilities impeded the municipality's attempts to distribute responsibilities for the walking group (i.e., taking responsibility for newcomers). Both present (as well as potential) participants expected the municipal service to be responsible for allotting new participants to the walking group. One municipal staff member described such an occasion:

> "Recently, we had an incident with a citizen who called and said, 'I was out there [where the walking group meets] and there was no one there, so that group can't exist anymore.' He was very upset with us for having advised him to go there. So, then I needed to get in touch with someone to find out—does the group still exist so that we may allocate people there? Then there was one woman who was ill, and she was the one I was in contact with, and she didn't really know. This can be difficult alright […]." (Alex, municipal staff)

The municipality's attempts to manage and link the group to the co-production via the Give&Take platform required tying the participants to the platform. Hence, for the municipality to manage them, the municipal staff had to work to draw the older people to the platform, which required more engagement from the municipality to handle the co-production structure they set out to make. This work impeded the rationale for effectiveness and efficiency, as associated with the previously mentioned logic of consequence (Bekkers et al. 2011).

The participants' response to attempts to tie them to responsibilities was to distance themselves from the municipality. However, the walking group was dependent on the conditions the municipality supported; the care center where the group met to sit down after walks and the coffee machine there were both crucial for the care activities to take place and for linking the older people to the walking group. For the municipality, questions remained concerning the walking group's access to the care home where the group met:

> "I'm not sure how to put it, but they shouldn't use our resources as a small private group." (Alex, municipal staff)

If the municipality withdrew from the co-production of the walking group, the participants' care practices, which included caring for the activity itself, others, and themselves, would be difficult to maintain. At the same time, there was no sign of their care practices becoming more effective, efficient, or appropriate. The inability of the municipality to manage the walking group created other problems, including how to co-produce care at the intersection of formal and informal care.

6. Discussion and Conclusion

The digital platform and the participants constituted a sociomaterial arrangement involving the interaction of humans and objects fostering possibilities to enact peer-to-peer care as part of the Give&Take innovation. The digital platform provided opportunities to intensify the participants' relationships and for care to take place outside the weekly walking activity's setting. Furthermore, it allowed the walking group's activities to be traced, thereby allowing the municipality to influence the group by formalizing attendance and distributing the responsibility for care within the walking group. The older people's ability to enact care linked to practices of being attentive to oneself and others, contesting boundaries, and protecting one's integrity (i.e., withdrawing from more formal care responsibilities). However, as the participants stressed the group's and their own integrity, they impeded the opportunities provided by the platform.

Tensions arose as the Give&Take platform aimed to facilitate opportunities for the municipality to supervise the co-production of care among the participants, but the older people resisted such supervision and showed little interest in using the platform. These conditions eventually left the municipality with the same issue that the platform aimed to solve: how to efficiently and appropriately manage the co-production for the municipality to produce a legitimate care service that builds on self-management and peer-to-peer interaction. What unfolded were unresolved tensions regarding the appropriateness and efficiency of the co-production, which implies that competing logics inform involved actors when they set out to co-produce peer-to-peer care (cf. Boltanski and Thévenot 2006, Mol et al. 2010). We now attend to these tensions.

6.1 The co-production of peer-to-peer care practices

Similar to many other Scandinavian co-production innovations and "welfare technologies" (Östlund et al. 2015), as well as the EU's policies and intentions to develop specific sets of active-aging activities (Lassen et al. 2015), Give&Take asked older people for particular versions of care (cf. Pols 2010). To co-produce peer-to-peer care, the innovation invited participants to exercise independence, responsibility, and manageability but discouraged them from becoming too self-governed, informal, or "uncontrollable." The Give&Take platform mobilized problems that influenced such practices. This mobilization focused on the promises of the Give&Take technology and the municipality's expertise and interest. Such focus has previously been portrayed by, for example, Lassen (2015) and is said to lead to the failure of many innovations in aging (see Peine and Neven 2019; Wanka and Gallistl 2018) and, consequently, to more work for those who provide care (Pols 2010).

Within public care, innovations try to overcome different logics by creating new, innovative solutions for the co-production of care (Bekkers et al. 2011). In the Give&Take project, institutionalized logics (i.e., effectiveness, efficiency, and appropriateness) molded the emerging co-production between the municipality and older people. Consequently, the co-production became more about administrating care resources (by managing the older people) than actual care. As the ability to care by principles that are unfixed, general, and manageable was lost, so were the possibilities to utilize the strength of the older peoples' care practices (cf. Mol et al. 2010). In other words, the "resources" which were to be utilized and that unfolded in older people's care practices could not be made "doable" (Lassen et al. 2015), in line with the norms and values underpinning institutionalized logics.

Characteristics such as attentiveness or specificity considered to be good in care practices are not necessarily efficient or appropriate (Mol 2008). In their care practices, the older people demanded a certain degree of freedom and rejected subordination to the municipality's management. We can view their withdrawal from the co-production as resistance overlooked in the innovation (cf. Yndigegn 2015). This, we argue, exemplifies how innovations in public care that try to tap into citizens' resources need to handle the somewhat loosely bound nature of care practices (see Mol et al. 2010). When developing the workings of care, its boundaries are contested and take a variety of shapes (Mol et al. 2011), causing tensions to arise between logics of care and institutionalized logics.

By offering co-production, the Give&Take project also fostered a sort of partnership. The innovation's loose character allowed for care practices to occur and develop while simultaneously (loosely) linking the older people to the municipality through, for instance, obligations to self-care, be active, and organize the walking activity. The findings imply that these activities were characterized by a certain equality or at least inclusiveness that may also have served the older people. We may therefore see the platform as a boundary object (Star 2010) that enabled co-production of care where both the municipality and the older people continued to meet social demands and obligations in relation to each other, despite a somewhat loosely organized co-production arrangement (cf. Allen 2020). However, obligations still guided the connections between the older people and municipality.

6.2 Theoretical implications for practice

Our study shows how care practices unfolded in a specific social innovation that aimed to co-produce peer-to-peer care for older people by tapping into their resources. We showed how care practices, their specificities, and logics clash with institutionalized logics enacted in the co-production of care. We argue that considering the logic of care practices (Mol 2008; Mol et al. 2010), together with the logics of effectiveness, efficiency, and appropriateness in public innovations from Bekkers et al. (2011), expands our understanding of the co-production of care that involves citizens' resources—something that prevails especially pertaining to EU policies on co-production and active aging. Such consideration may enhance the chances of creating co-productions that serves and benefits from older citizens' care practices. Future research may look into what kinds of ties this type of co-production generates and what the effects of these ties are. Regarding tensions, more research is needed on the tensions between managing and self-managing in relation to co-production.

Instead of treating social innovations of care for older people in terms of failure or success stories, social innovations may be understood as arenas where possibilities to care are enacted as part of the sociomaterial arrangements. By taking practices as a central unit of analysis, we may bring together traditions of STS, design (Shove 2014), and care in this endeavor. If recognizing how and under what conditions co-production of care following EU policies on active aging (see European Commission 2011) is enacted in innovation projects, we may use these projects as arenas to improve our understanding of the sociomaterial constitution of care (see Peine and Neven 2019). Opening up these innovations for analysis might invite discussions about good and bad that are suited for developing the organization of care. As noted by Mol et al. (2010), care is not always fun and successful: it is work; to care is to persist and to keep on tinkering.

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User Participation as a Matter of Care

The Configuration of Older Users in the Design of Assistive Technologies

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Abstract: The participation of older people in technology development is an ambivalent field: while promising a better fit between users and technology, it still is challenging for both the project and for older users. This is particularly the case when older people with cognitive or physical impairments are to be involved. The article examines the configuration of older people as users in the design of a digital memory training for older people with mild cognitive impairment (MCI). Referring to (feminist) STS, this configuration is conceptualised as a matter of care. Based on an ethnographic field study the article unfolds the spatial, affective, discursive and material practices of user configuration and describes ambivalences and asymmetries in the configuration process that determine the configuration of older people as users in user-centred design.

Keywords: age; technology; configuration; user-centred design; feminist STS.

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1. Introduction

Against the background of demographic change and active ageing policies, older people are assigned many tasks: for example, they are supposed to play an active role in society, engage in community service and volunteer work, all while staying healthy and fit. In doing so, they should make their own valuable contribution to master the social and economic challenges of demographic change. Participating in technology development is a relatively new topic in this arena of activities. Parallel to the rise of assistive technologies, which should enable older people to age in place autonomously and independently, they are perceived as a promising target group, but also as important participants in the development process. Their participation should increase the fit between the requirements and needs of older users and the design of the technical artefact. In the course of this redefinition of older people as key agents in the development process, various approaches have been developed to involve them. They range from user-centred design, to design for all, to co-design and co-creation. Irrespective of these different approaches, from the perspective of age(ing) studies, the question arises as *what* older people participate and *how* they participate. Mackay et al. (2000), for example, point out that the practice of user participation has little in common with the humanistic, democratic and utopian ideal of participatory design. Rather, users are considered as a "good thing" (2000, 738) because their participation would lead to an improvement of the technical artefact. Hagen et al. (2018) speak of an "acceptance bias" of user-centred approaches that pursue acceptance by means of participation – a bias that also affects the role of researchers accompanying the design process such as cultural anthropologists or social scientists (Beimborn et al. 2016; Lassen et al. 2015). Peine and Neven (2019) identify a tendency in which participatory methods become the *sine qua nons* of gerontechnology, in which user needs are seen primarily as input for design and development (see also Peine et al. 2014). Compagna and Kohlbacher (2015) emphasize that the integration of users primarily functions as a guarantee for being considered in the competition for funding, which does, however, not necessarily mean that users are successfully integrated.

This is where the article begins. It is based on my ethnographic research I undertook for my dissertation about the development and use of assistive technologies for older people[1]. The article describes the participation of older people in technology development from the perspective of feminist Science and Technology Studies (STS) using the example of user-centred design in state-funded technology development projects in Germany that design assistive technologies for older people. The article points out how older people become older users in the process of participating in the design process. Therefore, the article describes this process as a socio-material configuration and illustrates the different spatial, affective, discursive and material practices in which this configuration of older people as users takes place. From a feminist perspective, this implies asking about the power relations and the potential for intervention.

In the following I will briefly outline the context of user-centred design in information and computer sciences and theorise it from within (feminist) STS. Then I describe the spatial, affective, discursive and material enrolment of older people in the usability test of *MemoPlay*, a technology development project funded by the German Federal Ministry of Education and Research (BMBF), from an ethnographic perspective. The aim of this project was to develop an interactive online platform containing a memory training for older people with mild cognitive impairment (MCI)[2]. I will then discuss how these practices of configuration can be understood as a matter of care in the sense of Puig de la Bellacasa (2011) and reflect my research in the context of feminist STS. The article points out that the participation of older people in technology development projects is a practice that must be carried out with care so that participation can be arranged in an attentive, responsible, professional and reciprocal manner.

2. Theorising User-Centred Design from a (feminist) STS Perspective

2.1 User-centred design in gerontechnology

In the design process of a technical artefact various methods are used to test the prototype and to ensure that the requirements placed on it are met. Therein, user-centred design (UCD) has become the main design approach. It aims at achieving a high degree of fit between the needs and requirements of the later users and the technical artefact by involving persons who represent the target group as well as possible.

UCD goes back to the psychologist Donald A. Norman, who in his work at the University of California San Diego dealt with design principles for user interfaces in the late 1980s. He first presented his concept together with Stephen W. Draper in the book *User-Centred System Design: New Perspectives on Human-Computer Interaction* (1986). It is followed by *The Psychology of Everyday Things* (1988), in which Norman further elaborates his approach with regard to basic design principles.[3]

In the last years UCD has become an umbrella term for a broad set of methods and agendas linked to the participation of users in different fields of innovation (Karlsson et al. 2012; Marcus 2015; Oudshoorn and Pinch 2003a). Especially in European and national funding programmes on assistive technologies for older people – like for example active and ambient assisted living (AAL) – UCD has become one of the main approaches to enable older people to participate in the design process (Fischer et al. 2020; Merkel and Kucharski 2019; Ogonowski et al. 2018). In these contexts, UCD goes beyond Norman's classical conception by shifting the focus towards user-driven technology development. Here, the participation of older people in the design process pursues different objectives. First of all UCD – as it is for example mandatory in the German funding programme on AAL (BMBF 2010) – is a reaction to the lack of market success of the developed technologies (Fachinger 2018; Greenhalgh et al. 2016). To overcome the missing market penetration UCD should guarantee that needs and requirements of older users are met and the products' acceptance increases (Compagna 2012). Furthermore the participation of older people should avoid negative age-related stereotypes and ageism and foster the empowerment of older people as users of digital technologies (Beimborn et al. 2016; Endter 2016; Peine et al. 2014; Wanka and Gallistl 2018).

In contrast to this political agenda, the practical implementation of UCD reveals that these objectives cannot be achieved that easily. Rather, it becomes clear how tricky the application of UCD is. In most cases the project members like developers, designers or technicians are unfamiliar with older people as target group, but in the context of state-funded development of AAL they have to get familiar with them. Furthermore, they have to involve them and ensure their stable and long-term participation in the design process in general and the usability testing in particular, whereby the testing may be physically and/or cognitively demanding and emotionally stressful for the test persons. At the same time, the project members should ensure that the participation of the test persons does not jeopardise the success of the project, since this would also call into question the proof of success vis-à-vis the funding agency. At the same time, these challenges limit the scope for user participation as a democratic-humanistic form of participation and practice of knowledge production – as I will show in the following with the configuration of users.

Against this background critical gerontologists argue that UCD fails to involve older people adequately (Lassen et al. 2015; Merkel and Kucharski 2019). It is criticised for instance that their participation primarily functions to legitimize technological development or should foster the market success by improving the fit of prototypes with user requirements (Endter 2016; Neven 2010; Peine et al. 2014). Moreover, it is stressed that certain age groups are often underrepresented in UCD, such as socially deprived or educationally disadvantaged older people (Biniok et al. 2016; Künemund and Tanschus 2013; Compagna 2012).

2.2 Turning to the user: the perspective of (feminist) science and technology studies

At the beginning of the 1980s there was a growing interest in users beyond technical sciences (Joyce and Mamo 2006; Oudshoorn and Pinch 2003b). According to Mackay et al. (2000), this increased interest is based on an emerging scientific debate on technology in social sciences, which negotiates the question of the social construction of technology. The works of Trevor Pinch and Wiebe Bijker (1984) on the social construction of technology (SCOT) are linked to this turn to the user in early STS research. They assign a significant role to users in the stabilisation of a technology. According to Pinch and Bijker, users are significantly involved in the "closure" (1984) of the interpretative flexibility of a technology. They illustrate these closure processes with various examples, such as the invention of the bicycle or Bakelite (Bijker 1995; Bijker et al. 1987; MacKenzie and Wajcman 1985; Pinch and Bijker 1984).

Steve Woolgar (1991) also uses the idea of interpretative flexibility, whereby, unlike Pinch and Bijker, he does not regard the closure as a negotiation of users, but rather as a practice of designers and developers, whereby he makes use of the semiotic analogy of machines as text and users as readers. He defines this practice as a configuration of users, in which "the user's character and capacity, her possible future actions are structured and defined in relation to the machine" (Woolgar 1991, 89). He interprets this work of defining, enabling and limiting as "boundary work" (Woolgar 1991, 90). The result of this boundary work is a user-technology relation that is configured by the designers, not by the users. The latter are only given access to the use of the technology. Therein, the interpretative flexibility of the machine as text is limited. With his semiotic approach Woolgar is able to reveal user representations and imaginations of designers and developers. At the same time, the strongly semiotic orientation limits the conception of users and thus the analysis of the user-technology relation to its representative function and excludes other actors involved in the configuration. In contrast, Mackay et al. (2000) argue for the opening up of Woolgar's concept and taking more account of the configuration of designers by users or institutions to which they are connected. They suggest an understanding of configuration as a fluid, situated and constructive practice.

In contrast to Woolgar, who emphasizes the encoding of users by designers, Madeleine Akrich (1992) develops an approach that places the inscription of user representations at the center of her analysis. She reveals how the developers, in the process of designing technology, inscribe their ideas about its use, but also their preferences, competencies, moralities and attitudes into technology. She refers to the material-semiotic order that develops in the process as a "script". Although the users can modify the script, they are not involved in the scripting procedure.[4]

Within these strongly semiotic approaches of Akrich or Woolgar, the power dimension within the configuration of the technical artefact remains largely undiscussed. Although Woolgar does refer to the powerful practices that are needed to involve users in a way that is beneficial to the success of the project, his semiotic orientation limits the conception of users. Here feminist approaches provide a different perspective on technology development, in order to show the boundaries on which the constitution of a technical artefact on the one hand and its users on the other hand are based (Forsythe 2001; Moser and Law 2003; Rommes et al. 2012; Suchman 2007). For example, Lucy Suchman (1993; 2006; Suchman et al. 2002) has explicitly gone beyond the academic debate and has made feminist STS approaches productive for the work in the field of Computer Supported Cooperative Work. In this context, thinking about older users from a feminist STS perspective was also given a renewed impulse in the field of Aging Studies (Endter 2020; Höppner and Urban 2018; Joyce and Mamo 2006; Latimer 2018; Mort et al. 2013). Here a key aspect of this research is the consideration of users and technology as mutually co-constituting phenomena (Aceros et al. 2015; Endter 2018; 2020; Östlund et al. 2015; Peine and Neven 2019; Wanka and Gallistl 2018).

2.3 User participation as a matter of care

Theorising user participation from a feminist STS perspective shifts the focus towards the politics of user participation. Therefore, I draw my attention to the "intra-active open-ended performative processes of becoming that reconfigures connectivity, constraints and exclusions" (Suchman et al. 2002, 163) in the alignment of age and technology. Following Suchman (2007), when theorising the configuration of older persons as users, the matters of fact about age and technology in the routinised work of user integration has to be scrutinised. This means that it has to be examined what this work of assembling and reassembling older people as users means for the configuration of age in technology development.

This focus on users-in-the-making opens up the opportunity to "investigate the imaginative and practical activities through which socio-material relations are reproduced and transformed" (Thygesen and Moser 2010, 131). Thereby the goal is not to unmask the developers as ignorant towards the diversity and complexity of age and older users' needs, but "to move beyond critique" (Pols 2018, 2) by contesting the images taken for granted about age and assistive technologies in such an emergent context like elderly care technologies (Asdal and Moser 2012). On the one hand we find a manifest imagination of age as decline and loss, especially when thinking about old age cultural images are determined by notions of frailty or vulnerability (Gilleard and Higgs 2011; Katz 2015). On the other hand we have a contradictory imagination of assistive technology, telecare or robotics as innovative and helpful (Hergesell 2019; López Gómez 2015; Neven 2015). This juxtaposition of age as imagined as in need for technical care and technology as being able to provide this kind of care determines the age-technology-relation in the context of assistive technologies.

For feminist STS research this can be understood as a call to "stay with the trouble" (Haraway 2016) when doing research on age and technology. This means, for example, asking who sets "the conditions for practices and for what kind of realities that are made possible" (Thygesen and Moser 2010, 131) or pointing out how participation could have been undertaken in a different manner or how alternative configurations of users were excluded in the design process. Therefore, to think of user-centred design as a "matter of care" (Puig de la Bellacasa 2011) is a promising approach to make these entanglements and power relations visible. In her consideration of technology, Puig de la Bellacasa expands Latour's conception of technology as a "matter of concern" (Latour 2004) by referring to the affective dimension that accompanies things of concern. She states: "We must take care of things in order to remain responsible for their becoming" (Puig de la Bellacasa 2011, 90). For Puig de la Bellacasa this responsibility is also an "ethico-political obligation". For her, as a feminist scholar in the study of technology, this means that "we need to count all the concerns attached to [technology], all those who care for it" (2011, 90). In contrast to Latour, for Puig de la Bellacasa this also means taking a stronger stand for a position that takes into account the persistent forms of power, exclusion and inequality when dealing with matters of concern.

Following Puig de la Bellacasa, I consider the development of technology in general and the involvement of users in user-centred design in particular as a "matter of care". This conceptualisation throws light on the question of power and hierarchy that undermine the participation process. Caring in this sense is not understood as a work dedicated to the development and functionality of the artefact, as Treusch (2015), for example, clearly shows in her research on robotics, but as a reflexive practice that asks how the project members involved in the constitution of the technical artefact evaluate their actions of user involvement and to what extent they see themselves as responsible for the involvement of older people as users in the design of the technology.

From a feminist perspective, it matters whose interests are represented in technological development, whose work is rendered invisible, who is considered important enough to be included in the socio-material assemblage and who is excluded (Puig de la Bellacasa 2011; Suchman 2007; Moser and Law 2003). This goes along with Mol, Pols and Moser's notion of care in practice as "a persistent tinkering in a world full of complex ambivalences and shifting tensions" (Mol et al. 2010, 14). They understand these practices of tinkering as a form of doing good care, whereby "[t]he good is not something to pass a judgement on, in general terms and from the outside, but something to do, in practice, as care goes on" (2010, 13). With regard to user-centred design this means asking to what extent the agents involved in the process consider their own actions as good. It also means questioning the postulated ideology of user participation as a "good thing" (Mackay et al. 2000) for older people.

To question this goodness of user participation I refer to Joan Tronto's (1993) criteria of good care. Although Tronto does not take an STS perspective her conceptualisation of good care is fruitful for thinking about the relation of age and technology and linking STS and Aging Studies. According to Tronto, good care is characterised by attentiveness, responsibility, competence and reciprocity. Tronto argues that these requirements must be fulfilled for carers to be able to recognise the needs of others (caring about), to carry them out (care taking) and to serve them (care giving), thus building a mutual relationship between carers and those who are cared for (care receiving) and thus providing *good care*. Tronto's criteria can function as a heuristic for examining the extent to which user-centred design actually empowers users to participate in the design process and fosters a fit between technology and user needs.

Therefore, I apply Tronto's criteria of good care to user-centred design and analyse how the different spatial, affective, discursive and material practices of configuring older users are attentive, competent, responsible and reciprocal and thus representing a "specific *modality* of handling questions to do with the good" (Mol et al. 2010, 13).

3. Configuring Dementia

With the focus on dementia, ageing is no longer stigmatised as an age-specific loss of physical capabilities and competences, it is also configured as cognitive decline and the loss of personhood (Alzheimer's Disease International 2018). These scientific depictions of dementia in neuroscientific and cognitive psychological studies are echoed in public discourses about dementia as a threat or burden either to society or to the welfare state, but these cultural assumptions and normative expectations are entangled with material figurations of dementia for example in scientific laboratories (Åsberg and Lum 2010), clinical memory consultations (Moser 2008), care practices and environments (Spindler 2018) or in technology.

Sociologists working critically on this double stigmatisation deconstruct the fear of dementia as expression of our "cognitive culture" and modern individualism (Katz 2012). For example Latimer shows in her study on biomedical research how dementia is constructed as "the worst of what ageing does to people" (Latimer 2018, 839; see also Latimer and Puig de la Bellacasa 2011) and coincidently this construction legitimates medical research and intervention. Also Moser outlines Alzheimer's Disease (AD) as a powerful material-semiotic assemblage that mobilises different actors like for example scientists responsible for putting AD squarely on the public discourse and policy agenda as a significant topic (Moser 2008). Åsberg and Lum (2010, 329) critique the decontextualization and objectification of AD in biomedical imagination and scientific practice and highlight "the subject positions thus rendered available" in the object-subject-positionings of biomedical practices. Against the powerful instrumentalisation of dementia in the public health and scientific discourses, researchers such as Twigg and Buse (Twigg 2010; Buse and Twigg 2014, 2016) emphasise the role of materiality to reconfigure the ageing-dementia-relation. In their research they point out how the mundane practices of everyday clothing enable people with dementia to reclaim their status as autonomous subjects. Similarly, Kontos (2004; 2005; 2015) is broadening the empowering scope of embodiment in describing the bodily practices of remembering for example in dancing or singing. And Swinnen (2016; Swinnen and de Medeiros 2017; Swinnen and Schweda 2015) shows how people diagnosed with AD express themselves in poetry slams in a New Yorker day-care hospital. These research findings contradict the normative image of dementia as a loss of cognitive abilities and personhood, instead they reveal the mundane acts of performatively reconfiguring identity as an ongoing discursive articulation *and* material formation (Endter 2020).

4. Methodological Approach

The following ethnographic description of the configuration of older people as users in user-centred technology development is based on my fieldwork in the state-funded research project *MemoPlay.*[5] From March 2014 to November 2014 I conducted fieldwork in the project, which included accompanying the project members in their work, conducting interviews and actively participating in the tests as study personnel of the project. Furthermore, I conducted interviews with the older usability test participants and took part in their trainings at home as a participating observer. The fieldwork in *MemoPlay* was part of a larger field study in the context of my dissertation, in which I ethnographically examined different state-funded research projects on the development of assistive technologies for older people from 2014 to 2016. Most of them were part of the BMBF research agenda of Active and Ambient Assisted Living (AAL).

The empirical analyses presented here is based on my field notes, protocols, interview transcripts and minutes of conversations, as well as the field documents I have collected during my participation in the project. All interviews were transcribed and coded with MAXQDA. The coding procedure of my ethnographic material and its analysis is based on Grounded Theory in its reflexive (Breuer et al. 2010) and situational (Clarke 2012) modification. Furthermore, I have triangulated the ethnographic material with a document analysis of the BMBF research program on active and ambient assisted living from 2008 until 2016.

As ethnography always focuses on the single case – here the state-funded technology development project *MemoPlay* – the interpretation of the practices, meanings and structures is always situational and contingent (Rabinow 2008; Marcus 1995). Concentrating on a single project allows me to go into greater depth to describe the different groups of actors in their heterogeneity and relativity. At the same time, the analysis reveals problem areas and solution strategies that go beyond the individual project, allowing conclusions to be drawn about the field beyond the single case. The empirical analysis given here highlights the final usability test by describing the first meeting of the older participants with the project members Stefanie Müller and Thomas Beyer. Müller and Beyer are staff members of the gerontological research institute and responsible for the user involvement in the user-centred design of the project. In the empirical analysis given here I will ethnographically describe the first visit of the older usability test participants in the final usability test of the project.

5. Case Study

MemoPlay is the name of a German state-funded technology development project. From 2012 until 2014 it developed an interactive online platform. This platform contains three different components: a memory training – its central component – a communication tool to chat or for videotelephony and an information section for users with short films and texts about age-specific topics such as healthy living, nutrition, mobility and security. It should enable older people suffering mild cognitive impairment (MCI) to train their cognitive abilities by conducting the memory training. As a stand-alone application that can be installed both on a standard tablet or on a personal computer, it is intended for individual use at home without the need for assistance from care givers or medical staff.

The memory training consists of six different exercises in which, for example, the older user has to sort words to colours, mentally rotate geometric objects or compare numerical values. Five of these six tasks must be completed per training unit. The selection of the tasks as well as their degree of difficulty is determined by the programme's algorithm. After each unit a chart appears on the screen that reports the test results back to the user and compares them with the points already reached. With the help of the training, the cognitive performance of the users should improve over the course of the training.

The interdisciplinary research project team consists of three academic project partners – a gerontological research institute, a geriatric hospital, and a research institute for artificial intelligence (AI) – and two non-academic partners – an IT service provider and a provider of medical devices. The non-academic partners and the research institute for AI were mainly responsible for hard- and software development. The gerontological research institute and the geriatric hospital carried out the user involvement following a user-centred design approach.

In the user-centred design of the project people aged sixty years and older were involved as interview partners or test users in three different stages of the technology development: the requirements analysis, the formative evaluation and the summative evaluation of the prototype.

In the requirements analysis twelve participants – half of them diagnosed with MCI – had to fill in two standardised questionnaires to evaluate their technical competence and technology acceptance. Afterwards, a standardized interview was conducted with them. The interviews were analysed in-depth to derive requirements that should lead the iterative design process.

During the formative evaluation brief surveys were conducted in the day clinic of the geriatric hospital. For example, paper prototypes were tested in small samples up to five older people. They were shown different designs of pictures, icons or logos and asked which one they thought would better meet their needs or be more intuitive. More complex questions, such as the design of the menu navigation or the user interface, were tested with a larger group of patients of the day clinic using mockups to illustrate the design more adequately. All participants in the formative evaluation were diagnosed with MCI.

In addition to the formative tests in the day clinic a laboratory testing was carried out by the gerontological research institute after 18 months of the project's running time. Sixty people had to test one of the later six exercises of the memory training as well as various other functions, such as receiving and carrying out a video call. During their tests eye movements and facial expressions were tracked, logging data was collected and the behaviour of the persons was recorded. In this sample, too, half of the participants were diagnosed with MCI.

The final usability test of the summative evaluation started after completion of the development of the prototype in spring 2014. A total of eighty people – half of them diagnosed with MCI – was selected and divided into four groups of twenty people each. One test group carried out the memory training on a tablet, another on their home PC. The other forty people were divided equally between an active control group testing a video game and a passive control group not receiving any intervention. Participants were found through a senior university, advertisements on the Internet and the gerontological research institute's network.

While the previous tests were mainly concerned with aspects of usability and technology acceptance, the final usability test pursued a further scientific question. The gerontological institute and the geriatric hospital also wanted to find out whether regular memory training has a measurable effect on cognitive performance and neural structure. To assess cognitive performance of all participants, the test persons had to complete various psychological tests measuring their cognitive abilities at the beginning, in the middle and at the end of the usability test. From the persons assigned to the active test groups doing the memory training on tablet or PC, twenty were randomly selected to undergo magnetic resonance imaging (MRI) at the beginning and end of the eight-week test. The aim of the MRI examination was the visual detection of structural changes in the cortex due to training. If abnormalities were found during this examination, the person was informed and advised to consult a specialist to clarify the findings. This scientific evaluation of the training was a strong motivation for test users to participate in the study, as they repeatedly emphasised during interviews. Many hoped to obtain more precise and, above all, scientifically proven information about their cognitive performance. For most of the participants, cognitive fitness was proof that they were not yet old and did not show any signs of dementia.

6. Empirical Analysis

On a sunny Monday morning in May 2014, twenty older people arrive at the gerontological research institute for the first time. In the study room the tables have been already arranged in a closed rectangle. Each place has been prepared with a nameplate and a folder with information about the project, the agenda of the day and further information about the study. The people in the room have been invited to take part in the usability test of the project. As a test person, it is their task to test the prototype at home for eight weeks, to undergo psychological tests to determine their cognitive performance, and – if randomly chosen – to take part in the MRI examination at the beginning and the end of the usability test period. In addition to the participants, the two project members Stefanie Müller and Thomas Beyer, who both work at the gerontological research institute, and myself are present.

6.1 Spatial and affective user configuration

After all participants have arrived Müller and Beyer start their presentation. Müller informs the participants what will happen over the course of the next weeks and explains the study. She repeatedly emphasises how important it is that older people are involved in the development of technology that they will later use, hence why it is so important that the participants are here today and have agreed to participate in the study. She also appeals to their individual ambition and sense of responsibility when she describes the user test. No questions are asked during her presentation, everyone is listening carefully. Some take notes, but most of them follow Müller's explanations and wait and see how things will unfold.

In the further course of the test, they also only react when asked, they keep quiet, they complete the questionnaires without asking questions and they agree to the tests Müller and Beyer are doing with them, even if some mention later in a subordinate clause that they felt uncomfortable in the test situation they had to undergo during their visit. They want to appear competent and informed and, as if their participation would be put to the test, they want to prove themselves as suitable candidates.

In this test situation Müller and Beyer create a social situation, which addresses participants as users and encourages them to take on this role. For this purpose, the participants are placed in a spatial setting that is largely foreign to them, such as the things (questionnaires, psychological tests) and persons (study personnel) with whom they interact within this setting.

In addition, the older participants have to prove their cognitive abilities in front of two strangers who not only lead the study and thus seem to have a specific social status qua professional position, but also distinguish themselves from them as "scientists". Thus, they not only assign a specific role to the participants, but also assume one themselves. Within this setting, emotions such as shame and social norms, such as respect for authority, play a crucial role in understanding why the participants behave passively. Furthermore, the presence of the other participants reinforces the assumption of the role as test users. This also explains why no exchange between the participants develops in the further course of the event. When social communication takes place, it occurs on a hierarchical level in exchange with the coordinators of the study.

Müller and Beyer thus not only create a social, but also a normative space that promotes the assumption of the role of test users. In contrast to Müller and Beyer, who – as study coordinators and staff members of the gerontological research institute – can be assigned to the scientific field, the older participants are configured as a homogeneous group – the test users. The participants only know each other's names, but they do not have any information about age, profession or personal attitudes. This liminality enables Müller and Beyer to assign a new role to the participants and to spatially, affectively, discursively and materially code them according to this role. The spatial setting (a conference room in a scientific research institution), the materialities at hand (information material, presentation techniques, test sheets) and their own role as scientists help them to do this.

6.2 Discursive and material user configuration

In addition to the spatial setting, the dichotomous construction of study coordinators and test users along with the resulting asymmetrical positioning of the older participants, it is Stefanie Müller's lecture that convinces participants to take on the role of test users.

She is the welcoming project member, the professional scientist, the sovereign study coordinator. But she is also the test supervisor who provides the participants with questionnaires and test procedures to measure and classify their cognitive performance. What is striking here is the repeated reference to how important it is that those present take part in the study and thus make a central contribution not only to the *MemoPlay* project but also to the development of gerontechnologies as a whole.

Stefanie Müller does, however, not mention that the participation of older people is also highly relevant for the project team in order to meet the requirements of the funding authorities. Instead, she appeals to the sense of responsibility of the participants and stresses how important their feedback and test results are for the development of the prototype. Neither does she mention that its development has already been completed at the time the usability tests are carried out. At the end of the usability test, none of the eighty participants will have terminated prematurely, all will have undertaken their exercises twice a day and completed the test tasks as well as the medical examinations.

In repeatedly referring to the value of the training for the scientific investigation of cognitive performance, Müller does not only appeal to the participants' sense of responsibility, but also to their ambition to achieve good results and to prove that they are cognitively capable, on the one hand, and on the other hand, to their fear of getting Alzheimer's Disease, thus indirectly referring to the discourse on dementia. In her speech, Müller refers to the dementia discourse uncritically and places the users in the asymmetrical dementia-technology relation in which older people are regarded as potentially affected by cognitive impairments due to their age.

However, it is not only the study coordinators Stefanie Müller and Thomas Beyer, the spatial setting, the study situation and the circulating scientific knowledge that configure the older participants as users, but also the psychological test procedures and questionnaires used in the test to assess cognitive performance. In their materiality they witness the scientific authority of the study coordinators and contribute to their scientific performance. The test procedures not only generate different numerical values, but also rank the participants according to their performance and classify them into those without MCI and those affected by MCI. Therein, psychological tests tame older persons to fit into their assigned roles as users (Pols 2012, 144).

Of course, the participants are by no means passive puppets, they also participate in the configuration as users. Nonetheless, there are gradual differences between their own commitment and agency as users and the discursive and material practices of the study coordinators that configure them as users and situate them in the asymmetrical user-technology relation of the user-centred design (Endter 2018; López Gómez 2015; Neven 2010).

7. Discussion

7.1 User configuration as a matter of care

In the analysis of the different practices of configuration it has become clear that the usability test represents a critical situation in the development process. It is Müller and Beyer's task to handle this critical situation by integrating the older participants into the role of test users so that they "most likely act like users" (Woolgar 1991, 82). But the participants are "complex, fragmented in nature, and are attributed with varying significance" (Mackay et al. 2000, 738). To handle this complexity, Müller and Beyer employ different powerful practices that configure the participants as users spatially and affectively as well as discursively and materially. In this, user configuration becomes a powerful practice that distinguishes between those who assign positions (project workers) and those who are placed in those positions (older people). The asymmetrical relationship between project members responsible for conducting the usability tests and older test users who performed the tests guarantees that the test users behave in accordance to their role, develop a high level of compliance with the test procedure and ensure that the prototype evaluation is carried out. At the same time, this hierarchy ensures that the uncertainty introduced by the participation of older people is brought under control.

With regard to the question, if these practices of configuration can be regarded as *practices of care*, I return to Tronto (1993). She stresses that care is characterized by attentiveness, responsibility, competence and reciprocity. Considering the practices of Müller and Beyer, the empirical analysis shows that they meet the criteria mentioned by Tronto to a certain extent: they are attentive to the participants, ensure that they feel comfortable in the test situation, emphasize the importance of their participation and show how useful they are as users for the development of technology. In doing so, they signify the decision of the participants to take part in the usability test as a practice of *good care* – in the sense that they contribute to research and innovation as well as a better life for other older people when using assistive technologies. Furthermore, they themselves take on responsibility for the participants and prove their scientific competence in conducting lectures and test procedures. At the same time, it becomes clear that these practices are always aimed at involving the participants in such a way that they neither delay nor hinder the development of the technology, that their results do not endanger the success of the project and that they correspond to the user representations of the project and thus of the artefact. Müller and Beyer's actions are, however, not reciprocal – the last of Tronto's criteria. The test users only get involved when it is useful and helpful for the project. More participatory formats or participations that go beyond testing prototypes or being interviewed to evaluate technical features are not applied.

It becomes clear that the project members do indeed make an effort to involve older people in a good way. They do act to a certain extent attentively, responsibly and competently. However, they are basically not oriented towards the good of the users, but towards the success of the project and thus the development of a new technology – in this case the interactive online platform for memory training. However, this orientation contradicts the actual orientation of user participation as democratic and emancipative, and cannot be reconciled with Tronto's criterion of being a reciprocal interaction. This clearly shows that the project members' concern for the users cannot be described as *good care* in the sense of Tronto. Rather, it becomes apparent that good care is not addressed to the users, but to the technology. What follows from this if user participation is considered a matter of care from a feminist perspective? First of all, it shows that user involvement is ambiguous, situational and contingent. Beyond this, it also calls into question what can be regarded as user participation in technology development in general and user-centred design in particular. In this it can be seen an opportunity to show how the participation of older people in technology development is a practice that needs to be taken care of. On the one hand, UCD represents the opportunity for older people to be involved in the development of technologies that are important for them. User participation offers the possibility to counteract stereotyping and deficient images of age and raise developers', software engineers' or designers' awareness to the heterogeneity and multiplicity of age. On the other hand, it has been emphasised at various times that older people often do not participate as participants in the humanistic, democratic sense of participatory design but as preconfigured test users. Here it becomes clear that both the question of when participation takes place and the question of how it takes place is an expression of a specific power relation in which older people are involved but do not participate. Herein, UCD is a relational, situated practice with shifting powers and moving targets. It cannot be judged as enabling or paternalistic, instead it is ontologically multiple (Mol 2002). Latimer calls such heterogeneity "a multiple inhabited by a multitude" (Latimer 2019, 277). In this multiplicity the older participants are configured in the spatial, affective, material and discursive practices of the project members in order to witness a user-centred design of the prototype without participating in the development of the prototype.

Against this background Neven (2010; 2015) asks why more and more older people should be involved in technology development and suggests that the outcomes of participation should be scientifically evaluated rather than continuing current practice. Künemund (2018) argues similarly with regard to the German AAL funding programme and calls for a problem-oriented scientific evaluation as starting point of technology development that should be carried out independently of the involvement of older people. Wanka and Gallistl (2020) also demand a revision of the funding programmes which envision other participation formats of older people. This article adds a feminist perspective to these calls with the aim of intervening against established practices and views of older users and power relations in UCD as explained in the following.

7.2 Being reflexive: the politics of doing research on technology

Participating as a feminist STS scholar in the user-centred design implies "reclaim[ing] and reinvent[ing] the politics of relation" (Latimer and López Gómez 2019, 251). This means critically asking how one's own research stabilises the normative potential of user participation as good. While Puig de la Bellacasa emphasises "the ethico-political obligations" (2011, 90) that shape our research, reassembling the often-neglected "real" users and what they imagine technocare to be like, this implies "staying accountable to the politics, power and privilege involved in such work" (Martin et al. 2015, 630). This can be a form of care. This suggests understanding research as an open-ended and "response-able" (Barad 2007) process of "being alongside" (Latimer 2019) or as Martin et al. have claimed it: "As the contexts in which we work become seemingly more urgent, that is, more critical, we must become even more cautious about how we enact our care. Likewise, the greater success we STS scholars have in world-making, the more we have to be accountable to and take responsibility for those whose lives we touch" (Martin et al. 2015, 635-636). In the context of assistive technologies this means taking on accountability for the world-making effects of one's own research and the intimate entanglements in the research process including participation in the configurational practices of user participation. Thinking about the technology-age-relation in UCD from a feminist STS perspective broadens this reflexivity to the question of intervention. By re-contextualizing the powerful practices of Müller and Beyer as care that is contradictory, multiple and relational instead of objective, quantifiable and per se good, is an attempt to intervene into the politics of age and technology as it is powerfully enacted in the policy agendas of active and assisted living. Explicating the boundaries, differences and contradictions that constitute technocare, scatters the normative power of user participation as a "good thing" and opens up the multiple ontologies of the age-technology-relation.

8. Conclusion

The ethnographic description showed how older people are configured as users in user-centred design in state-funded research projects on the development of AAL technologies in Germany. It pointed out that the involvement of older people in the design process is a critical situation for technology projects and their outcomes. By ethnographically describing the practices of configuring users in the state-funded AAL project *MemoPlay*, it could be illustrated how participation is limited to passivity and control. In this, UCD can be understood as a powerful practice "that includes particular objects of attention and concern and inseparable knowing subjects" (Suchman 2011, 134) and at the same time excludes and makes invisible other practices and subjects. The result of this boundary work is the constitution of older people as users of assistive technologies in the design process that do not question the design process. Against this background it becomes clear that user participation is less a manifestation of the participation process of older people than of the powerful practices of establishing controllable users. If UCD should lead to an involvement of older users it must become a matter of care for those responsible for the user involvement. Tronto's criteria can lead here as a taxonomy that can guide the participation process and lead to a more participative involvement of older people as users in the development of technologies that should fit their needs and not in reverse.

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[1] The dissertation "*Assistiert Altern. Die Entwicklung und Nutzung technischer Assistenzsysteme für ältere Menschen aus kulturanthropologischer Perspektive*" is published in spring 2021.

[2] MCI can occur at an older age and cause impairments of memory, attention and thinking. These may be significantly below the performance usual for the respective age and educational level without significant everyday restrictions (Etgen et al. 2011). However, it is assumed that MCI is associated with a highly increased risk of dementia, especially with regard to the occurrence of Alzheimer's dementia (Pantel and Schröder 2007).

[3] In addition to the more narrowly defined user-centred design, there are a number of approaches that address a broad group of users, such as human-centred design, design for all or universal design. They all have the common objective of designing human-technology interfaces for all users, regardless of previous knowledge and experience, age or gender. These design approaches have their origin in early trade union efforts to improve the computer workstations of employees in Scandinavia (Ehn 1989; Bødker and Pekkola 2010).

[4] Akrich (1992; 1995) uses the terms "subscription" and "de-inscription" to describe precisely those processes of appropriation that run counter to the action programmes. De Laet and Mol (2000) later expand the idea of re-scription with their concept of fluid technology to point out the creative and unpredictable practices of use and modification.

[5] The project name, places and persons mentioned in the following have been anonymised by the author.

Ageing as a Boundary Object

Thinking Differently of Ageing and Care

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Abstract: Ageing is not only a chronological matter. The following contributions at the crossroad of STS, material gerontology, design, and medical sociology offer alternative views on ageing and care. Ageing emerges as a boundary object through which authors explore the relationship with technologies and technology-based processes and practices. Authors point out that becoming older is a sociomaterial process and emphasize the importance of thinking with care when designing technology as well as the relevance of the socio-technical imaginary in conceptualizing older people.

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Introduction

Michela Cozza

In one of her foundational articles, Susan Leigh Star (2010, 604) says: “I am invariably asked the question, ‘*well, but what is NOT a boundary object?*’ (or, along the same lines, ‘Couldn’t *anything* be a boundary object?').". In this article as well as in other contributions, Star has always refrained from normative statements about the true and proper meaning and use of boundary objects despite she has provided a definition that reminds us of their plasticity and robustness (Star 2015).

In the same article, she continues by pointing out one dimension that we deem relevant to this special issue on ageing and technology and, all the more, in this Crossing Boundaries section of *Tecnoscienza*. Star thinks of standards and boundary objects as inextricably related, especially over time, in so far as what was a boundary object at one time may become standardized later on. When this movement happens, as Star highlights, the standard as such throws off or generates residual categories. Such a deep interconnection between boundary objects and standards, and the relationship(s) between standards and residual categories are key to the study of ageing and technology, in particular by noticing that "[c]ertainly, our society makes age – precise chronological age – something that no one should be without (…) chronological age became a privileged standard for classifying individuals" (Treas 2009, 65).

By referring back to Star where she clarifies that the term 'boundary object' embodies both a pragmatist sense and a material one – so that we should go beyond the common idea of object as (exclusively) a thing – it seems quite reasonable to assume 'age' as a boundary object, "something people (...) act toward and with. Its materiality derives from action, not from a sense of prefabricated stuff or 'thing' -ness" (Star 2010, 603) as material gerontology has recently foregrounded with regard to how technologies and objects in general embody and foster a specific view of age(ing) (Höppner 2017; Höppner and Urban 2018; Wanka and Gallistl 2018). Yet, age as boundary object turns out to be a problematic standard depending on which actions are undertaken in relation to it and which are the associated meanings, as well as material and symbolic implications that many STS and other critical scholars have discussed in relation to technology design in care settings (Maller 2015; Mol, Moser and Pols 2010; Buse, Martyn and Nettleton 2018).

Today, the chronological age is remarkably wide in the scope of its coverage and classifications relying on this standard are as many as the related organizing purposes. On the basis of chronological age (among other relevant standards), individuals are referred for medical tests, children are admitted to different grades, and seniors qualify for dining discounts or are entitled to get specific welfare services (Cozza et al. 2019). So far it does not seem that the effects of taking age as an 'ordering principle' is producing the dramatic effects that the above-mentioned relation between standards and categorisation was heralding. However, by crossing several boundaries like, for example, that between medical sociology and

STS we discover that ageing is quite often associated with a sociotechnical imaginary of vulnerability and frailty that – at least in the countries of the Global North – leaves very little space to a romanticised idea of the later life as the age of wisdom and inactivity. On one hand, there is an idea of older people as 'people in need' whose being and doing is marked by age-associated decline as a condition that homogeneously concerns all elderly (WHO 2017); on the other, and in sharp contrast with the previous frame, there is a huge emphasis on activity in later life as proved by an incredible amount of scientific and business initiatives falling under the concept of "active ageing" (Katz 2000).

In this section of the special issue, ageing is the boundary object through which authors explore the relationship with technologies and technology-based processes and practices by crossing multiple disciplinary boundaries and pointing us towards alternative views of later life, older people, age and ageing.

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Connecting the Dots of New Materialist Approaches in the Study of Age(ing): The Landscape of Material Gerontology

Vera Gallistl and Anna Wanka

Gerontology – the discipline concerned with questions surrounding age and ageing in the broadest sense – has increasingly turned to technology use in later life as a topic of research. Whereas many gerontological studies on ageing and technologies are rather applied and techno-optimist, asking how technology can improve older adults' lives, more critical and cultural approaches have developed rather recently (Kolland et al. 2019). They voice two types of critique: First, they criticize Gerontology's blindness when it comes to the discourses and imaginaries of age and ageing that shape technological development and design. This criticism, often elaborated by researchers working at the intersection of Science and Technology Studies (STS) and Gerontology, targets, on the one hand, ageist stereotypes about technology use in later life in design processes and the paternalist stance towards older adults resulting from it (Peine and Neven 2019), and, on the other, the techno-optimism of gerontological research itself (Neven and Peine 2017; Peine 2019). Second, critique from new materialist approaches in Gerontology questions the underdeveloped role materialities play in researching ageing and technology. Such approaches argue to take the materialities that constitute human life worlds, like the ageing body, the spaces we are in, and the things that surround us – including technologies – more seriously when we aim to better understand age and ageing.

For studying ageing and technologies this implies to grant those materialities their own agency - technologies are not just being *used by* but *interact with* older adults.

Following this strand of critique, several scholars within the study of age(ing) have started to think about materialities in more depth (for example: Calasanti 2003; Gubrium and Holstein 2008; Buse and Twigg 2016; Artner et al. 2017). One approach developed from these endeavors is *material gerontology* (Höppner and Urban 2018). Material gerontology has been heavily influenced by both cultural gerontology (cf. Twigg and Martin 2015) and new materialism (cf. Barad, 2003). New materialism is an umbrella term for a nexus of theories formulated mainly in gender studies and feminist STS and bringing together concepts such as "agential realism" of Karen Barad (2003), "Deleuzian materialism" of Rosi Braidotti ([1994] 2011), or "posthumanism" of Donna Haraway (2007). These approaches understand discourses and materialities as inextricably linked within "material-discursive practices" (Barad 2003, 818). This implies that we do no longer look at how older adults use or act with technologies - how they *inter-act* with technologies -, but how ageing and technologies *intra-act*: hence, how the constellations of discourses (like discourses and imaginaries of ageing) and materialities (like ageing bodies) that constitute ageing are linked to the discourses (like technological innovation discourses) and materialities (like the devices themselves) that constitute technological innovation in discursive-material practices and, accordingly, form *processes of entangled becoming*.

For the study of ageing and technologies, looking at these socio-material processes of *becoming* can enable a fuller and more exciting picture of how age and ageing is socio-materially co-constituted and can also enable a more nuanced discussion about the role diverse materialities (from technologies to other objects) play in this process. For STS, such approaches can enable a fuller and more differentiated understanding of the particularities of age and ageing as a socio-material phenomenon. In the following, we illustrate how material gerontology approaches questions around ageing and technologies and discuss which insights such a perspective yields for STS.

Connecting the dots: material gerontology

In this section, we want to take a broader look at the concepts and approaches within material gerontology by answering the following three questions from a material gerontological perspective: (1) *Who and what is involved* in ageing processes? (2) *Where and when* do ageing processes take place? (3) Where are the *boundaries* of ageing processes located and who defines them?

From a material gerontology perspective, ageing processes are co-constituted in a nexus of discursive-material practices. This then, first and foremost, means acknowledging that (human) ageing itself is not a phenomenon that takes place *within* or happens *to* a human being, but that ageing emerges as a phenomenon through the entanglement of diverse materialities, discourses and subjectivities. The process of ageing is therefore not only a biological, but a symbolic, discursive, cultural and – most importantly - material phenomenon (Wanka and Gallistl 2018), in which a variety of human and non-human actors, humans, things, technologies, animals and much more are entangled (Höppner and Urban 2018). Material gerontology therefore does not center ageing processes in one human actor but acknowledges a variety of – human and non-human – actors of ageing processes. Ageing is therefore understood as distributed (Höppner 2021). The processes of *becoming* old is therefore an assemblage of materialities – from human bodies, things, technologies, spaces and their relations. Studies within material gerontology have consequently analyzed the role of things, objects and technologies in ageing processes (Kollewe 2020), and have significantly gone beyond viewing them as 'passive' participants in research projects, but rather granted them agency in shaping experiences and identities in later life (Lovatt 2018). However, material gerontology does not only focus on technological innovation, but also engages with more mundane and ordinary objects of later life, such as dress (Buse and Twigg 2016) or furniture (Depner 2015), which enables material gerontology to not only look for innovative or new technologies in later life, but also to provide tools for making the ordinary, tacit and non-verbal aspects of materialities of age and ageing more visible.

Second, material gerontology approaches question *where and when* ageing processes take place. While ageing processes have traditionally been located within, or close to the ageing body, not only by medical or psychological, but also by social gerontology (Öberg 1996; Martin and Twigg 2018), material gerontology significantly expands thinking on *where* ageing processes take place, making the ageing body no longer the central *place* of ageing (Höppner and Urban 2018). Studies instead highlight the close connection between the materiality of bodies, artefacts, and aspects of space in the becoming of age and ageing (Buse et al. 2018), hence considering bodies, technologies and spaces as interrelated parts of socio-material assemblages of ageing (Jarke 2020). Studies have, inter alia, explored the architectures of care and health of later life, highlighted how imaginaries of ageing bodies are (re)produced through architectural spaces (Nettleton, Buse and Martin 2018) or studied how understandings of a central place of ageing – the home – is constituted through the entanglement between objects, spaces and embodied practices in processual manners (Lovatt 2018). This has also enabled material gerontology to see how age and ageing are shaped through spaces in unusual and unexpected ways, e.g. looking at constellations of ageing in mountains (Gallistl and Parisot 2020; Höppner 2015), or at materializations of ageing in benches in public spaces (Moulaert and Wanka 2019). Age(ing), from a perspective of material gerontology, therefore is not only shaped by and through spaces, it itself emerges as a spatial phenomenon, as it "'spatialises', that is, it produces its respective spares as three-dimensional arrangements comprising artefacts and bodies" (Reckwitz 2012, 252).

Such a perspective also enables material gerontology approaches to question *when* ageing processes take place. Understanding ageing as a distributed phenomenon with multiple actors (Höppner 2021) also means acknowledging the multiplicity of intersecting temporalities that age and ageing is built through. While ageing is often associated with a particular kind of time, namely (scarce) life-course time (Kottmann 2008), research in material gerontology has significantly expanded this view, and shown how multiple temporalities of age and ageing can become conflicted or stand in contrast to each other, e.g. in innovation discourses of the arts (Gallistl 2020) or technological development (Peine and Neven 2020). From a material gerontology perspective, ageing therefore not only spatializes, it also temporalizes, as it produces diverse (and sometimes conflicting) temporalities.

Third and consequently, material gerontological enables a new perspective on how boundaries are drawn in the processes of *becoming old*: boundaries between diverse actors of ageing – like ageing human bodies and the things that 'surround' them -, boundaries between what is 'old' and what is 'young', or boundaries between what is 'normal' and 'deviant' ageing. One central discussion concerns the boundaries of the ageing body, which, in gerontology, has often been conceptualized through a medical gaze, as a distinct, rational and – most importantly – enclosed entity (Martin and Twigg 2018; Höppner and Urban 2018). Despite the fact that body boundaries have been remarkably expanded in the last years, for example through the diffusion of new care technologies, implants and mobile devices, the 'ageing body-entity' is still often perceived as the foundation of gerontological knowledge (Martin and Twigg 2018). Material gerontology, on the contrary, highlights that humans are aged in actor-networks, entanglements, assemblages and that the boundaries between actors in these relationships are made in *practice*, rather than being pre-defined. Drawing on Barad's (2003) conceptualization of agential cuts, research within material gerontology has, for example, asked how the often taken-for-granted boundary between human and non-human actors of ageing are made through processes of *becoming with things* (Höppner 2015).

Establishing boundaries, making connections: material gerontology and STS

Finally, we discuss where and how a material gerontology perspective overlaps with other approaches aimed to better understand ageing and technology, especially with those at the intersection of Science and Technology Studies (STS) and gerontology, and which insights a material gerontology perspective could bring to STS.

At first sight, the similarities between the material gerontology and other approaches towards ageing and technology within STS are striking: Both understand ageing as a processual constellation of practices that is distributed between humans and non-humans (Höppner 2021; Moreira 2016); and that these practices co-constitute both ageing and other actors involved in it (Höppner and Urban 2018; Peine and Neven 2019). Moreover, both perspectives stress the importance of materialities and their spatial distribution in this process of co-constitution (Wanka and Gallistl 2018), at the same time acknowledging that the boundaries between the material and the non-material, the human and non-human, are themselves drawn in the course of it (Höppner 2017; Irni 2010).

However, a material gerontology perspective demarcates from traditional STS perspective in one crucial aspect: in how seriously it takes the centrality of age and ageing. For STS, age tends to be treated as a social phenomenon alike any other, and a STS perspective could be applied approach the co-constitution of age(ing) and technologies just as it could be applied to approach the co-constitution of health/illness and technologies, or gender and technologies – all with quite a similar design and theoretical background. A material gerontology perspective, however, cannot so easily be applied to other phenomena than age(ing) - despite its influences from gender studies and (feminist) new materialism. For STS, age(ing) tends to be seen as a case, whereas for material gerontology, it is a concept – as age is not a blank canvas to be 'filled' with empirical data, but an analytical approach.

Borrowing from Nicolini's metaphor of "zooming in and zooming out" (2009) makes this distinction more explicit: When STS and material gerontology ‘zoom in’ at their research phenomenon, both perspectives ‘meet’ at the ‘intersection’ of co-constitution of age(ing) and technologies, where they are both concerned with practices, processes and materialities. However, they ‘separate’ when they ‘zoom out’: Here, STS refers back to and takes into account a broader ‘non-age related’ picture, comprising, for example, technology design processes and the discourses, narratives and images around age and ageing, but also technologies and innovation, that are (re-)-produced in them. Material gerontology, on the other hand, ‘zooms out’ to consider and refer back to the life-worlds of age(ing), including the situation of older adults in a political economy of ageing, their structural and symbolic disadvantage in society, their generational socialization, their life-courses and biographies, and the range of materialities and materialized temporalities that characterize their life worlds: from fancy and ‘new’ to mundane and ‘old’ devices, artefacts and objects.

* * *

Careful Co-Design: Working with Feminist Accounts of Care in Co-Design

Helen Manchester

Technologies and their effects have become increasingly implicated in our everyday lives, loves and caring practices (Matthewmann 2011), including those of older people living in care facilities. To date mainstream technologies designed for the ageing market have been less than successful, often due to ageist stereotypes that perceive ageing as a ‘problem’ and technologies as potential easy win solutions (Vines et al. 2015; Peine and Neven 2019). In design processes the ‘problem’ has often been defined by designers at the outset, echoing cultural tropes of older people as frail and lacking agency (Boyle 2014).

More recently there has been a growing focus on consideration of the social and everyday lives of older people and the emergence of new methods of co-designing alongside older adults (Vines et al. 2015; Rodgers 2018). These methods have tended to foreground power relations between humans, in particular the dichotomous relationship between those with power (e.g. designers) and those without (e.g. older adults). However, this approach has often had the effect of sidelining the material and more than human actors participating in these processes and can fail to account for the entanglement of social and material worlds. In order to intervene in design practice, Science and Technology (STS) scholars have suggested that problems should be worked on within human collectives who gather around particular 'matters of concern' related to ageing (Latour 2005). These matters of concern are considered to be entangled in social and material processes and practices.

STS and feminist materialist thinking in co-design

In my own co-design work in care settings for older people I bring an approach that draws on some of these ideas from STS but also combining them with feminist materialist thinking concerning the relationality between care and technology (Mol, Moser and Pols 2010). These scholars argue of the 'absurdity of disentangling human and non-human relations of care' (Bellacasa 2017, 2; Mol, Moser and Pols 2010) suggesting that paying attention to the relational, affective and interdependent effects of technologies, alongside other care practices, is vital in technological design processes. Taking this stance into processes of co-design in care settings involves rejecting more instrumental, economic accounts of the world and increasing awareness and visibility of the networks of actors that are taken for granted in everyday practices of care (Mol, Moser and Pols 2010; Barad 2007; Bellacasa 2011). The co-design process here involves making visible, and tangible, sociomaterial relations of care and how they contribute to social well-being. The process of technology design proceeds as an open-ended innovation process where technologies are considered unfinished projects which are open to adjustment or tinkering (Akrich 1992; Mol, Moser and Pols 2010).

Bringing feminist materialist ideas of care to the practice of co-designing technologies means engaging with care in all its sociomaterial complexity. To simplify some complex historical arguments, feminist scholars ask us to reconsider care in four key respects: firstly, seeing care as an everyday, messy, material practice; secondly, seeing care as political (and often overlooked); thirdly, understanding care as going beyond language to encompass embodied materialities of care including touch and bodies and finally care as a dynamic process being about diligent attention to detail, involving repair and maintenance (Tronto 1993; Bellacasa 2017).

Careful co-design

Drawing on these ideas of care Bellacasa (2011; 2017) has suggested that STS scholars might consider moving beyond the Latourian call to gather around matters of concern to consider intervening in 'matters of care'. In my own work I have been interested in bringing Bellacasa's rather theoretical ideas to the practice of co-design. I have begun to think about co-design as a matter of care or as a care practice which, I believe, supports more ethical, sustainable design in the ageing sector. Below I will outline how taking this approach might change practices of co-design and will argue that this approach is of particular value when working in settings where questions of care are predominant.

Firstly, moving from 'I am concerned' to 'I care' draws attention to affective aspects of technology design practices that have often been ignored. It involves paying attention to the networks of actors that are often taken for granted in technology design processes, including making visible how bodies, space, aesthetics and intangible concerns come together as we co-design technologies. For instance, noticing how the touch of a hand or the view out of window, might be important elements to consider in both the design practice and in relation to the object of the design.

Working with co-design as a care practice also highlights co-design as a material, vital doing. It suggests the need for diligent attention to detail, for constant repair and maintenance and attention to humans but also things and materialities as we co-design together and with the material world around us. I have always found the below quote from Miriam Winance particularly helpful in thinking about good co-design practices – if we substituted the word 'care' with 'design' the quote gets to the heart of how careful co-design processes work in practice:

> to care is to meticulously explore, quibble, test, touch, adapt, adjust, pay attention to details and change them, until a suitable arrangement (material, emotional, relational) is achieved. (Winance 2010, 111)

So matters of care are doings, they cannot help but therefore involve the social and the material world and the more than human.

Careful co-design also involves a critical approach that questions why certain practices of care have been invisible and de-valued and looks to enable new actors and tools to align in trying out a more democratic and holistic future making approach to the design of technologies. The contention here is that open ended, careful design projects are necessary in order to make 'good' care practices, exemplified by approaches that acknowledge the ethical/political, the affective and the material/ maintenance of care (involving our bodies, ourselves, and our environment) more viable and present in new technological designs and approaches to care.

So what does this mean for co-design practices and outcomes? It involves us attending to *sociomaterial arrangements* as matters of care in co-design processes. For instance, recognising the role of material culture, such as aspects of the built environment and everyday objects, in care settings in order to illuminate and develop their role in caring practices (Maller 2015; Buse, Martyn and Nettleton 2018).

Careful co-design in practice

In order to provide an example, the next section of this short paper explores our co-design process in care homes in which we conducted a process of technology co-design focused on democratic community building through storytelling. We spent time observing in the settings as part of the 'discovery' phase of our design work and instead of focussing only on the human care practices and relations we instead specifically attended to the material and more than human world and the importance of these elements to the older people we were working with. For instance, we observed the blackbird that sings outside the window that was given a name by some of the residents, the touching and grooming activities such as nail painting that care staff engaged in, the long and deserted corridor through which residents must walk in order to reach the beautiful garden room and the sound of the tea trolley that provided a familiar and comforting rhythm to the day. We were then able to build on these often invisible elements of caring practices in our co-design work, bringing in different material and sensory design interventions such as object orientated sessions where residents told stories about their favourite objects to other residents, and sensory sessions involving smells and an array of fabrics (velvets and silks and furs) for residents to touch and smell.

In adopting this approach we found that, as designers, we were able to identify some key tensions or problems related to how assemblages of care often worked to diminish the relational, emotional and embodied aspects of care. Relationally we found that older residents struggled to make connections with each other but also that care staff often felt anxious about having one to one conversation with residents. Emotional issues included those related to living with loss; of objects, relationships, and homes. Embodied/material problems emerged, for instance, around the particular aesthetics in the care settings, the constant noise of the TV, and the noticed disconnect with the natural world and the world 'outside' the care setting.

In identifying these key tensions we felt we were able to move from a focus on problem solving and towards thinking about our co-design process as joint problem making as the matters of care, outlined above, emerged through doing the designing together. In order to identify these tensions we had explicitly engaged with how human and non-human entities emerge, shift and fuse together during our co-design process. This helped us to understand, through a relation lens, what entities become, do and produce when they are associated together and the different problems or matters of care that therefore emerge.

In order to ensure this joint problem making approach we discovered the importance of recording, mapping and playing back the different entities and their relations, to our co-designers in multiple ways, bringing material and immaterial aspects of matters of care, that are not always visible or tangible, into the open.

We found that the outcome of the co-design process also then changes as we were then engaged, not in simply co-designing technologies to solve the problem of lack of community in care settings, rather we needed to co-design care arrangements or sociomaterial arrangements (Criado and Rodriguez-Giralt 2017). This might require ‘technology’ designs that make adjustments to intangible aspects of culture and re-designs of space, but it might also mean working alongside care staff to develop their confidence to deliver care differently, or alongside policy makers to challenge the current economic models around social care provision.

Conclusion

So up to now I’ve suggested that the social and the human has often been foregrounded in co-design work - a focus has often been on power relations between humans and the design of more democratic processes, bringing diverse publics together around matters of concern. This is important. However, in my work I have found that thinking about co-design as gatherings around matters of care helps us to focus in on the material and the more than human in co-design processes, to consider the political and ethical issues that have various everyday effects in care settings. It helps us to think about co-design as problem making rather than problem solving and leads us to co-design technologies as sociomaterial care arrangements.

* * *

Frailing Technology: Ageing between STS and Medical Sociology

Tiago Moreira

In this short essay, I explore how vulnerability could be embedded in technological design in the ageing domain and beyond. My point of departure is the suggestion that health and activity/mobility play a central role in the sociotechnical imaginary of ageing societies. I suggest that crossing the boundaries between medical sociology and science and technology studies enables us to question this configuration, and to re-think the socio-materialities of ageing. To do this, I draw on empirical data from a set of interrelated projects conducted in last 5 years, starting with a reflection on a fieldnote written in 2017.

Between the molecular and the experiential

I think it was the fact that I was understanding most of Jennifer's presentation about her doctoral research to the other lab members that I first remarked in my notebook. Contrary to other research progress oral reports to the Thread Lab – a cell biology of ageing laboratory where I conducted ethnographic fieldwork between 2015 and 2019 –, Jennifer's touched on a subject I knew something about: frailty. In the two years before I had been involved as a collaborator in a randomised controlled clinical trial of muscle strength training and protein supplementation as a means to delay frailty and its musculoskeletal component - sarcopenia - in older individuals. In the process, I had become interested in the on-going controversy about the concept age-associated frailty (e.g. Pickard 2018), its prevalence in the population, and aware of debates about the complicated relationship between frailty and sarcopenia in the ageing population.

What I had recognised in Jennifer's presentation was not only the use of a commonly used definition of frailty – as a "state in which the ability of older people to cope with […] stressors is compromised by an increased vulnerability brought by age-associated declines in physiological reserve and function" (WHO, 2017) – but more importantly her drawing on a specific standard, the Frailty Index (Mitnitski, Mogilner and Rockwood 2001) – also used in the sarcopenia trial on which I was a collaborator –, to measure 'health deficits' in the aged mouse. In an operation that cell biologist of ageing von Zglinicki and colleagues (2016) described as "reverse translation", Jennifer's aim was to draw and validate equivalences between deficit indicators used for humans in the Frailty Index and markers of health in the laboratory mouse. In practice, 'reverse translation' was a difficult undertaking, because it required knowing and caring for lab mice in highly specific, detailed ways (Friese 2019) – e.g. assessing, scoring and maintaining fur shade, texture, grain and general condition. This process was intended to establish a biomarker baseline to explore the value of senolytic therapies – "agents that selectively induce apoptosis [cell death] of senescent cells" (Kirkland et al. 2017, 2297) - in the reversal of frailty, which was the key objective of Jennifer's research project.

Underpinning the parallels across sites is a common approach to technoscientific innovation, supported by a shared standard (Frailty Index). In the sarcopenia trial, the focus was on designing exercise routines and protein-rich food products, testing their acceptability in the older population and their efficacy in countering loss of skeletal muscle mass, and frailty more widely. In Jennifer's study, the idea was to design and test therapeutic agents to reverse the accumulation of cells which have lost their capacity to divide (senescent cells), and thus to prevent the development of age-associated conditions such as frailty. This rationale is also evident in the design of 'healthy ageing' interventions aiming to involve older people in urban cycling in many contemporary cities (Lassen and Moreira 2020). In all these instances, innovation is justified by alignment with the promise to address a specific socio-economic problem, research projects and initiatives hinging on the possible impact of technological intervention on the frailty of older populations, where prevalence is estimated to be up to 60% (Collard et al. 2012).

The choice of frailty as a target of technological intervention is significant beyond its prevalence and is intimately linked to how this syndrome has come to embody the predicaments of growing old in contemporary societies. As Gilleard and Higgs (2014) have argued, frailty is the defining condition of the Fourth Age, a collectively imagined last phase of life characterized by ill health and dependency. They suggest that, contrary to other stigmatising conditions, the labelling mechanics of 'frailing' does not enact a concrete spoiled identity, as expected by models of stigma inspired by Goffman (1963), but rather a sense of abjection towards older people, thus marked by "a future unspecified adverse outcome". In this, research and innovation program to prevent frailty can be seen to deploy a central sociotechnical imaginary that links health and activity/mobility to technology in the ageing society.

It is useful to think of health, activity and technology as being in a three-way relationship (Moreira 2016, 47-49). In this triangle, practices of health production and measurement – e.g. exercise routines - become linked to technoeconomic promises of re-activation of the ageing body (e.g. reversing frailty). Relatedly, valuations of activity/mobility become closely associated with health measurement (e.g. Frailty Index), on the one hand, and the effects of technologies, on the other. Interestingly, such technologies are not confined to one single domain, ranging from biocellular therapies, to assistive robotics to the design of protein-rich foods. The range of possible interventions on the frail ageing body blurs the distinction between computing, biomedicine, public health, sport, food science and technology, and other fields. Technoscientific practices, in domain of ageing, as the example of frailty makes clear, offer to modify health and activity through a set of converging tools and forms of knowledge that align the "molecular and the experiential" (Lappé and Landecker 2015, 152).

Frailty at the crossroads

Understanding and investigating empirically this specific configuration of ageing-related technological practices requires a careful but equally inventive combination of theories from both science and technology studies and medical sociology. Using the example of frailty, again, will help to clarify this argument. In both the clinical trial and the Thread Lab, technological design and testing relied on a workable category of frailty, made conspicuously visible in Jennifer's attempts to 'reverse translate' the deficit accumulation model of frailty to the lab mouse. Committing to a specific formatting of frailty had consequences, for example, for how exercise protocols were designed in the clinical trial, and in turn, for the recruitment criteria used. Thus, it was sometimes the case that potential participants became classified as 'too frail' or 'too vigorous' to be included in the trial (Otto and Moreira 2018), making their situation potentially excluded from the networks of health production the trial was precisely attempting to build (Star 1991).

Attending to these situations is one of medical sociology's unique strengths, taking the point of view of the 'patient' and exploring the dynamic relationship between identity and the person's social world (e.g. Charmaz 1983). In distinction from the deficit accumulation model of frailty (see above), medical sociology's analysis of the experience of frailty focuses on how bodily disruption – e.g. a fall –calls into question the person's habitual, socially grounded way of being and unsettles her hitherto unproblematic relation to the world (Pickard 2018; Bury 1982). In this process, reconstructing one's identity does not necessarily entail identifying fully with the label of frailty, but might lead to a reconstruction of one's activities and social networks, so that physical limitations can be contained, and a sense of continuity maintained, despite increased awareness of decline. What, in the deficit accumulation model, is cast as risk, is experienced by older people as uncertainty, enacted in a cautious and continuously re-invented navigation of their socio-material world.

Contrasting this nuanced understanding of frailty with the ‘scripted’ specification of technological use I encountered in the trial and the laboratory is useful for two key reasons. On the one hand, it contextualises uses of technology in a mode of pragmatic engagement – that of the activities of everyday life –, and thus helps in STS’ aim to deflate technology-focused solutions to the ‘problems of ageing’. From this perspective, as I observed, protein-rich food products for frail older people often merely add functionality to an already ‘healthicised’ meal, where ingredients are included mainly for their physiological benefits to reduce the risk of disease. Reluctance of older people to participate in this arrangement of eating should thus not be surprising and cannot be understood through the frame of therapeutic ‘compliance’ or ‘adherence’ (e.g. Conrad 1985).

On the other hand, understanding living with frailty as form of mundane work offers an alternative, diversity-focused, and embedded ‘configuration of the user’ to be used in technological design (Peine and Neven 2020). Medical sociology recognises living with chronic illness, disability or frailty as both a mode of practice – often conceptualised as a form of work (Corbin and Strauss 1988) - and a way of knowing: these two dimensions are inextricably connected. For medical sociologists, ‘experience’ is not a uniquely individual set of impressions but rather a form of socially grounded knowledge (Bury 1982), collectively produced by the interactions and negotiations of a variety of actors across formal and informal settings. This provides another point of fractional contact between medical sociology and STS in the domain of ageing. How are the forms of situated cognition that we usually see as living with and caring for frailty better supported through technological devices or processes? Addressing this question requires starting from an understanding of existing practices of frailty - a grounded theory of frailty – to identify technological needs and possible forms of user involvement. It might also invite us to reconsider technological practices in the arena of ageing.

Medical sociology direct STS further into praxiological investigations (Mol 2002) of the sociotechnical or socio-material constitution of ageing. It does so, however, by emphasising the human perspective – the ‘patient’, user, older person, etc. Indeed, a consistent critique of medical sociology by STS scholars has been its belief in the intrinsic character of human agency (e.g. Moreira 2004). Medical sociology’s orientation to agency is problematic because of how it overlaps with calls and prompts to make older people more ‘active’ in society through technology intervention (see above). In this, ‘active ageing’ technologies have become the target of criticisms for their inability to integrate the experience of decline, loss of function and passivity in their enactment of ageing, that is to say, to encompass the diversity and tensions inherent to a condition like frailty, as detailed in medical sociology's own empirical investigations of it. By drawing uncritically on medical sociology' humanist commitment, STS partakes uncritically in the normative aim "to reconceptualise older individuals as active users of technology rather than as passive recipients" (Czaja and Barr 1989, 128). In doing this, STS thus risks neglecting its own tradition in problematizing agency (Latour 1988; Callon and Law 1992; Gomart and Hennion 1999; Barad 2007).

Frailing technology

What would be consequences of conceptualising older people as both passive and active users of technology? To do this, we might want to start by taking frailty as an object lesson. As suggested above, frailty is interesting because it both deploys technological expectations about innovation in the ageing society and challenges the parameters on which those expectations rely. Frailty is both the defining condition of older age and the most puzzling and difficult to stabilise, define and measure both in the clinic and the lab. Its experience is marked by hesitation and uncertainty, with pragmatic engagement defined by fluctuation between inaction and careful mobility. How could technology for older people be re-imagined if frailty became its paradigm; if, instead of taking as point of departure an able bodied, active, engaged human, we would begin with vulnerability?

In this shift, vulnerability should not be conceptualised as an exceptional state but as a relationally produced human attribute (Mackenzie, Rogers and Dodds 2014), rooted in socio-technical systems (Hommels, Mesman and Bijker 2014). Frailty could thus become the model for research on technoscience in the ageing society, specifying a pragmatic and fragile balance between autonomy/activity/mobility and dependency/passivity/delicacy. Rather than aiming for technology to fix and establish the right balance between these two poles, we should try to understand how technoscience can care for the dynamic between them, enabling a continuous mutual adjustment of the capacities of ontologically heterogeneous actors. In this process, technology would undergo what we, after the process of adapting a physiological scale to lab mice describe above, could call a 'reverse frailing', where technological expectations are embedded in uncertainty and enacted in a cautious and continuously re-invented imagination of the materialities of ageing.

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Paolo Giardullo

Non è aria. Cittadini e politiche contro l'inquinamento atmosferico [It is not air. Citizens and policies against atmospheric pollution], Bologna, Il Mulino, 2018, pp. 184

Dario Minervini *Università degli Studi di Napoli Federico II*

"Non è aria" is an Italian saying that, more or less, means that it is not the right time or that you do not need something in that specific moment. In the case of the book, this title is a pun on the literally "is not air" referring to atmospheric pollution.

Paolo Giardullo adopts a hybrid perspective. He mixes theoretical sensitivities from the Environmental Sociology with STS, in order to deal with this thin (as air) and heavy (as the polluted rain) object of inquiry. The book is organized in three chapters in which the author take stock of 1) the theoretical and analytical proposal, that is the hybrid conceptualization above mentioned, 2) the governance and the policies facing atmospheric pollution, 3) the multiple socio-material interconnections that perform (and are performed by) the assemblage including cars, places, containers and coal.

Because of the theoretical hybridity of the framework, it can be said both that the book is not original in itself, neither that it can be considered something yet established in the current sociological literature. A general issue framed according to the Environmental Sociology debate, a sort of longstanding novelty in the Italian academia, is here endorsed by the references to the classics of STS studies. In particular, the main theoretical arguments summoned from STS are those developed by the Actor-Network Theory (ANT) scholars. The first theoretical section (Chapter 1) unfolds from Bruno Latour's pivotal contribution in challenging the sociological effort to retrace the interplay of the human agency whit that one emerging from materiality to by John Urry's social "on the move" approach. The latter was one of the scholars that directly addressed, from a pragmatic point of view, the issue of the climate change (Urry 2011). This reference is very closely connected with the main argument of the book we are discussing here. Indeed, the point the book addresses is how the "high carbon lives" perform, and are performed by, practices that are not merely the consequence of individual preferences but "ingrained" in everyday life of contemporary times. Air pollution is "ingrained" as well, as a complex configuration participating to (and tied to) a wider socio-material assemblage that Giardullo depicts through his analytical effort.

The analysis of governance arrangements and policies (Chapter 2) envisioned to face atmospheric pollution is the way to shed light on Ecological Modernization "from inside". Here Environmental Sociology provides both a descriptive tool to sketch the multilevel governance of sustainability policies and a prescriptive reformist model to foster the eco-transition. Giardullo tries to balance this ambivalence managing the intrinsic normativity of the Ecological Modernization, looking at how norms, institutions, technologies and markets are intertwined in structuring the solutions to the ecological crisis.

Such an extended unit of analysis consists of an "assembled" scenario that includes, of course, those "guilty" people polluting the air by using their cars for the mobility of everyday life. What the environmental policies try to frame and address as bad behaviors or a lack of awareness, is represented in the book as something more complex and distributed within a bundle of practices consistent with auto-mobility system. Cars and automobility are one of three analytical focuses scrutinized in the book; the other two are the logistics (mainly road transport) and heating systems (Chapter 3). These different fields are investigated through their specificities, trying to consider the situatedness of the socio-material practices investigated. In this regard, this book seems to be too slender. Indeed, the empirical strategy does not include those thick descriptions featuring accounts stemming from the ANT, consistently with its ethnographic sensitivity. The reconstruction of the social practices, cultures, skills and materialities, in the manner the Lancaster school use to investigate these issues, could have been useful, as well (Shove, Pantzar, Watson 2012). On contrary, connections between automobility, logistics, heating and air pollution seems to be presented at (too?) high degree of abstraction.

Despite this, the book provides interesting insights in the three fields above mentioned, and the line of reasoning leads to clarify the general frame in which the *ontological politics* (Mol 1999) of the air pollution is performed. For example, how the moralities intertwined with the connections enacting the mundane ways we use to move, transport, and heat are diversified and often contradictory is displayed. Security, practicably, viability, (economic) saving, cleaning: all these values are negotiated ad composed through a steady work of maintenance.

The actors that we look at as "guilty" because polluters, experience the conflicting moralities of the ordinary social practices in everyday life, sharing a responsibility that cannot be retraced as punctual but that emerges as dispersed and distributed. Of course, this point could be questioned by those social scientists endorsing a "critical critique" posture of research. From this standing point, the lack of an analytical attribution of responsibilities would be considered the main weakness of this study. STS teach us that, unfortunately, this sort of dilution/distribution of responsibilities is the result of an effective articulation of the air pollution socio-material assemblage, more than the critical weakness of Paolo Giardullo. In other terms, air pollution emerges – and is performed – as a "strong" phenomenon because of the solidity of the complex web of synergies and interactions between heterogeneous elements and because of the effectiveness in the enrollment of humans and non-humans.

From a pragmatic point of view, power is not (only) a matter of good or bad intentions or behaviors, neither it is directly sloping from unfair/unsustainable norms and policies. It is something that works making solid in time and space a hybrid configuration of actors and practices. So how to foster a critic to such an issue (the atmospheric pollution), even if from a non-normative standing? On this point, studies adopting pragmatic perspectives will lead to open new questions, more than stating answers and responses. Giardullo invites us to insist on the work of deconstructing the self-prophecy and the automatism of prescriptive framing facing pollution through technological determinism.

Maybe we can be a little more ambitious in retracing how the epistemological distance from the dramatic consequences of the environmental crisis plays a fundamental role in undermining the enactment of alternative assemblages. People, organizations, institutions, socio-material arrangements are differently tied to the very destructive dynamics of climate change, very often learning and experiencing the "bright side" of the environmental crisis. So, there are actors who are more or less close to environmental problems, as well as there are different rates of complexities featuring these problems (Carolan 2004).

Air pollution is a matter of practice indeed, but not so immediately close in epistemological terms (meaning also in practical perception) to those that enact the air pollution itself. So how people claim to fight it and, at the same time, why they cannot detach themselves from this socio-material configuration seems to be another worthy research path to follow, after this Giardullo insightful book.

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Kat Jungnickel
Bikes and Bloomers. Victorian Women Inventors and Their Extraordinary Cycle Wear, Cambridge, MA, the MIT Press, 2018, pp. 323

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In the late 1800s, a cycle craze swept across Britain. The bicycle became the new means of getting about for the middle and upper classes, men as well as women. While there were very few concerns as to the suitability of this activity for men, for women who took up cycling, their new activity was deemed problematic, on several accounts. There were strong social norms in place around mobility and the (in)appropriateness of women appearing in public. Medical beliefs of the alleged weakness of the female body prevailed, and, there was the "dress problem". A woman striding a bike in men's wear was unthinkable. Riding a bicycle in long skirts was of course both difficult and dangerous. But, the alternative, that is, to simply removing them and wearing trousers was definitely out of the question. The clothes thus had to be adapted and adjusted to meet the needs of riders, while at the same time respecting the notions of what was considered proper clothing for a respectable woman.

This required creative and innovative thinking and actually resulted in various patterns and designs being created by women, for women. Many of the ideas were patented. But who were these inventors and how did they come up with their designs? What motivated them and how were they and their inventions regarded? What can patents for cycle wear from the late 1800's tell us about mobility, technology and women's positions and possibilities? In her highly interesting and captivating book, Kat Jungnickel traces some of the women behind these inventions. By combining materials found in archives with ethnographic insights gained from actually making dresses from these patterns, she sheds light on a hitherto neglected area.

At first, I have to admit, the prospect of reading a study of patents did not really spark my interest. But, very soon I realized this was neither dull nor dry. On the contrary, it was exciting and, as Jungnickel notes, it helped me get closer to the women of the era as I could hear their voices and see significant sides of society through their eyes.

In one article on strategies for gendering design, Maja van der Velden and Christina Mörtberg (2012) discuss and demonstrate the intricate connections between gender, design and material objects. Similarly, in a study on Philips electric shavers Ellen van Oost (2003) shows how shavers configure the users' femininity and masculinity. Patents, as Jungnickel's book convincingly shows, prove to be excellent sources for exploring the close ties between design and gender. As they constitute both social and technical data, patents "reveal how the politics of mobility and ideas around gender, citizenship and public space have been debated, imagined and materialised onto bodies over time" (p. 5). As the focus is on patents of cycle wear this becomes even more revealing, since it very clearly highlights the relationships between the physical body, technology, society and public space. Cycle wear both enables and constrains mobility for women.

The book is divided into three parts. In the first one, which consists of five chapters, the author explores cycling in Victorian Britain, the emergence of the Lady Cyclist and the "Dress Problem". As mentioned, the various creative solutions to this problem led to a number of inventions and patents. Important in this context is that in the1890s, the patenting process was changed and thus it became possible for new groups of inventors, among them women, to claim their inventions. At the same time, bicycling became fashionable with the middleclass. This led to a rapid growth of the production of cycle-related paraphernalia and apparel. One of many examples is "the Pneumatic Tube Coil" – hairstyle, promoted as the "latest novelty" for mobile women, which appeared in advertisements in 1897. The popularization of cycling also led to an intensification of patent applications. In the year that patent applications rose to 30958, as many as 6000 were cycling-related.

Moving to the second part of the book we get to know some of the inventors of the time. In five chapters, the lives and histories of six women, two of them sisters working together, are presented. One of them is Alice Bygrave, a London-based dressmaker and the woman behind the "Bygrave Convertible Skirt". With the help of archival records, census-aggregate data and patents, contemporary journals and newspapers such as *Bicycling News* and *Pall Mall Gazette*, Jungnickel paints a picture of a successful entrepreneur. Alice Bygrave travelled to New York to promote her skirt and get it patented; the skirt was appreciated by the highly popular Stanley Cycle show, and it was praised in Australia. She was not the only inventor in the family though; her father, who was a watch- and clockmaker, was an avid cyclist with a keen interest in bicycle design and he held several patents. In 1894, the year before Alice's patent, he submitted a patent for "Improvements in Cycle Saddle Springs". Jungnickel speculates that father and daughter might have spent time talking about ideas and making models. His experience with the patent process may have helped her become familiar with the application process.

There were also professional cyclists in the family; one of her younger brothers and his wife were both racing cyclists. Rosina Lane, as was her sister-in-law's racing name, was a successful cyclist. In several photographs, she can be seen wearing the "Bygrave Convertible Skirt". Though Alice Bygrave appears as to have been a both talented and industrious business woman, Jungnickel emphasises the importance of not forgetting the collaborative work that that seem to have gone into her creations. "Piecing together Alice's story", she writes, "reveals a diverse range of influences that helped her shape her creative endeavours" (p. 154). The exploration of Alice Bygrave's life and invention ends with a section called "Interviewing the 'Bygrave Convertible Skirt'" which accounts for how Jungnickel and her collaborators set about making the skirt. Following the step-by-step instructions provided by the patent, turned out to be quite difficult and raised many questions. But it also becomes obvious how: "the skirt operates like a timepiece. There are clear parallels between her invention and her family's watch- and clockmaking influences" (p. 154). This is knowledge that could have been gained only through the researchers' practical engagement with the patent.

The chapters that follow are structured in the same way and centre around other inventors and their patents. Some designers made cycle wear that would conceal and understate while others did the opposite: their dresses were designed to stand out. This shows how important it is, as Wiebe E. Bijker states in *Of Bicycles, Bakelites, and Bulbs* (1995), to "never take the meaning of a technical artefact or technological system as residing in the technology itself". Instead, we "must study how technologies are shaped and acquire their meanings in the heterogeneity of social interactions" (p. 6).

As genealogists are well aware, it is always easier to follow the extraordinary or the people of ill-repute. Tracing an ordinary and law-abiding individual is much harder, as she leaves few traces in the archives. This is the case for Julia Gill, the woman behind patent no. 6794: "A Cycling costume for Ladies". There were several women with this name and which one of them designed the convertible cycling semi-skirt is not clear. As Jungnickel points out, we can never fully know the past. But we can test various possible scenarios and see what emerges. Julia Gill self-identifies as a court dressmaker, which means she made clothing for high-society women to wear for special occasions. Jungnickel discusses how cycling became fashionable among upper class women, which meant they also needed to include cycle wear in their wardrobe planning. The section ends, like the others in this part of the book, with focusing on the inventor as Jungnickel and her team sew the skirt. "On paper this garment looks socially possible, but in material, it reveals itself as very risky!" (p. 180). The third and final part of the book is a conclusion, which is about the politics of patenting. This is followed by a list of British Cycle Wear Patents 1890-1900.

To conclude, *Bikes and Bloomers* proved to be one of the most exciting books I have read in a long time. Interesting and well written, it adds a lot of new knowledge to the fields of both the history of bicycling and of fashion and design, and to Science and Technology Studies. It is a fascinating "account of cycling, sewing and suffrage" (p. 6) and the arguments are strong, substantiated by the use of various materials and sources. Jungnickel's combination of methods works very well and the procedure of actually making and wearing the skirts clearly deepens my understanding of both the idea behind the invention and its applicability. Located in the theoretical framework of feminist and science technology studies it is also a feminist reclamation project. Jungnickel wants to render the inventors and their stories visible, arguing that "Learning about past lives invites us to reflect on our own" (p. 9). Because what women wear while cycling, still matters.

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Christopher M. Kelty
The Participant – A Century of Participation in Four Stories, Chicago and London, University of Chicago Press, 2020, pp. 344

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Christopher Kelty is an anthropologist and historian who has dedicated the last couple of decades of his scholarly work to study, discuss, and understand participation. *The Participant* stands apart from his previous works as it shifts the focus away from grassroots or domain specific forms of participation with their localized practices, cultures, politics, and infrastructures. Indeed, the book encompasses a far-reaching aim. Its starting point is that participation has increasingly become associated to decision-making and political processes. The aim of the book is to investigate the genealogy of participation pertaining to the last century of US and EU societies, and therefore to identify both the particularities and "the singularity of participation, not just its variations." (p. 6). The book goes beyond the usual questions about "participation in what?" or "why do we participate?" and it focuses on the thought-provoking one about whether it is possible to participate in participation. As such, the contribution of the book is ambitious and, admittedly, unique in its scope, finding its place along those few that try to question participation in fields such as, for instance, media and cultural studies (Barney et al. 2016) and participatory design (Andersen et al. 2015).

The Participant is ambitious also for its unconventional and, in some ways, performative nature. Kelty admits a "mischievous pleasure in an absurd experiment" (p. 6): to write an ethnography of participation based on experiences of participation, which he did not have. As a matter of fact, "the participant" is not that much of a real object (or subject) of study for the book, but rather a fictional character, yet realistic and plausible. The vignettes of "the participant" open and close each of the central chapters and they allow Kelty to bring into focus four assemblages of participation. These are understood in the book as "practical, material arrangements of people and things" (p. 37) and they characterize a specific way of *formatting participation* – a central concept in *The Participant*. Each assemblage supports a specific inquiry angle of the three constitutive elements of participation: *contributory autonomy*, *the experience of participation*, and *forms of life*. In each chapter, such analysis is done through the thorough and meticulous inspection of the historical artefacts and documents of participation, as well as through the meta-analysis of how scholars, practitioners, and institutions interpreted and talked about participation.

Contributory autonomy highlights the form of personhood that stands at the basis of participation. Under late liberalism this form of personhood has become increasingly individualized, and participation is currently understood first and foremost as an individual contribution, which is governed by procedural rationality, to a collective. With the experience of participation Kelty brings back at the center of the discourse the affective, emotional, and subjective dimensions of participation. The experience of participation, he argues, corresponds to the "soft part of the social fossil" (of participation) (p. 78). This is the part that has been increasingly lost in our contemporary understanding of participation, because of its elusive, ephemeral, and difficult-to-grasp nature, and because it has been continuously neglected in our understanding and framing of the phenomenon. Finally, by building directly on Wittgenstein's concept of forms of life, Kelty points to the importance of the "rules of the game" or, as he defines it, *the grammar of participation*. When equally and commonly understood and judged, such grammar of participation allows for a full experience of participation. Individual and collective become one. However, when the grammar is not understood or valued in the same way by all parties at play, suspicions, perplexity, and puzzlement characterize the experience of participation.

Chapter 1 (*Participation, Experienced*) focuses on the work of Lèvy-Bruhl and on an older meaning of participation that paved the way to today's understanding of participation as political concept. Indeed, is Lèvy-Bruhl understanding of *participation mystique* that explicitly connected participation with ethical personhood. Central to Lèvy-Bruhl's work was the emotional and affective dimension of direct, unmediated encounters with unknown (primitive, in his vocabulary) forms of life. With the mystical nature of participation, Lèvy-Bruhl highlights the fact that perplexity, the symptom of experiencing participation in this case, foreruns any rationalization of that experience. Chapter 2 (*Participation, Employed*) focuses on the early experiments of social psychologists in work setting to promote an early form of participatory management. In particular, the chapter reflects on the influence that Kurt Lewin's scholarship had on the implementations of such experiments and starts by analyzing Harwood Pajama factory pioneering work in this area. The chapter uncovers the stark difference between the early experiences of workers' involvement in decision making as a group and the subsequent formalization of such involvement into a routinized, individualized process of workers' motivation and satisfaction management. The former was oriented to improve working conditions and workers routines, while the latter to spur productivity or to overcome resistance to change. Chapter 3 (*Participation, Administered*) looks at participation in the domain of public administration. It reflects on the events surrounding the transformations of the Model City program of Philadelphia and how these were tightly connected to the engagement of a black neighborhood. At the center of this chapter is also the concept of expertise, which entered the discourse about citizen participation as a way of circumscribing the scope and power of citizens involvement by means of intermediation and the transformation of participation into a form of consultation. In chapter 4 (*Participation, Developed*), the enthusiasm for and the expectations over the Community Development project – evolved later into the Popular Participation Programme (PPP) – of the United Nations and the World Bank come at the center of the analysis. The chapter shows how Paulo Freire's scholarship of the *pedagogy of oppressed* has been appropriated into the foundations and the many interpretations of Participatory Action Research and, more importantly, embedded into the design and use of "participatory tool kits", which for over two decades became the magic box of wonders of the professionals in and outside of the PPP. *Participation, Concluded* is the fifth and last chapter. Here Kelty tries to suggest possible ways to format participation to move past merely cooptative frames that maximize individualized forms of contribution. These suggestions come in form of statement of principles (e.g. "creating the possibility of disagreement, not the guarantee of consensus") which take stock of the lessons examined in the previous chapters and are read in contrast to the technologically and digitally mediated forms of participation of the twenty-first century.

One regret I have about the book concerns this last chapter and the lack of a reflexive gaze on the suggestions made here. They remain in the form of general principles that (should) apply to assemblages of participation of twenty-first century media and technology. However, an explicit argument, even speculative or provocative, is lacking about how these suggestions could be materialized to support a re-enchanted and full form of participation rather than, e.g. a more coopted one. In my opinion, there is a missing story that is the one of a last participant or the participant of the future: one who could have enlivened the visible, diarchic, inert, and rife with disagreements form of participation, which Kelty suggests.

I believe that *The Participant* is of great interest to an STS audience whether already familiar and engaged with the theme of participation or not. First, Kelty assumes insights from STS scholars to support the epistemological and methodological foundations of his work: Donna Haraway's emphasis on stories that animate the world; Bruno Latour's credo in prioritizing method over domain; and, in particular, Noortje Marres and Javier Lezaun's works on the material and public dimensions of participation (Marres 2012; Lezaun et al. 2016). Their influence shows through the key arguments, the organization of the book material, and the characterization of the four assemblages of participation. Second, Kelty is skillful in avoiding remaining stuck in a one-dimensional and static understanding of agency when analyzing such assemblages. Through these assemblages, participation is shown to be triggered, supported, mediated, and performed equally by humans and non-humans and it is meticulously discussed by trying to account for all these facets. For instance, particularly effective are the considerations on Queen Victoria's portrait and the Participatory Development Tool kit, which are at the bases of the first and fourth chapters, respectively. The distinction between when and how these artefacts participate versus when and how they mediate participation is clear and convincing. Third, at the center of chapter three it stands a relevant consideration on the role that STS as a field has played in advancing our contemporary understanding of expertise as being always, and at the same time, deeply political and technical. While taking only a few pages of that chapter, the argument for STS is profound, because it provides STS scholars with a mirror for looking at how the field participated in the story of participation. I argue that for any scholar engaged in the "third-wave", or the "participatory turn", of STS (Lengwiler 2008) *The Participant* would prove incredibly inspiring.

To conclude, of *The Participant* I greatly appreciated the richness and thoroughness of arguments. Never shallow or hasty, neither when addressing the minute details of a participatory experience – e.g. the first chapter basically revolves around the unpacking of a footnote belonging to one of Lèvy-Bruhl's works – nor when talking more broadly about how the experience of participation crosscuts the four assemblages. Moreover, what I found particularly convincing in Kelty's work is the analytical frame of the three constitutive elements of participation. As the author rightly puts it, many engage with participation nowadays either to study, implement, or perform it, but we rarely find an explicit explanation of what participation is meant or thought to be at its core. In my opinion, Kelty has shown convincingly throughout the book that the contributory autonomy, the experience of participation, and the forms of life can scaffold a rich and not taken for granted understanding of participation.

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Paolo Landri
Digital Governance of Education: Technology, Standards and Europeanization of Education, London, Bloomsbury, 2018, pp. 192

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Since the upsurge of remote schooling due to the current COVID-19 pandemic, research about the digitalization and the digital governance of education systems has gained significant importance. In this context, Paolo Landri's monography *Digital Governance of Education – Technology, Standards and Europeanization of Education* appears both as a valuable guide and as a precursor for methodological concerns that researchers increasingly have to respond to. This is especially the case if one shares Landri's intent to not produce a static rendering of education policy and practice as "matters of fact", but rather to retrace the shifting power relations and risks regarding digital governance. What makes this book unique is that it provides a sophisticated account of the state of affairs regarding the digital governance and digitalization within the European and Italian educational landscape shortly before the acceleration towards digital schooling we are witnessing during the ongoing pandemic. The research questions Landri aims to investigate concern the sociomaterialities of digital governance, the relationship between standardization and digitalization and their potential impact on schools as we have known them in the past, which he refers to as the "classical morphology of schooling" (p. 106). The book illustrates not only how digital technologies contribute to the standardization of education systems. Moreover, it demonstrates how digitalization reshapes the conditions of educational practice itself. In other words, it gives insight into how some aspects of schooling that once remained tacit and implicit are now susceptible of being either codified or hidden within a new regime of visibility.

As it has been acknowledged in many other STS studies, social research at the intersection between social phenomena and technology presents considerable methodological challenges due to the necessity to acknowledge the entanglement of human and nonhuman actors and the need to uncover the concealed workings of algorithms and digital infrastructure. In an effort to bridge STS, sociology of education and a digital sociology of school, Landri responds to those challenges with a "composite approach" consisting of historical analysis, semiotic analysis and multi-sited ethnographies. He uses these methods in order to develop complex cartographies of the digital governance of education. Here, Landri embraces the concept of "cartography" introduced by Rosi Braidotti (2011, p. 4), considering it as a "theoretically based and politically informed reading of the process of power relations". In writing these critical cartographies, Landri makes use of Actor-Network Theory (ANT). However, as he explains, ANT is used as a sensibility rather than as a systematic and complete theorization. This is consistent with the problematization that the word "theory", present in the acronym ANT, that we find in previous discussions about "after-ANT". As educational contexts are often characterized by volatile configurations and assemblages of learning, this non-reductive perspective of ANT as sensibility has enriched a number of studies in the past. Thus, Landri draws from a strand of studies that have been adapting ANT to issues of learning and education since the '90s, featuring, among others, researches such as those of Jan Nespor, Helen Verran, Estrid Sørensen, Radikha Gorur, Tara Fenwick and Richard Edwards (2010; Fenwick et al. 2011). Recently, the concept of sociomateriality has been used to refer to the co-constitutive entanglement of humans and nonhumans in practices. With the addition of a sociomaterial vocabulary in recent studies, it is possible to discern how this book advances an emerging research field related to the study of sociomateriality in education.

The book is structured into seven chapters. While the first, second and the last chapter respectively represent the introduction, the theoretical frame and the conclusion of the overall book, chapters 3-6 approach the digital governance of education from different directions. Chapter 3 consists of a historical analysis of European cooperation that brings us back to the apparent paradox between current developments and the avoidance of cooperation in the domain of education in the original Treaty of Rome of 1957. Landri retraces how different education systems have gradually been made commensurable, leading to the current emergence of a "supranational space of European Education" (p. 33). In chapter 4, the author shifts to the national Italian context and discusses emerging forms of digital governance. The analysis focuses on the case of a national database of school profiles ("Scuole in Chiaro") and the fabrication of a school data infrastructure of self-evaluation. In chapter 5 we get an additional view on these issues by means of data from a multi-sited ethnography in different primary and secondary schools. Interestingly, head-teachers are supposed to insert reports for self-evaluation and self-improvement in a national web interface. The authorship of these reports, however, is not entirely independent, as automated compliance checks and notifications encourage the integration of performance items that are linked to certified national data and benchmarks already registered in the system. Landri shows how schools, in relation to their socio-economic status and pedagogical culture, find different strategies of compliance or non-compliance with the system, which he classifies as "alignment", "muddling through", "fabrication" and "opting out". In chapter 6, we learn more about the new emerging morphology of the "digitally supportive school" in the Italian context. Landri connects the new identities of "digitally confident and supportive" teachers, students and schools framed in EU policy documents and surveys (European Commission 2013, 143-151) with the evolution of policymaking that has recently led to the second National Plan Digital School (MIUR 2015). In an effort to account for the complexities of organizational change, this is complemented by another ethnographic case study of an Italian school that is recognized on a national level as a digitally supportive school.

Under the influence of COVID-related school closures and limited reopenings, one could easily be inclined to think that digital technologies disrupt educational practices in ways that either reflect hopes for a deschooled society (Illich 1971) or elicit skeptical voices about the potential failure of public education (Postman 1995). Landri, however, illustrates how digital governance is performing "change without rupture" and describes how schooling experiences "a deformation of its space while retaining its basic properties" (p. 106). Arguably, in light of recent emergency remote teaching experiences during the pandemic, one may determine that digital means can be used to perform continuity. Strikingly, Landri shows how the conformity of digital governance with traditional regimes of standardization may also interfere with the enactment of a digitally supportive school. In the case described in the book, the digitally supportive school is characterized by distributed educational leadership, an orientation to knowledge-in-action rather than highly standardized skills and a reflexive enactment and shaping of digital technologies, e.g. by choosing not to follow the national trend and opting to acquire video projectors rather than the more expensive smartboards. Today, these considerations help generate further hypotheses about the reactions of schools in the shift towards emergency remote teaching and after, with either the temporary absence or consolidation of digital forms of governance. At the same time, they may also indicate directions to consider for future configurations of digital schooling.

A recurrent theme throughout the book is the “myth” or the “paradox” of transparency. Landri demonstrates that dominant forms of digital governance add additional layers of opacity and obscurity and do not necessarily ensure more accountability. Consequently, an apparently well-intended pursuit of transparency can result in unintended effects, suspicions, uncertainties and ambiguities along with tendencies of surveillance and control. This makes it all the more urgent for researchers to follow the path outlined by Landri in order to critically engage with the ongoing changes in education systems.

Whereas in the book we get to know some of the possible tensions that arise from the introduction of new forms of digital governance in educational practices, we now face a situation that exhibits an unprecedented scale of shifts towards global platforms, transformations of teachers’ digital labor practices and digital inequalities (Selwyn and Jandrić 2020). Landri acknowledges that the cartography he has produced is necessarily incomplete, as unreachable actors remain impossible to account for. Yet, I argue that in the future it will be possible to look at this book as a work that marks and documents a “pre-pandemic” digital governance of education in Italy and Europe. At the same time, such a retrospective view will provoke questions about further aspects of educational practice that may have appeared as too mundane in the past to justify extended exploration. In fact, as the topology of schooling now reaches beyond the classroom into home environments through the integration of digital devices, new challenges for a digital sociology of school arise that extend the original scope of Landri’s book. For example, it would have been compelling to know more about the extent to which the described forms of digital governance have affected or have not affected yet the everyday lives of students from their own perspectives. In spite of that, I consider the theoretically and empirically grounded cartographies presented in *Digital Governance of Education* as a valuable landmark in the challenge of critical, STS-informed education research that should not be ignored by anyone investigating contemporary education policy.

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David Neyland, Vera Ehrenstein and Sveta Milyaeva

Can Markets Solve Problems? An Empirical Inquiry into Neoliberalism in Action, Cambridge, MA, the MIT Press, 2019, pp. 336

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Neyland, Ehrenstein and Milyaeva's monograph poses the question of whether or not markets solve problems. Although ultimately the authors leave the reader to answer this question for themselves, they do provide more than enough empirical detail to allow them to do so. After a grounding in the fundaments of neoliberalism (e.g. Harvey 2005) and the issues associated with markets being introduced to areas from which the public sector wishes to withdraw, the reader is introduced to the sensibilities of social Studies of Science and Technology through the work of Callon (1998; 2007) and others. Through these works, the reader is alerted to the fact that markets are created – through disentangling relations between actors before re-entangling them into new configurations. Such work, drawing as it does on ANT, also draws attention both to important non-human actors – non-human actors form the network linkages the make possible these new configurations - and to the fact that markets are performative, the result of the work done by the many public and private organizations who undertake to create them. This introductory chapter is clear to note also the negative consequences of creating markets – primarily through the mechanism of externalizing unwanted costs. Thus, such issues as living wages, working conditions, environmental degradation and loss of rights are seen as outside of the strategic and legal purview of the organizations involved. Yet, as the authors note, externalizing costs is precisely the reason that markets are made to appear more "efficient" than managed public services burdened with broader social responsibilities.

The book then goes on, through subsequent chapters, to lay out the detail of their own original empirical work. The chapters comprise a number of examples of attempts to instigate working markets in previously publicly funded arenas and in one instance, a new market where the existing one was failing. The examples covered include using markets to regulate carbon emissions through carbon trading, persuading pharmaceutical companies to make low-cost vaccines for the third world by guaranteeing sales, using competitive pressures (ranking) to determine the allocation of funding for university research in the UK, transforming private data into a market where citizens can secure ownership over and then rent their data, bringing private actors in to deliver services for vulnerable children and the privatization of UK student maintenance through a loans system and saleable student debt.

These empirical accounts are really the heart of the book. They provide an extensive and detailed resource for academics, students and policy makers interested in precisely how markets are created. The accounts build only loosely on the work of ANT authors in showing how markets are literally brought into being through accounting techniques, contract negotiations, demand guarantees and return calculations. The authors unpack how markets are negotiated and re-negotiated over time to meet the needs of its defined stakeholders and beneficiaries. The journeys from public good and prevention of harm, to markets and investment opportunities, we find, are hard fought, complex and expensive.

Throughout these chapters there is a great deal of constraint on the part of the authors. We are walked through even-handed and pluralistic accounts of the minutia of how and what it is that forms and holds markets together. In many respects the accounts function as mini-histories of the work of market builders. While the focus is upon how markets are achieved there are still plenty of examples of how this work can produce poor outcomes. We learn, for example, that the system of "carbon trading" put in place to replace pollution regulation, gave poor results because EU negotiators, keen to placate industry, set pollution limits too high. These were then easily met by normal technology change. Because of the difficulty of arriving at the first set of agreements, there was little appetite to go through the process again to adjust the limit on more than an irregular basis. We find a similar story for the UK governments' decision that University's should compete with one another for public research support. We learn about the huge effort and cost required to set up the scheme and the enormous efforts gone to ensure the credibility of the results. What we learn from the examples is that markets take huge amounts of administrative effort to set up, meaning that once in place they resist adjustment – unlike the imaged free-markets of neoliberal advocates – real markets are complex socio-material, behemoth and quasi-bureaucratic entanglements.

Social care provides a more disturbing example of what it really means to turn a public service into a market. Here private agencies were brought in to work with/for local authorities in social care, using what is termed Social Impact Bonds. In the example provided private agencies where offered the opportunity to work with children at risk of being taken into care – investors would be paid by results, numbers of children kept out of care, ensuring their best effort through market discipline but also showing a clear path toward profit. In effect, disadvantaged children were transformed into an investment opportunity. The scheme, a pilot and skewed heavily in favour of investors, was scrapped after a change in government policy. Government withdrawal from responsibility for financially supporting students in the UK through government grants created a similar "investment opportunity" – this time in the form of packaged up student debt that was then sold to investors. Here, government increasingly worried that it would not be able to "sell" the debt, was forced to offer it on increasingly advantageous terms. Concerns on both sides of the Atlantic over the use of personal data reflects the different political hues of how markets are deployed. While in the US individuals are assumed to own their data and are therefore taken to be in a position to seek economic rent from it as responsible economic actors. In the EU, GDPR rules reflected a quite different assumption, that citizens should be protected from predatory data-monetizing enterprises.

The accounts themselves as I say are highly restrained and to an extent this is frustrating. They are detailed, but not made to work very hard in terms of new theoretical insights or critical analysis. So much more could have been said, for example, about the huge con that student loans were (Mason 2016). The book would have felt richer if the reader where given a sense of this historical roots of this shift, the economic chaos that has resulted from it and the social and growing political disenchantment in it. It was also surprising, but perhaps in keeping the restrained tenor of the book, that the authors avoided the more scandalous examples of private investment in public goods in the UK, US and elsewhere – such as public-private partnerships in building schools and hospitals in the UK (e.g. Plimmer 2016) or privatized water supply where under-investment has led to crumbling infrastructure and to attempts by some municipalities to pull ownership back into public hands (e.g. McDonald and Swyngedouw 2019). Or for that matter, the deaths that have occurred on British railways as a direct result of under-resourced privatized maintenance (Murray 2002). Moreover, given the empirical detail of this book, I think there was an opportunity to talk more about precisely why market entanglements end up producing such poor results. STS theory in markets, such as Callon's, is not further developed across the chapters.

The final chapter returns once again to theory and is more analytical in approach. Here, again, rather than building on the ANT introduced in the first chapter, we are introduced instead to Kuhn's concept of scientific paradigms and in particular his idea of problem-solution coupling. The departure into quite different theory is odd, but the subsequent discussion is actually a very useful way to frame how market dogma operates. Problems are defined in such a way as to align with marketisation-as-solution. Further problems, stemming from the attempt to marketize, are coupled to further solutions (standards, contracts, participation) as means to move forward, while remaining within a market solution frame. Many aspects of the cases are then re-described in this framing to good effect. As a reader I was a little unsure why this concept was not a shaping narrative throughout the accounts. There are some links here back to more contemporary STS thinking, but largely by way of analogy with what is already evident from the empirical evidence collected.

The book's strength ultimately is in its empirical detail rather than in its theoretical or critical contribution. Readers of this book will gain excellent insights into the minutia of, in particular, the detailed contract negotiations that bring markets into reality, as well as useful insights into how to create vehicles to attract private investment to existing public services. The book is a must for policy makers who may still be thinking of heading down this road (or indeed who need to understand where they are presently, in order to more easily reverse out of it). What the book is not is an attempt to move STS theory on or to provide a thoroughgoing critique of marketization. Students of neoliberal-inspired policy making will find plenty of detail. The book offers valuable insight into how markets are made to work, while ultimately sidestepping the question of whether they do or not. Spoiler alert, they don't – but we knew that already.

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Tom Nichols

The Death of Expertise: The Campaign Against Established Knowledge and Why It Matters, Oxford, Oxford University Press, 2017, pp. 252

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According to Wiebe Bijker, Roland Bal and Ruud Hendriks (2009) we live in paradoxical times. Scientific advice is asked for all serious problems, but as soon as it is given, citizens, politicians and organizations comment on and criticize it. This paradox of scientific authority is at the origins of what has been called a crisis of expertise, a widespread trend which is grounded not only in socio-technical developments, such as the spread of social media, but also in cultural and political changes related to new visions of democracy and the democratization of science.

The crisis of expertise is a topic that is currently in vogue, and has been widely discussed in the field of science and technology studies and other academic communities (Collins and Evans 2007; see issue 3/2003 of “Social Studies of Science”). This area of research is also linked to a more recent, broader debate about the so-called “post-truth era” (see issue 4/2017 of “Social Studies of Science”), which highlights the development of an “epistemic turn” in Western democracies that produced a less critical relationship with deception (Keyes 2004). Under the aegis of the post-truth thesis, scholars have shown how a plurality of “truth markets” coexist within the new post-truth regime (Harsin 2015).

In this context, it is disappointing that an established scholar such as Tom Nichols does not feel the need to address the studies and opinions of his fellow experts, even in a text with pretensions to popular appeal. There is something paradoxical in describing and stigmatizing the end of expertise without drawing upon the knowledge of experts on the end of expertise. A typical failure on the part of experts that has contributed to the crisis of expertise is, according to Nichols, cross-expertise violations, that is, the overconfidence that leads experts to make pronouncements on matters far beyond their general area of competence and use their own epistemic authority to lend weight to hastily constructed opinions. This book is a blatant example of a political scientist overreaching into a field in which he lacks competence.

Nevertheless, Nichols's book, which appeared in English in 2017 and was immediately translated into Italian for LUISS University Press, attempts to describe this phenomenon by breaking it down into its many facets. Or, at least, into some of them. The book's chapters, in fact, address the main fields in which the death of expertise is taking place, according to the author.

First, he describes what he considers a crisis of the ability to argue. In his view, we are losing the ability to conduct conversations focused on the "thing itself", as Husserl would say, where one is able to separate judgments about opinions from judgments about people, to recognize that certain opinions are more grounded in knowledge and reality than others, and to change his or her mind. According to Nichols, this inability underlies well-known phenomena such as echo chambers, confirmation bias and conspiracy theories that support the dissemination of alternative knowledge and therefore the crisis of expertise.

A topic that is very close to the author's heart is the commercialization of the American university, that is, the transformation of the relationship between professors and students, which is increasingly modeled on marketing demands and customer satisfaction rather than on educational patterns. This, he claims, impels teachers to subordinate the contents of their teaching to the opinions of their audience and therefore to common sense, indirectly teaching their students that all opinions are equally valid and that those held by the majority should therefore prevail, regardless of the degree of expertise of the majority itself.

Of course, the book would not be complete without a chapter on the role of the Internet in the crisis of expertise, given that it is one of the most commonly discussed topics. Nichols's opinion, however, is that "the Internet is not the primary cause of challenges to the expertise. Rather, the Internet has accelerated the collapse of communication between experts and laypeople by offering an apparent shortcut to erudition" (p. 105). The problem with the web is that its infinite scope, combined with the use of search engines, means that anyone can easily find enough documentation to convince them still further of the truth of their deeply rooted convictions. Even the most serious crowd-sourced projects, such as Wikipedia, cannot do without the help of experts to ensure that the contributions of laypeople are trustworthy. Wikipedia is for Nichols an object lesson in the limits of the Internet-driven displacement of expertise.

A chapter addresses the issue of the decline of traditional journalism. Free information is a major pillar of a democratic society, which in order to function properly requires well-informed citizens. Nichols's thesis is that in a world in which citizens demand to be entertained instead of informed and journalists work in a hypercompetitive media environment, this essential function for democracy is becoming lost, along with the function of the media to discriminate between reliable and unreliable news and knowledge.

Finally, a chapter is dedicated to the role of experts themselves in causing the crisis of expertise through their mistakes and cheating. In addition to the aforementioned case of cross-expertise violations, Nichols deals in detail with the shift from explanations to predictions and the case of deception, such as the manipulation of data and falsification of credentials. An important aspect that the author emphasizes is that the crisis of trust in experts is not so much about their specific expertise on given issues as about their ability to apply that expertise when it comes to matters of public policy.

To summarize the main thesis of the book, for Nichols we are witnessing more than a natural skepticism towards experts. We are witnessing the growth of a stubborn form of ignorance, which is generated by "an increasingly narcissistic culture that cannot endure even the slightest hint of inequality of any kind" (p. 4). The death of expertise is the result of the spread of a form of ignorance which is so radical as to deprive those whom it afflicts of the ability to realize it, and therefore make them prey to the Dunning-Kruger Effect, according to which the dumber the individual, the more confident s/he is that s/he is not actually dumb.

Yet the fundamental point that escapes Nichols is that, on the contrary, the crisis of expertise is not a *crisis of ignorance*, but a *crisis of trust*. It is not about individual education or the qualities of "people", but rather the relationship between experts and laypeople in contemporary society. The case of vaccines is significant in this regard. As Nichols himself observes, the parents most likely to resist vaccines are not found among small-town mothers with little schooling, but among educated San Francisco suburbanites in Marin County: "While these mothers and fathers are not doctors, they are educated just enough to believe they have the background to challenge established medical science" (p. 21). The fact that they are educated people suggests that what motivates them is not the rejection of expertise and experts, but the awareness (absent in less educated people) that there are *other* experts besides those who are institutionally legitimized. That is, the awareness that experts may disagree with each other, and that consequently the institutionalized expertise of doctors and scientists is not necessarily true. The crisis of expertise is, in short, very different from the "death of expertise": it does not concern the recognition of the legitimacy of the epistemic authority of experts, but it questions *whose* epistemic authority should be recognized. The current crisis of expertise seems to be the result not so much of an aggressive rejection of epistemic authority as of greater independence of the lay public in choosing the network of experts to whom they are willing to grant such authority.

If we consider the problem from this point of view, we are encouraged to address a number of issues about scientific controversies, boundary work strategies, the construction of the ideas of science and pseudo-science, the dynamics of stabilization of knowledge claims, reputational policies of institutionalized and alternative knowledge networks, and so on. In other words, this would open up a vast set of issues within the sociology of knowledge that the current debate on the crisis of expertise has not yet fully scrutinized. However, Nichols fails to deal with such issues, not only because of his approach as described above, but also because the scientific interest that drives his research focuses on the political dimension of the problem. This becomes clear in the book's conclusions. When trust between experts and citizens collapses, Nichols writes, "experts and laypeople become warring factions. And when that happens, democracy itself can enter a death spiral that presents an immediate danger of decay either into rule by the mob or toward elitist technocracy" (p. 216). The death of expertise interests him as a dysfunction of democracy itself, not as a moment of transformation of knowledge production processes. Therefore, the reformulation of the title in the Italian edition seems appropriate.

Nichols has produced a rather US-centric journalistic pamphlet, which is easy to read but rather meagre in terms of content and depth and which is ultimately yet another of the many outpourings of old-fashioned university professors as they rail against the decay of their own institution, their own prestige, and the quality of their students. The nostalgia for an elite university institution, a form of university that exists only in the memories of the older generations, recalls ways of approaching modernity *à la* Ortega y Gasset, and makes Nichols appear to be a fundamentally conservative observer. He blames stereotypes, but the protagonists of his narrative are themselves highly stereotyped figures, such as "citizens", "experts", "students", "journalists" and, above all, "people". Society is flattened into categories, which do not do justice to actual social subjects. Who are the experts? It makes a big difference if we are thinking of scientists (experts in the production of knowledge) or of professional groups such as lawyers (experts in the use of expert knowledge). Even within the limited sphere of those who produce new knowledge, the crisis of expertise acquires different meanings – and will produce different effects – if the experts who are affected by the crisis are researchers in institutionalized fields of western science, developers of innovative, cutting edge areas of research, disseminators, consultants to policy makers, or experts in alternative knowledge (pseudoscience). To flatten the complexity of such a complex landscape is to do the reader a disservice, even the generic "educated reader" at whom this volume is probably aimed.

Mark Twain is reported to have once affirmed in a letter to the *New York Journal*, commenting on rumors that he was gravely ill or even dead: "The reports of my death have been greatly exaggerated". As observed by Gil Eyal in his *The Crisis of Expertise* (2019), this applies to the death of expertise as well. After all, he notes (Eyal 2019, 3), "whenever a book is published with the title 'The death of … (common sense, books, money, white privilege, or what have you),' it's a fair bet that Twain's quip holds, the reports are greatly exaggerated, and the subject of the lament is gratefully invigorated by the renewed interest in its health".

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N. Oudshoorn

Resilient Cyborgs. Living and Dying with Pacemakers and Defibrillators, London, Palgrave Macmillan, 2020, pp. 350

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Providing an autonomous review of a medical book during a moment in history when the ubiquitous COVID-19 pandemic progressively has reshaped the imagined future of health and illness has been a challenging task. Other diseases look anachronistic. Nelly Oudshoorn's book *Resilient Cyborg* is a strong call to the "COVID-aside reality", telling us how some people are living and dying with pacemakers and defibrillators, which are intrusive technologies surgically implanted in patients' bodies. Pacemakers and defibrillators have changed radically over the past few decades (the first prototype for a pacemaker was introduced in 1985), considering that at the beginning, they were used only for patients who had survived cardiac arrest. Nowadays, these medical devices transform subjects into "mundane cyborgs".

The book's core argument is that people living with defibrillators and pacemakers are far from being passive entities. With a strong empirical focus, the volume takes the reader on a journey inside and outside what the author calls "everyday cyborg bodies" (p. 17).

Oudshoorn's book is structured around four main parts ("Introduction: theorising the resilience of hybrid bodies"; "Technogeographies of resilience"; "Resilience and difference"; and "How hybrid bodies fall apart").

The first part (Chapters 1-2) theorises on the resilience of hybrid bodies, a concept that has inspired many STS scholars (but not exclusively) to address human-technology relations, resulting in extensive cyborg literature (Haraway 1991; Mol 2002). Everyday cyborgs must live persistently and inseparably with technology implanted inside their bodies – but with an expiration date. Considering that these devices' batteries last approximately 5-10 years, many people must undergo several implantations throughout their lives. Controlling the battery's lifetime is "crucial because heart devices fail to work when the battery is weak or empty" (p. 69). Therefore, battery life also must be taken into account.

Like bodies, technologies can fail. This topic is examined to illustrate how pacemakers and defibrillators not only can save lives, but also introduce new vulnerabilities. The vulnerability of an everyday cyborgs is not something isolated. On the contrary, it is embedded in a network of relations of human and non-human actors, including relatives, healthcare professionals, biomedical technologies and socio-technical environments. Vulnerability should not be considered only through its negative connotations, as it can create awareness of technological systems' fragility and contribute to learning and coping with potential technological risks. This is how Nelly Oudshoorn adopts the resilience perspective – something that is not given (far from being static) and always a "work in progress" (p. 44).

The second part of the book (Chapters 3-5) provides the reader with variety of sources through which to follow the author in her narrative. The empirical data are derived from observations of 10 pacemaker/ICD (Internal Cardioverter Defibrillator) control visits, semi-structured interviews with patients and healthcare professionals, analysis on different online communities and articles on the security problems of pacemakers.

Oudshoorn presents the concept of techno-geographies of resilience to explain how responsibilities – in terms of equity in the dominant Western health care system – are distributed differently between actors and spaces. They are geographically situated. Pacemakers and defibrillators might appear to be isolated pieces of equipment that work automatically, but they cannot be separated from local infrastructures because technologies participate in redefining the meaning and practices of the spaces in which they are used. At the same time, people *somatically wearing* these devices are not invisible and inactive. More specifically, this part of the book describes the monitoring and surveillance trajectory, including follow-up visits, and it opens up the discussion to a major topic: vulnerabilities of patients who must learn how to cope with different aspects of the implants. As mentioned above, despite its promises, technology can arise and introduce new vulnerabilities that make some ordinary activities difficult or even impractical, such as air travel, working in a context full of machinery or simply using everyday consumer electrical devices. Even the intimate sphere with a partner can require alterations. Basically, a traditional safe place (home) or a leisure activity can endanger these patients. Such vulnerabilities can lead to a particular kind of 'existential uncertainty' in the (re)construction of a new identity because of this double fragility of the body and the technology.

In the third part (Chapters 6-7), Oudshoorn demonstrates socio-demographic variables' pivotal role in becoming a resilient cyborg. In particular, the author adopts an intersectional approach – that is the combination of a person's multiple characteristics to explain discrimination and forms of oppression – to uncover dynamics that can shape vulnerability and resilience. Unflinchingly, the author discloses how gender and age matter in the world of heart-wired cyborgs. Bearing in mind that most people who receive these devices are white adult men, pacemakers and defibrillators may not fit other bodies easily. Gender is involved when the author describes mismatches between devices and bodies in the Western cultural ideal of femininity and beauty. Surgical scars make the disease visible, but these scars imply much more than an aesthetic defect; they imply a "drastic change in the ways in which women relate to their bodies and to others (p. 156)". The "gaze of others" (p. 155 and p. 178) matters even more for women because their bodies are more subject to inspecting gazes than male bodies. However, some women may resist these cultural norms by showing off their scars publicly and articulating new forms of normalcy.

Age is another crucial variable, as these medical devices can affect younger and elderly people's lives differently. Young people may receive these implants because of genetic predisposition for life-threatening heart-rhythm disturbances. In this sense, the genetic diagnosis of a predisposition might become a *family-disease*, i.e. the person is a sort of *cyborg-in waiting*. However, older people are more likely to receive these implantations to prevent sudden cardiac arrest or to treat heart failure.

In this regard, anxiety is knowledgeable in different forms of emotional work. Because they have not experienced any prior cardiac problems, children or young adults have the dilemma of deciding whether or not to continue using these medical devices, balancing the "risk of lifelong implant against the consequences of not putting in a new defibrillator, which can be more devastating, particularly if the medication fails to work" (p. 199). Cardiac arrest survivors, who often are elderly, experience high stress, anxiety and depression levels, especially during the first six months after being discharged from the hospital.

The last part of the book (Chapters 8-10) takes a strong stance, highlighting the ambivalent and intricate life cycle of wired-heart cyborgs, with a specific focus on what actually happens when they face end of life. In this sense, it is significant to examine how technologies affect how people cope with dying and death. To keep these hybrid bodies alive, it is important that patients with these implants feel the active presence of and engage with their close relatives, technicians, nurses and other professionals. Just as an everyday wired cyborg's life differs from those who do not use these devices, in the same way, the passage from life to death is not the same for wired-heart cyborgs as it is for people living without internal heart devices.

The widespread use of life-extending technologies has created several ethical dilemmas, as they generate responsibilities ("Will a medical intervention prolong the life of a patient or contribute to a prolonged, unwanted way of living and dying?" p. 232) that did not exist before the surgical implantation. Basically, pacemakers and defibrillators orient "dying trajectories" (p. 230), influencing the perception of and expectations tied to dying.

This book can act as a thought-provoking work for different scholars in getting closer to a complex theme. The merging of humans with technology is a classical topic supported by a rich STS vocabulary, including words as cyborgs, entanglement, human-machine unions and incorporation.

Following recent STS scholars (Pinch and Bujstervard 2012), it is relevant to ask how people living with internal heart devices use their sensory experiences as a new resource to make sense of their transformed bodies. Patients play an active role in managing and shaping the care they receive, doing many tasks that actually are not seen, a sort of "invisible work" (Strauss et al. 1997). Additionally, this book sheds light on the full circle of hybrid bodies, from how technologies transform human life, to contribute to postpone death and fall apart. The death of technologies largely is neglected in the sociology of technology, as studies focus more on how technology exists and shapes our lives, not how it ends.

Future studies possibly could broaden research on disparities in accessing to these medical devices, as well as expand understanding on how to become a resilient cyborg. Additionally, the book does not address other differences, such as ethnicity and disability – an aspect that the author admits. More emphasis on other variables that are strong predictors of health outcomes, e.g., education level and income – which are actually part of the intersectional approach (Kaufman 2010) – could have grounded Oudshoorn's analysis on a more solid basis. The intersectional approach may provide an important heuristic for grasping the multiple differences on building resilience.

At the end of the book, the author proposes a *sociology of resilient cyborgs*. Like all lay people, resilient cyborgs gain knowledge and skills in different ways through a constant process. They learn what it means to live with their implants in their daily lives, including monitoring practices within the clinical environment.

To paraphrase Simone de Beauvoir: one is not born, but rather becomes a cyborg.

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G. Tipaldo

La societa' della pseudoscienza. Orientarsi tra buone e cattive spiegazioni [The Pseudo-Science Society. How to navigate among good and bad explanations], Bologna, il Mulino, 2019, pp. 311

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The red thread running through this book is the idea that sociotechnical controversies – where scientific and pseudoscientific knowledge claims are clashing in the public sphere – follow a typical causal structure. Such a structure makes recent oppositions to vaccines or beliefs in alternative cancer therapies very similar to local conflicts against big infrastructures – those well-known as exemplars of the so-called NIMBY (Not In My Back Yard) or BANANA (Build Absolutely Nothing Anywhere Near Anything – or Anybody) syndromes.

According to Tipaldo, while commonalities prevail, two features distinguish more recent controversies from NIMBY and BANANA conflicts. The first distinguishing feature concerns the issues at stake. Issues at stake in NIMBY used to be undesired land uses (LULU, Locally Undesired Land Uses, is actually a more neutral acronym than NIMBY to identify them); recent controversies are mainly focused on collective decisions affecting individual personal bodies – through public regulation/intervention about health, food, personal habits. "Not in my body" (NIMBO) is the best-suited synthesis for them.

The second distinguishing feature concerns the role played by science. In NIMBY or BANANA controversies, scientists used to play a secondary role and they only came on stage when called by public administrators and politicians to support their own decisions. In recent technoscientific controversies, instead, scientific experts are positioned at the center of the stage – as sharing with governmental bodies the responsibility of public decisions – while opponents support the so-called fake scientific knowledge. The first part of the book (Chapters 1-3) is devoted to explain the different syndromes: NIMBY, BANANA and the new NIMBO type. In the second and third part of the book (Chapters 4-7), the author's declared intention is to identify the vocabularies of motives underlying the controversies to understand what kind of subjective good reasons are driving hostile attitudes against scientific expertise supporting public decisions. This understanding is a necessary presupposition for any sound sociological explanation of these phenomena, while at the same time being useful to deconstruct false representations of scientific claims opponents. It is on these misrepresentations that the choice taken by many scientists to avoid opening overt controversies with them – as mainly not experts – has been grounded ("science is not democratic!" is the standpoint emblematically made by immunologist Roberto Burioni, intending not to debate with assumed not qualified speakers), as already had happened towards LULU opponents.

According to the author, prevalent explanations of opposition to expert knowledge follow three main theoretic models: a) the deficit model of scientific communication; b) the agenda-setting theory of mass media, depicted as spreading alarmism and sensationalism; c) the particularistic vs universalistic values model, related to the NIMBO syndrome and extended to pseudoscience followers.

To deconstruct each of these models, Tipaldo uses data from official statistics and sociological research. Comparison between the Italian context and the rest of Europe is carried out using a mix of secondary data analysis of national and international studies and of primary data analysis of research results produced by the University of Turin's team which he belongs to. The chapters of the book dedicated to this aim (ch. 4 and ch. 5 describing case studies and especially ch. 6, deconstructing mainstream explanatory models) are rich in details and quite sophisticated in the empirical deep deconstruction of previous accounts of those cases. They are the most valuable contribution of the book and are worth reading for anyone interested in this field of study, based as they are on the author's sound research experience on the issue.

The first explanations being discussed are those referring to the deficit model. Tipaldo shows that in specific controversies, for which data have been collected about people enacting anti-expert behaviors, those who decided to act against experts' advice were more educated than the rest of the population (the cited case regards parents who didn't vaccinate their children because distrusting general or pediatric practitioners). Moreover, their judgments about scientific knowledge were extremely positive. However, they didn't trust scientists' advice as experts, considering the economic interests of pharmaceutical companies as a structural bias of the field, which prevail on disinterested expertise. According to the author, what parents trusted (too) much, in their exitance towards vaccines, were their cognitive capabilities: they were excessively confident in their ability to navigate the Web to catch the correct information about any field of scientific expertise relevant to their personal and to their relatives' health needs.

The second kind of accounts submitted to scrutiny entails the agenda setting theory. Tipaldo confutes the opposition between traditional media agenda setting theory and the theory of social media as non-mediated communication platforms. The role of mass media has radically changed, as the web 2.0 has transformed what used to be the public into several potential influencers. Communication platforms now use to channel communications flows into echo chamber bubbles, through agenda setting and agenda cutting strategies aimed at making people stay within the platforms longer and longer, feeding firms' marketing and commercial interests. Traditional mass media re-mediate information when it spreads more diffusively than expected so that at the end of the process cross-media echo chambers reciprocally feed the information flux from social to traditional media and from the last ones to the internet by aggregating and polarizing beliefs, attitudes, and vocabularies of motives. The main stage where controversies are played is the re-mediated public sphere in which communication platforms and traditional mass media set the frameworks within which opposite narratives are enacted and circulated by actors. Actors' visibility and success opportunities are filtered by the rules of the audience and by web reputation. On that stage, scientific experts are captured within a game which they do not dominate, as science and pseudoscience controversies are situated within the frame of *par condicio* as if they were representative of opposite political parties.

As his third analytical move, Tipaldo empirically dismantles the hypothesis of low civic attitudes as a feature of people trusting pseudoscientific knowledge. When data were purposively collected to assess its plausibility – he argues – they show pseudoscience activists being concerned not only about avoiding perceived disadvantages (as the NIMBY acronym would suggest for LULU conflicts) but also about pursuing collective and more general interests (as the BANANA syndrome, but also the shift to public action in many of the controversies, reveals). What they lack is generalized trust in other people, in institutions, and scientific expertise. As the author stresses, this result is recurrent in recent data diffused by Eurobarometer, concerning Italy but not only. The problem with scientific expertise is that it is considered to be too much tied to big companies' economic interests and to political power to be considered reliable.

Looking for alternative explanations based on perceived "good reasons" and legitimated vocabularies of motives adopted by involved actors (although sometimes the author's harsh irony – especially about the Di Bella case – clashes against his interpretative claims), the theoretical framework within which Tipaldo moves is that of the mediated public sphere. Although the contemporary scene on which much of the controversies are played is that of dis-intermediated social platforms, the author's attention in the seventh and conclusive chapter of the book is mainly focused on traditional mass media. Such controversies reach traditional mass media and pertain vocabularies of motives supporting the relationships among the main actors moving on those mediatic scenes, as representatives of politics, scientific expertise, and pseudoscientific knowledge claims. This is the framework that makes comparability possible among the different case studies he refers to (going from the Bonifacio to the Di Bella and Stamina therapies and then to the anti-vax movement). Within that framework, vocabularies of motives governing relationships among Politics, Science, and the Media are especially those implied in processes of scientization of politics – supported by the rhetoric of evidence-based policy – and politicization of scientific expertise supported by the rhetoric of public engagement of science.

The mediated public sphere is the frontstage in which public controversies acquire visibility and pseudoscience is legitimated according to symmetric narrative strategies enacted by the media. Within a wider arena, comprehensive of a relevant backstage, mutual dependency among Politics, Science and Society is crucial to understand how the struggle for democratic consent, on the one side, and lay people's trust in science and politics, on the other side, are caught in a vicious circle through which the first one erodes the second. This vicious circle is, according to Tipaldo, the process through which what was intended to be a knowledge society is transforming itself into a pseudoscience society.

Following the model of Propp's Morphology of the folktale, the author reconstructs the scripts through which different knowledge claims, coming from the backstage, arrive on the frontstage through the voice of a Spokesperson (the Protagonist) and acquire public resonance while being refuted by official science that is their main Antagonist. The media, the public and politics are all represented in this common narrative structure through which public trust in science is notwithstanding eroded, while the voice of pseudoscience is eventually defeated.

However, many of the subtleties which the reader is introduced to in the *pars destruens* of the book are left aside in the *pars construens*. The representation of Politics, Science, Society and the Media as distinct – although intersecting – systems is too simplistic to fit the STS perspective, which the author claims to be the chosen framework for his inquiry. His analysis may hardly be said to appear consistent with an advanced understanding of the distinctions either of Politics and Science or of Science and Society as specific and never fully accomplished aims of Modernity (Latour 1993). Indeed, drawing on plenty of research and on the very same data he refers to in chapter 6, one can say that the ground of pseudoscience is not mistrust in *science* nor in *scientists* but in officially sanctioned *experts* addressing issues of public relevance.

Furthermore, the temptation – which Tipaldo in the end does not resist – to discard current discourses supporting pseudoscientific and conspiracy theories by introducing logical counterarguments is, at best, useless and misleading, especially if contextualized within his refutation of the deficit model and his claim of adhering to the STS perspective. STS classical studies (by Collins & Pinch, Wynne, Gieryn) shed light on the apparent difficulty in resolving controversies between established scientific knowledge and knowledge claims refuted by science as coming from outside its boundaries. Recent analyses point to the necessity to elaborate, new strategies of inclusion in order to face the complexity of conflicts concerning environmental issues, among others - that cannot be solved only through logic argument and communication policy (Sarewitz 2004; Pellizzoni 2006).

The tale of the battle between Science and Pseudoscience is a metaphor for what Tipaldo apparently thinks is the real battle: the one between Democracy, on the one side, and Populism, on the other.

However, recent results from survey and interviews data on Italian antivax and vaccine hesitant parents (Lollo 2020) apparently challenge the interpretative ground of a perspective reducing to populism the whole spectrum of positions going from antivax, to vaccine hesitancy and trust in alternatives to mainstream bio-medicine, while suggesting the need for an articulated and more nuanced insight of these movements.

As Fuller (2018) remarks about post-truth, pseudoscience cannot be equated to anti-science. It rather indicates the overarching acknowledgment that if science plays a crucial role in one's life, hence it cannot be left entirely in the hands of others. In this view, science is undergoing a sort of Protestant Reformation. It is becoming "Protoscience", that is science "taken personally […] as a life-shaping form of knowledge", whereby self and world are rearranged "to enable one to live – or die, as the case may be – with whatever one happens to believe" (Fuller 2018, p. 107). As a result of its "increasing visibility in public affairs, [which] coincid[es] with the ability of people to access the entire storehouse of scientific knowledge from virtually any starting point on the Internet", and their increased education, science is now becoming "the target rather than the agent of secularization" (p. 108). Consistently with these attitudes, science is actually becoming "customized", being transformed in "idiosyncratic interpretations and appropriations of scientific knowledge that, to varying degrees, contradict the authority of expert scientists" (p. 7), building on the distinction "between what one 'knows' (that is, has learned), and what one 'believes' (that is, acts upon)" (Fuller 2018, 184; see also Pellizzoni 2019).

As convincingly argued by Tipaldo, NIMBO movements settle themselves at the convergence of the avoidance of feared individual negative consequences of public health choices, on the one hand, and, on the other, the perceived denial of the opportunity for citizens to freely access promised (although yet not validated) therapeutic alternatives ("my body, my choice"), through the monopolistic closure imposed by public policies and legitimated science and expertise. It is then necessary to admit that what is actually at stake is not science but the scientization of the implied value controversies as a way of concealing them, while using science to legitimize value choices. Maybe this would be a more intriguing path to suggest to Tipaldo for next time, along with looking for the vocabularies of motives underlying hostile attitudes against scientific expertise supporting public decisions.

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When theory meets practice. Entanglements of ageing and technology at the cross-roads of STS and Age Studies

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