
DIY gerontechnology: circumventing mismatched technologies and bureaucratic procedure by creating care technologies of one's own

Jenny M. Bergschöld^{1,2} , Louis Neven³ and Alexander Peine⁴ 

¹*Institute for Interdisciplinary Studies of Culture, NTNU, Trondheim, Norway*

²*Smart Sensor Systems, SINTEF Digital, Oslo, Norway*

³*Active Ageing Research Group, Avans University of Applied Sciences, Breda, The Netherlands*

⁴*Copernicus Institute of Sustainable Development, Utrecht University, Utrecht, The Netherlands*

Abstract This study analyses ‘Do-It-Yourself’ (DIY) gerontechnologies and shows that they can be viable and valuable alternatives to ‘ready-made’ gerontechnologies. Using the concept of innosumption, we analyze the work of care workers in gerontechnology showrooms in Norway. We show how and why care workers will sometimes advise older adults to assemble DIY-gerontechnologies. Such DIY-gerontechnologies are not high-tech solutions made by technology producers, but creative solutions that older adults’ suit to their specific needs and assemble for themselves from mundane objects that are available in shops. So far, analyses of the design, implementation and use of gerontechnologies have almost exclusively focused on professionally designed and produced ‘ready-made’ gerontechnologies. But for various reasons, ready-made gerontechnologies often do not fit in well with the lives of older people. In such cases, care workers guide older people to the innosumption of DIY-gerontechnologies that offer workable solutions that are useful, quickly implemented, easily understandable and often cheap. We show that and how the existence of DIY-gerontechnologies questions the reasons behind the strong and widely accepted assumption that only high-tech innovations are a proper solution to the needs of older people.

Keywords: socio-gerontechnology, innosumption, DIY gerontechnology, materiality of care, demographic ageing

Introduction

In Western Europe, the population aged 65 or higher is expected to increase from 18.5% in 2010 to 27.3% in 2035, and the population aged 80 or higher will increase from 5.1% to 8.6% in the same period (United Nations 2013). This demographic change, generally referred to as demographic ageing, is believed to lead to a future crisis for healthcare systems and welfare states (Mort *et al.* 2012) unless older adults can be enabled to age in their homes. In the context of the

challenges posed by demographic ageing, technological innovation has emerged as a key theme as nation states have sought for solutions (Cagnin *et al.* 2012, De Smedt *et al.* 2013, Mort *et al.* 2012, Neven 2011, Neven and Peine 2017, Östlund 2004, Peine and Herrmann 2012). In the academic literature, these innovations are conceptualized in the term gerontechnology (Charness and Schaie 2003, Graafmans *et al.* 1998, Joyce and Loe 2010, Joyce *et al.* 2017, Sixsmith and Gutman 2013). Gerontechnology is not only seen as a potential solution to the problems and challenges associated with demographic ageing, but also perceived to have a considerable potential to open new market opportunities (Kohlbacher and Herstatt 2011), as well as enable older adults to realize their wish to age in their own homes (Astell 2013, Larsen *et al.* 2013) even in cases where the older adult has dementia (Bergschöld 2018a).

Gerontechnologies thus promise a ‘triple-win’ where the state, the market and older individuals are all meant to benefit from scientific and technological innovations (Neven 2011, Neven and Peine 2017). For nation states, the triple win logic is very attractive. It promises to help citizens, solve thorny policy issues and generate economic growth by means of innovation. As a result, many nation states – and indeed the European Commission (2016) – buy into the triple-win logic of the ageing-and-innovation discourse (Neven and Peine 2017). For instance, Norway has the political ambition to achieve a nationwide implementation of gerontechnologies to support ageing in place despite mental or physical disability by 2030. However, it has also become increasingly clear that the triple win bears the risk on focusing too much on innovations rather than technologies that are meaningful in the lives of older people (Bergschöld 2018a, 2018b, Giaccardi *et al.* 2016, Neven 2015); as such, it also bears the risk of hindering the development of suitable care technologies that are accessible and usable for older people (Neven and Peine 2017).

In accordance with the National plan for implementation of gerontechnology issued by The Norwegian Directorate of Health in 2012, Norwegian municipalities have funded and established 17 educational showrooms throughout the country in locations that are easily accessible to the population. All of these showrooms are open to the public and attract a wide variety of visitors from all over Norway. Most often, the people who visit the showrooms are older adults, relatives of older adults or care professionals responsible for older adults who are ageing at home. The purpose of these showrooms is to provide a place where members of the public can come to learn from the care professionals who work there about how gerontechnology can help them, or the older adults that they care for, to safely age in their own home (Helsedirektoratet 2012). These care professionals – a diverse group of for instance nurses and ergotherapists – interact with members of the public who visit the showrooms seeking information about gerontechnologies. As such, the showrooms and the care professionals who work in them play a key role in the uptake of gerontechnology in Norway. However, there are no formal guidelines that dictate how this work should be done and little is known about how this work is performed in practice, or the implications it might have.

The people who visit the showrooms have various problems that drive their interest in gerontechnology. In this context, the care professionals’ task is to find a way of helping the visitors to identify which device will resolve their problem. In doing this, the care professionals draw on a wide variety of gerontechnological devices made by technology producers that are put on display in the showrooms. Because gerontechnology is heavily subsidized by the Norwegian state and distributed through the welfare system, these technologies are not commercially available and they cannot be purchased by visitors in the showrooms. Instead, these collections of technologies are meant to serve as examples of gerontechnologies that the visitors can look at and try out in order to determine which type of device may suit their needs. Then, they can start a procedure (via NAV¹) through which they can obtain these technologies.

For the purpose of this article, we will call the technologies available in the showrooms ready-made gerontechnologies. When talking about their work, the care professionals describe that in most cases, they are able to help visitors choose one of the ready-made gerontechnologies on display. Yet, the care professionals also describe situations where they encourage visitors to use a very different type of gerontechnology, which we call do-it-yourself or *DIY gerontechnologies*. In such cases, instead of suggesting one of the devices on display, the care professionals discuss with the visitors to find solutions that can be accomplished with means already available to them. DIY gerontechnologies are solutions that resemble the functions of ready-made gerontechnologies. DIY gerontechnologies are not pre-formatted solutions designed and assembled for older adults by someone else, but creative solutions that older adults suit to their specific needs and assemble for themselves. For instance, a white board stuck to a door with messages about the time a partner would return became a low-tech solution to help an older woman with dementia to deal with her inability to remember where her husband went.

In this article, we want to understand better the nature of DIY gerontechnology, and situate them in the growing body of literature around the local adaptation of gerontechnologies (Bergschöld 2018a, 2018b, Giaccardi *et al.* 2016, Joyce and Loe 2010, Loe 2011). More specifically, our case material triggered two lines of exploration: First, the interactions of care professionals with the showroom visitors resembled what Schot and Albert de la Bruheze (2003) have described as mediation processes for the ‘mutual articulation and alignment of product characteristics and user requirements’ (p. 231). According to Schot & Albert de la Bruheze, mediation processes typically occur in dedicated spaces – they call them ‘mediation junctions’ – that are located outside the traditional spaces of technology production or technology use. The showrooms in our case seemed to be excellent examples of mediation junctions. Hence, our research is particularly interested in mapping and understanding how care professionals and showroom visitors ‘negotiate, articulate, and align specific technical choices and user needs’ (p. 234), and more importantly why such negotiations would lead to advising DIY rather than ready-made gerontechnologies.

Our use of the term ready-made gerontechnologies does not mean to imply a distinction between innovation and use. On the contrary, Schot and Albert de la Bruheze’s (2003) work is embedded in a long and prolific line of thinking in Science and Technology Studies (STS), that has highlighted the agency of users in transforming the purpose and meaning of technologies during use (for overviews, see Oudshoorn & Pinch, 2003; Peine and Herrmann 2012). This literature has shown how it is futile to talk about a technology, singular, but has explored the complex arrangements of practice, space and materiality that configure technologies, plural, as they are appropriated at different sites of use (De Laet and Mol 2000, Suchman 2007). In recent years, scholars have started to apply these insights to the study of gerontechnologies in use, such as alarm pendants, remote monitoring systems or pill dispensers. They have shown how such gerontechnologies are fluid across various situations of their use and appropriation. For instance, alarm pendants that are meant to be worn constantly, are often used only selectively, in situations that older people experience as risky, for example, in the bathroom (Aceros *et al.* 2015). Ready-made gerontechnologies, therefore, are ready-made only in the sense that they are marketed as gerontechnologies that are meant to fill specific functions in relation to ageing and later life. During use, however, older people and their caregivers will need to negotiate their fit into the local arrangements of practice, space and materiality (Joyce and Loe 2010, Joyce *et al.* 2017, Loe 2011).

The occurrence of DIY gerontechnologies posed us with a challenge. DIY gerontechnology, after all, involves the repurposing of technology unrelated to care or ageing, for specific care needs, and in relation to already existing device ecologies and infrastructures. In our analysis

of the care professional's accounts, we turned to the notion of 'innosumption' that was recently introduced by Peine *et al.* (2014) to enrich the conceptual basis in which gerontechnology is discussed. Closely related to the STS work mentioned above, the term innosumption departs from a distinction between technologies that older people make for themselves from 'scratch', and technologies that they appropriate and re-negotiate. These are obviously related processes and their distinction may seem trivial. However, in our analysis of the care professionals accounts, it allowed us to consider the care givers, as well as the older people they refer to in their descriptions of their work, not just as users but also as designers. That is, the notion of innosumption allows us to describe DIY gerontechnologies as unique assemblies of tools and practices that are discussed and made visible as gerontechnologies at the mediation junction of the showrooms.

Under the triple win rhetoric, old age is not associated with creative inputs and tinkering, nor is it associated with the plentiful relationships that older people already have with technology (Neven and Peine 2017). The empirical observation of DIY gerontechnology thus challenges the existing imaginaries that inform current policy making and public understanding of the design, implementation and appropriation of gerontechnology. So far, the debate and associated policy and innovation programs are informed by a portrayal of gerontechnologies as devices that are made by technology developers, and older adult consumers as actors whose agency is largely limited to the rejection or appropriation of such ready-made devices (Peine *et al.* 2014). Indeed, an active and creative role for older users is often designed out of gerontechnologies as older people are implicitly or explicitly seen as incompetent users of technology and it is judged to be dangerous for them to tinker with technology (Giaccardi *et al.* 2016, Neven 2015). By contrast, the notion of innosumption offers a possibility to expand the analytical scope by focusing on the agentic capacity of care professionals, older people and others to make their own gerontechnologies.

Method

The empirical material analyzed here was gathered during visits in four different showrooms in two urban and two rural areas of Norway during a few weeks spread over 2015. This study singles out material from four of those visits, one in each showroom, where the care professionals working in the showrooms during the time of the visit were asked to describe how they help visitors to identify which type of gerontechnology they need to be able to continue ageing at home. The interviews were loosely structured and conducted in the style of conversations. Each interview lasted for 2–4 hours, 10 hours in total.

The showrooms visited vary in size from small nooks and rooms in buildings primarily used for other purposes, to large living labs that take up entire buildings. Typically, they are staffed by about 1–4 care professionals. These care professionals have a variety of professional backgrounds and are often still professionally active in other roles in addition to working in the showrooms. Some are nurses, others are ergotherapists, some are experts on dementia, and others specialize on physical handicaps. All in all, it is a heterogeneous group of care professionals that have in common their work in showrooms and their experience of demonstrating the properties and functions of gerontechnologies. Additionally, all have extensive professional experience of the implementation of gerontechnologies in the lives of older people from their respective professional backgrounds as, for example, nurses and ergotherapists. As stated in the introduction, there are no formal guidelines that stipulate how this work should be done. For us, this meant that we treated the issue of how the care professionals interact with visitors to accomplish successful appropriation of gerontechnologies as an empirical inquiry.

All interviews were audio recorded. The audio recordings were transcribed word for word by a research assistant and translated from Norwegian to English by one of the authors. Translations privilege clarity of meaning over verbatim. All names are fictional and all information concerning the care professionals, professional titles and training, as well as the names and locations of the showrooms are withheld to ensure the care professionals anonymity.²

The analysis is informed by social constructionist grounded theory (Bryant and Charmaz 2010, Charmaz 2006). In practical terms, this means that the transcriptions were first openly coded (Clarke 2005) with *in vivo* codes (Charmaz 2006). This coding process suggested a patterned consistency. While there are differences in terms of personal style and choice of words, all care professionals described that they regularly encounter older adults who use DIY gerontechnology, or that they have encouraged visitors to assemble and use DIY gerontechnology as an alternative to ready-made gerontechnology. In other words, the empirical material was riddled with stories about visitors that acted as *innosumers* (Peine *et al.* 2014) to produce DIY gerontechnologies.

Thereafter, focused coding (Bryant and Charmaz 2010) was used to identify all segments in the empirical material where the care professionals made references to DIY gerontechnologies, explicitly or implicitly. Using selective coding (Charmaz 2006), we then singled out descriptions of *innosumption* where the care professionals describe how DIY gerontechnologies can be used to overcome obstacles that would otherwise have made it hard or even impossible for visitors to appropriate or use gerontechnology at all. We used these descriptions to analyze how care professionals construct and link the characteristics of DIY gerontechnologies with visitors needs and requirements. That way, we could understand how *innosumption* in the form of DIY gerontechnology is an important part of the care professionals accomplishments of visitors appropriation of gerontechnology. The statements were not treated as fact or fiction, but as the care professionals verbalized meaning-making of the understandings that shape their strategies of action (Swidler 1986, 2006) when they interact with visitors who seek to appropriate gerontechnologies.

The notion of mediation (Schot and Albert de la Bruhze 2003) has proven particularly useful because it allowed us to describe how care professionals, together with older people, shape gerontechnology, also in the wider picture. From this perspective, the care professionals' descriptions of DIY gerontechnology and the processes that lead to their accomplishment, are not descriptions of unique events, but descriptions of how *innosumption* and DIY gerontechnology shapes and matters to the implementation of gerontechnology in Norway.

How DIY gerontechnology matters

In talking about how they help visitors, the care professionals describe that they usually start by talking to the visitor about his or her needs or the needs of an older relative that they care for. After identifying what the problem is, they will show some examples of gerontechnologies designed to solve such problems to show the variety of available gerontechnologies that the visitor can choose from. However, in describing their work with visitors, it was also common for the care professionals to portray the ready-made gerontechnologies as cumbersome, undesirable, difficult, or even impossible for visitors to appropriate, even if visitors are very motivated. As a result, they would often describe that they encourage visitors to assemble their own DIY gerontechnologies instead of advising them to try to appropriate ready-made gerontechnologies.

For instance, Clara, characterized DIY gerontechnologies as a preferable alternative to ready-made devices because access to ready-made devices is regulated by the need for a

medical diagnosis that warrants the claim that the device is needed and worth the investment. Meanwhile, equally functional devices can be assembled from parts purchased at for instance, JULA a well-known Scandinavian department store that specializes in home improvement.

Quote 1

Clara: There are several possibilities that we recommend to [visitors]. [acquiring gerontechnology] doesn't always have to be about [formal procedures] because in those cases you need a diagnosis. You can also go to Julia and buy something for 80 NOK³ that can work just as well if you want to. Like this motion sensor on the bed that activates the light. Buy two of those, put one by the bed, and one close to the door [so the light goes on when going back and forth for visits to the bathroom during the night]. It's really about taking it down to the most basic level. IKEA sells strips of LED lights, they're better [than regular lamps] if the person has cognitive decline.

The most common type of problem that the care professionals describe, and that DIY gerontechnologies can solve, are the complex bureaucratic processes and regulations that render the acquisition of ready-made devices difficult, as Rose describes:

Quote 2

Rose: if someone has a long-standing [that's more than two years] need for an assistive device and the reason is good enough, then an ergotherapist or physiotherapist can request such a device from NAV, and then you get it. [...] so you can get gerontechnologies from NAV. But it's really a very complicated system.

By contrast, DIY gerontechnologies offer a pragmatic and quick workaround to this cumbersome and complex bureaucratic process. Rose continues:

Quote 3

Then there are products in regular stores, [that can be assembled to] serve the same purposes [as ready-made devices], but where you don't have to go through NAV.

Rose describes the functionality of such DIY gerontechnologies as equal to that of ready-made gerontechnologies, but she also characterizes them as much easier to appropriate. She accomplishes this characterization by contrasting the relative simplicity of appropriating DIY gerontechnologies in terms of buying products in a regular store and assembling them into a functional solution, against dealing with the complexity of the bureaucratic process that governs the appropriation of ready-made devices so cumbersome. Looking at the showrooms from the perspective of innosumption thus highlights a few of the problems surrounding ready-made gerontechnologies, as they meet everyday lives.

Rose illustrates this bureaucratic complexity by describing the appropriation process of ready-made gerontechnologies as a series of requirements that must be fulfilled before someone who wants a ready-made gerontechnology can acquire the device they need. First an ergotherapist or a physiotherapist must establish that the individual has need for a particular gerontechnological device, then it must be established that this need is 'longstanding' meaning that it must be a need that is expected to last for more than two years. Thereafter, the ergotherapist or physiotherapist makes a formal request for this device on behalf of the individual who needs it. She uses this description as a contrast against the relatively simple matter of going to a store and immediately acquire a DIY gerontechnology that is able to serve the same purpose

as a ready-made gerontechnology. In doing so, Rose not only characterizes DIY gerontechnologies as performing the same functions as a ready-made gerontechnology. She also characterizes DIY gerontechnologies as the preferable alternative because they are not bound to the bureaucratic process that obstruct the visitors' appropriation of ready-made devices.

Other descriptions characterized DIY gerontechnologies as easier to implement than ready-made gerontechnologies. For instance, Donna characterized DIY gerontechnologies as solutions to problems created by the complex bureaucratic processes that surround the implementation of ready-made devices. Where Rose described the complexity of bureaucracy around the purchase of ready-made gerontechnologies, Donna referred to the complex bureaucratic processes that regulate the implementation of GPS tracking devices:

Quote 3

Donna: Many visitors ask us «can't you just arrange a GPS, can't the municipality just arrange a GPS? Surely, that's the easiest solution» [But it's not easy] at all! You have to map the situation. When did the need arise? Will the technology be used indoors or outdoors? Who is responsible for receiving the alarm if he calls for help? Is he lucid? Does he consent to GPS tracking? All of these things. Implementing a GPS tracking device when a person doesn't want to have it is a huge process. If they do want it and do not have the power to consent, then it's a smaller issue. But there are also those who don't want it, but where the family insists because it's dangerous to not have it, but they refuse. Then you need statements from homecare services or from the GP, and then those statements are sent to the county doctor and you need to get all that documentation in place. [...] but you can also go and buy a GPS and arrange it privately, then it's not such a hassle. There was a man who was in here. He puts the GPS collar for his hunting dog in his wife's rug sack so he can track her if she doesn't come home [from one of her walks].

Like Rose and Clara, Donna describes DIY gerontechnologies as the preferable alternative in comparison to ready-made devices because of their capacity to solve problems caused by bureaucracy and formal process. However, where Rose and Clara characterized DIY gerontechnologies as easier to access, Donna characterizes DIY gerontechnologies as easier to implement than ready-made devices.

Donna first illustrates the complexity of implementing a GPS tracker in any situation by describing all of the information that care professionals must gather before a GPS tracker can be implemented. Thereafter, she characterizes DIY gerontechnologies as significantly easier to implement than ready-made devices: she describes how the formal procedures that regulate the implementation of a ready-made GPS tracker requires that the end-user either consents or is formally declared as cognitively unfit to provide consent. By contrast, she describes a case where a simple and buyable device could easily be implemented to serve the same purpose without following complex procedures.

This "ease" of implementing a DIY gerontechnology obviously also raises questions. Is a partner or child allowed to simply bypass careful ethical consideration by health care professionals about privacy, autonomy and consent in order to provide a make-shift safety device that they think their partner or mother needs? Does this tinkering with a GPS collar in a rucksack lead to a safe gerontechnology? What if something goes wrong? But, in contrast, can one wait for formal procedures to be completed in the face of a pressing safety issue in the present? The bypassing of ready-made gerontechnologies and the accompanying (bureaucratic) processes by creating DIY solutions thus also raises pertinent and complicated questions about roles and responsibilities of informal carers and their use of technology. What is clear,

however, is that in the case Donna described, DIY gerontechnologies were seen as an easier solution to the problems presented by having a partner with dementia than ready-made gerontechnologies could offer.

While all care professionals characterized DIY gerontechnologies as easier to appropriate and implement than ready-made devices, there was some variation in how they characterized the specific traits that make DIY gerontechnologies easier to implement than ready-made devices. For instance, Amy described how DIY gerontechnologies can be easier to implement because they do not require users to learn how to operate new technology. She emphasized the advantage of DIY gerontechnology by illustrating the importance of suiting gerontechnology to the users specific needs.

Quote 4

Amy: We had an older man in here who was very stressed, didn't have much time. His wife has dementia and the doctor had told him to come here and take a look at the digital calendars. We have tablets with calendars and apps and many different things that can serve as reminders but then we talked a bit and I asked if he likes to use tablet and "no no" he disliked technologies. Ok, so I asked "so what are the challenges in your everyday life then?" because it's important to try to understand what they need before you start suggesting solutions.

This older man thus came to the showroom as the doctor had told him to do so, but a high-tech solution was not what he was after. Instead Amy listened to what his problem was and suggested a low-tech DIY solution:

Quote 5

Then it turned out that he couldn't leave the house because she was always wondering where he was and when he was coming back so I looked at this one [she points to a whiteboard] and I took out the pen and wrote "back in 10 minutes, back in 30 minutes." He went and bought a whiteboard, glued it to the front door and wrote on it and it worked for them for a while. I mean that's not technology, its manual but it works and it works in a way that is suited to them. If he would have had to start to learn about tablets when he clearly didn't want to, and understand everything with wifi and subscriptions here and there, and to put everything in. . . Because someone needs to administrate these things too, then he would have become even more stressed. Not just one persons' life is implicated by the technology we implement. We see that a lot, the relatives who are caregivers. It's very hard on a person when their spouse has dementia. The gradual loss. . . . And then to have to also manage a lot of things that you don't really have the energy for. . .

Similar to Clara, Amy describes how DIY gerontechnologies are easier to implement than ready-made devices. However, Amy's characterization of the relative ease that DIY gerontechnologies offer is not related to bureaucratic processes or regulations, but to how their design can be adapted to fit user's requirements and pre-existing technological environments; in this case, a solution that took into account the pre-existing endowment with technology (glue and a door, rather than WiFi or tablets) could do the job the ready-made XXX gerontechnologies could not.

Clara describes how ready-made gerontechnological devices that are meant to support or even replace cognitive functions delegates the responsibility to render the device operational to members of the household. This means that these devices require that someone in the household is equipped with the competence and willingness to start using the device, and shoulder

the responsibility of the work that the device requires to function. However, not all who care for older adults with cognitive impairments have this competence or willingness. In these cases, implementation of ready-made devices can be difficult or even impossible to achieve without adding to the burden of already strained relatives. However, there are many things that can serve as reminders, and thus DIY gerontechnology can be assembled in many different ways. Thus DIY gerontechnologies offer attractive alternatives to ready-made devices because they can be suited to fit different levels of technological literacy and competence.

Also, Rose characterized DIY gerontechnologies as easier to implement than ready-made devices because they can be suited to the users level of technological literacy and competence. In contrast to Amy, who emphasized that read-made gerontechnologies often require a level of technological competence that many visitors don't have, Rose highlights that ready-made gerontechnologies can also be at odds with the devices that already populate the lives of older people or family care givers. DIY gerontechnologies do not always require the tinkering with various parts and new acquisitions. Sometimes it can be as simple as using an existing function of an existing device, such as setting a reminder in a mobile phone:

Quote 6

Rose: Most of the older adults today use computers and such. . . . They already have smart-phones and calendar apps. So, the issue with reminders, remembering appointments and such [if you suggest a device that just serves as a reminder to them] they just look at you and say "but I'll just put it in my phone".

Older people thus may have more skills and technological savvy than designers envisage, and their lives contain more digital technologies than designers (or the set-up of the showrooms) envisage. In such cases, ready-made gerontechnologies are at odds with the lived realities of their users and implementing DIY gerontechnologies offers solutions that are attractive because they are by definition designed to fit with the users' life and preferences.

The innoassumption of DIY gerontechnology

When visitors seek care professionals' advice in relation to how they might be able to solve their problems with gerontechnology, the care professionals cannot simply base their recommendations on a selection of ready-made gerontechnologies. They must also consider other situational aspects. For instance, is the problem that the visitor needs to solve constitutive of a longstanding need? Or, is there a documented medical diagnosis that can warrant a claim for a ready-made device (quotes 1, 2 and 3), in what socio-technical environment must the device be functional? Who is responsible for operating the device? (quotes 4, 5 and 6). Is anyone in danger if the problem is not solved immediately or is there time to wait for bureaucratic processes to finish? (Quote 4). What are the preferences of the people who will use, or manage the device on behalf of the user? (quotes 5, 6 and 7)? What is their technological competence, and what technologies do they already have and use?

From the accounts of the care professionals, it becomes clear that their task is more complex than taking stock of basic needs, and directing visitors to ready-made gerontechnologies that suit them. Rather, the care professionals need to negotiate with the visitors the details of their specific situations, and how gerontechnologies would fit. This includes negotiating the bureaucratic procedures that surround ready-made gerontechnologies, and their alignment with the specific situation of visitors. In other words, in the showrooms, care professionals and their

visitors negotiate and articulate user-technology relationships (Schot and Albert de la Bruheze 2003). In some cases, these negotiations can successfully align the visitor's requirements with the characteristics and rules of ready-made gerontechnologies. The care professionals then advise visitors to acquire a ready-made technology. In other cases, however, ready-made gerontechnologies do not survive these negotiations, and other cheaper, more accessible, and simpler devices become part of the articulation. In other words, the visitors and care professionals negotiate and articulate what we have called DIY gerontechnologies.

In their descriptions, the care professionals not only characterize DIY gerontechnologies but also different kinds of visitors who have engaged in articulating DIY gerontechnologies. For these visitors, ready-made gerontechnologies did not provide an attractive offer for various reasons: Sometimes, they cannot document a longstanding need (quote 2 and 3), or a medical diagnosis that warrants a claim for a ready-made gerontechnology (quote 1). In other cases, visitors reject ready-made gerontechnologies because they ignore or try to bypass ICTs that they already use (Quote 6). Yet other descriptions characterize innoconsumers as older adults who seek gerontechnologies that can help them cope with the difficulties of caring for older adult spouses with cognitive decline who are ageing at home and for whom they have become informal carers (quotes 3, 4, 5 & 6). These descriptions illustrate how visitors can become innoconsumers because they are worried for the safety of someone who refuses to consent to the implementation of GPS trackers (quote 3), and because they are unwilling or unable to handle the task of managing ICT's (quote 5 and 6).

Together, the care professionals described different kinds of visitors who, with help from the care professionals, become resourceful producers of gerontechnologies specifically suited to specific problems, needs and desires. That is, the care professionals described different kinds of *innoconsumers* that negotiated the configurational work that would be necessary in order to align available resources, including mundane shops like Jula or a simple white board, with their specific situations. However, they also illustrate that while older adults are certainly capable of technological innovation and assembly, their turn to innoconsumption is not generally occasioned by enthusiasm or desire to tinker with technologies. Rather, innoconsumers turn to DIY solutions because they experience problems with the implementation of ready-made gerontechnologies and the bureaucratic regulations that surround them. Yet, while DIY gerontechnologies can tackle a variety of problems, the work of informal caregivers does not always align with the interests of the older adults for whom they care. This was the case, for instance, in the case described by Donna, where a visitor used the GPS tracker for a dog that provides the same functionality as a ready-made solution, but without requiring complicated procedures to establish the compliance of his spouse. For this visitor, the choice was not between a ready-made and a DIY gerontechnology. From his perspective, the DIY solutions was the only way to continue to manage the challenges of ageing at home with his wife.

DIY gerontechnologies are similar to ready-made devices in the sense that they can be assembled so as to mimic, or at least resemble the functionality of ready-made devices close enough to render them sufficiently functional. Importantly, however, it is also made up by the understanding that innoconsumption is considerably easier than other forms of appropriation, and constitutive for a better fit between users' needs and skills in comparison with ready-made gerontechnologies. Together, these descriptions of similarities between DIY gerontechnologies and ready-made devices characterize DIY gerontechnologies as devices that are assembled by lay people – older adults and their informal carers who are sometimes older adults themselves.

However, DIY gerontechnologies do not only fulfil similar purposes as ready-made gerontechnologies. They are also distinctly different from ready-made devices. Most importantly, DIY gerontechnologies are not bound by complex bureaucratic procedures, or the need for a diagnosis. In this sense, DIY gerontechnology are easier to access than ready-made

gerontechnologies: their implementation is not regulated and can be done without going through a formal consent procedure.⁴ In part this is because they are implemented and used by informal carers like spouses or other relatives as opposed to care professionals. Additionally, DIY gerontechnologies are accepted by people who reject ready-made devices because of their implicit assumptions that technologies are not yet in place in the lives of older people. Hence, the occurrence of DIY gerontechnologies also highlights the importance of already existing technologies in the lives of older people, and how they can be re-appropriated and domesticated to address newly arising care needs. In this regard, DIY gerontechnologies tend to be cheap, easily obtainable and they require little to no learning as they build on the existing skills of older people and informal carers.

Conclusion

This study shows that DIY gerontechnologies which come into being as a result of the work of innoconsumers are common alternatives to ready-made gerontechnologies. The appropriation and use of technologies that are considered useful by older people is thus not necessarily hinged on care professionals and older adults' acceptance or re-negotiation of ready-made gerontechnologies as designed by designers and engineers. Indeed, our investigation of the showrooms and the professionals that work there has revealed some of the problems that ready-made gerontechnologies face, and how they could be circumvented. Most interestingly, the attempt to discuss how ready-made gerontechnologies can be implemented often resulted in alternative solutions that are useful, quickly implemented, easily understandable and often cheap.

We have termed such easy, understandable and often cheap solutions DIY gerontechnologies. We find it remarkable that DIY gerontechnologies often resulted from attempts of the care professionals to negotiate with visitors a feasible and useful implementation of ready-made gerontechnologies. Indeed, the accounts of different care professionals indicate that a distinct advantage of DIY gerontechnologies lies in their capacity to function as work-arounds to mismatches between the everyday lives of users, including their digital lives, and ready-made gerontechnologies. Moreover, rules and regulations associated with the welfare state pose additional barriers to the acquisition and implementation of ready-made gerontechnologies.

At a fundamental level, therefore, DIY gerontechnology point out that ready-made gerontechnologies, and the many bureaucratic procedures that surround them, do not sufficiently consider the diversity of care relations and the complex arrangements of practices, spaces and materiality in which they are enmeshed. This confirms previous studies that have demonstrated the relevance of such arrangements for the implementation of ready-made gerontechnologies (for instance López Gómez 2015, Milligan *et al.* 2011). In contrast, DIY gerontechnologies highlight innoconsumption as a process through which older people or their care givers, in our cases with the support of care professionals, circumvent ready-made gerontechnologies altogether. Instead, they acquire or repurpose mundane, commonly available devices that are able to tackle specific problems in their care arrangements.

With the exception of Loe (2011) and Giaccardi *et al.* (2016), little attention has been paid to such low-tech, DIY technological solutions to the problems that older people face. We speculate that one of the reasons for this is that, while these solutions fix the problems of older people, they do not fit in with the triple-win logic of the ageing-and-innovation discourse (Neven and Peine 2017). For the triple-win to function the solution has to be high-tech, and above all, made by a technology producer or there is no promise of economic gain.

Innosumption of low-tech DIY solutions by care workers and older people may result in workable solutions for older people, but it does not result into the triple-win. It is indicative that even care workers in the show rooms describe the DIY solutions that they advocate with the words ‘that’s not technology’ (Quote 5). Apparently, only new high-tech innovative solutions count, innosumption of low-tech simple solutions made from cheap parts bought at local stores does not. Even though it fixes the problem. If our speculation here is correct, this leads us to ask a question: what is gerontechnology really about? Is it about solving the grand challenge of ageing, and thus caring for older people, or is it about industrial policy to strengthen innovative industries?

The focus on high-tech innovation versus low-tech innosumption also has repercussions for the social studies of gerontechnologies. Previous studies that have focused on older adults’ appropriation and acceptance of gerontechnologies have often described how high-tech solutions are designed and how older adults reject these ready-made gerontechnologies (Botero and Hyysalo 2013, Essén and Östlund 2011, Neven 2010). These studies have sought to critique the stereotypical notion that ageing goes hand in hand with disinterest in technology by showing that older adults do not reject gerontechnologies out of hand, but because designers tend to base the technology on false assumptions about what older adults want and need. While this is certainly valuable, and indeed the authors have themselves engaged in many of these studies, it also limits the analytical focus to ready-made and often high-tech innovative gerontechnologies. Typically, these studies have also often limited the role of older adults to consumers whose only agency lies in acceptance, rejection or perhaps selective use of devices designed and made by others. In doing so, there has been little attention not only for the role of mediators like the care professionals described in this study play, but also for the creative, pragmatic, but also sometimes problematic innosumption practices that older people engage in to resolve their problems when ready-made gerontechnologies fail to suffice.

In this article, we have analyzed the innosumption of DIY gerontechnologies as recollected by care professionals while we were discussing with them ready-made gerontechnologies displayed in showrooms. These ‘mediated’ accounts of DIY gerontechnologies proved useful in grasping the phenomenon in the context of the biopolitics of care. We show *that* DIY gerontechnologies exist. Hence, the focus on local adaptation of ready-made gerontechnologies needs to be extended to include such locally created alternatives to what is available through existing care systems. Against this background, we suggest that future research should explore DIY gerontechnologies ‘in the wild’, that is, visit the spaces where they exist and map the practices and assemblages that enact and sustain them.

Address for correspondence: Jenny M. Bergschöld, Institute for Interdisciplinary Studies of Culture, NTNU, Trondheim, Norway.

E-mail: jenny.bergschold@sintef.no

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Notes

- 1 NAV is an organization in the Norwegian welfare state that is the result of a combination of two previously separate organizations. Originally, the name NAV was an acronym that stood for 'Ny Arbeids-og Velferdsforvaltning', which can be loosely translated as 'the new work and welfare administration'. However, after much debate and some time the name was officially changed. As a result NAV ceased to be an acronym and today this combination of letters is the official name. NAV's primary role is to constitute a link between the state and the locally governed Norwegian municipalities by handling financial matters related to the states responsibility for the welfare of Norwegian citizens. For this paper, NAV's role as a financial partner to municipalities and a distributor of gerontechnologies is the most relevant, but NAV also handles other financial matters such as paid sick leave from work and paid unemployment. (<https://www.aftenposten.no/norge/i/nQaeo/Barnet-skalhete-NAV>), accessed last February 17th 2018.
- 2 The ethical considerations of this study were reviewed and approved by the Norwegian Social Science Data Services (NSD). Written information about the study was distributed to all research participants and verbal informed consent to being audio recorded and quoted for the purposes of research was obtained from all research participants. This consent procedure is in accordance with Norwegian law, as well as the general ethical guidelines issued by NSD and the individual instructions provided by NSD before fieldwork commenced. More information about Norwegian law and NSD's ethical guidelines in relation to consent procedures can be found here http://www.nsd.uib.no/personvernombud/en/help/information_consent/, accessed last 17th of February 2018.
- 3 At the end of February 2018, 80 Norwegian Kroner was about 8 Euros or 10 US dollars.
- 4 It is obviously debatable whether this circumvention of consent procedures is ethical. Simultaneously one can also argue that people can be at risk of harm during lengthy formal procedures which may not result in granting a needed care technology. Either way, the implementation and use of DIY gerontechnologies is surrounded by major and obdurate ethical issues which warrant serious investigation.

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