

Co-creating digital public services with older citizens: Challenges and opportunities

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Abstract: Older citizens are excluded above average from digital public services as they do not meet older adults' needs and expectations. Yet most digital technologies, designed for an ageing population, reproduce particular images about age and ageing, such as the old age defined by ill health, deficits and limitations or an emphasis on active ageing. Digital public services are no different. We are interested in understanding through what kind of methods older adults may be enabled to become active co-creators of information systems and in so doing may transform our images of an ageing population. The paper is based on a collaborative research project in which older adults co-created a digital neighbourhood guide. We describe a framework of interventions which facilitated the co-creation process and discuss associated challenges and opportunities.

Keywords: older adults; co-creation; open data; participatory design; cultural probes; civic tech

1 Introduction

Interactions between public authorities and citizens are increasingly mediated by digital technologies as more and more public services are provided via digital channels. However, in many cases these services are not used widely and in particular, older citizens are excluded above average, as digital services do not meet their needs and expectations. Recently the idea of 'open government' has attracted attention, encouraging the development of so-called civic apps (digital applications that are based on open government data and developed by civil society actors such as Code4America). These civic apps are meant to provide for better and user-centred services and to foster public participation and engagement in the development and provision of public services through the use of open government data.

Older citizens—if at all—are often only marginally involved in such kind of civic technology engagement. They very rarely constitute the focal user group of civic apps; commercial web applications mainly focus on their assumed deficits and limitations (e.g. physical and cognitive decline, loneliness, dependency) [Ange16]. Hence such mediated services are predominantly based on stereotypical images of 'being old' and/or inscribe ideals of active and healthy ageing in the technology, that correspond with contemporary neoliberal concepts of optimisation and self-responsibility [Suop15, Suop16, Katz00].

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Governments are placing an increasing emphasis on opening their data repositories so as to encourage new forms of service design and delivery [Shak13]. A growing number of cities are making their data openly available. However, such open data is normally read-only (that is, citizens are usually not able to easily suggest changes, correct errors, etc.) and there is little return for local governments [LeAW15, HuKr14]. Often developers anticipate the needs and wants of citizens based on their own experiences with lack or insufficient knowledge about prospective user groups. This is also common in other software development contexts: Often they are based on the designers' assumptions regarding older people's needs [Neve10] and are based on stereotypical images of ageing as biological and chronological process of physical, mental and social decline [WaGa18]. Hence, most information technologies designed for an ageing population are developed with the intention to counterbalance those deficiencies. In so doing they reiterate and reinforce prevalent discourses around ageing and script particular images of "age" into technology [PFJM15].

Thus, in order to create value that benefits administrations as well as citizens, it is crucial to engage citizens into the process of open data service app development, especially those who are often forgotten when it comes to technological innovations. There is a need to bring together city administrations as data owners, technology developers and older citizens as knowledgeable individuals and prospective users in order to co-create valuable public services based on open data in participatory design processes. This paper analyses and discusses challenges that emerge when co-creating digital public services for an ageing population as well as opportunities for alternative forms of civic technology. Based on an action research project in which we co-created a digital neighbourhood guide with older citizens, this paper addresses the following questions:

- How can we engage older citizens in the design of digital public services?
- What are challenges of co-creating digital public services for older citizens?

This empirical study is based on the EU-funded project MobileAge (2016-2019) in which we developed and evaluated a co-creation methodology in four European cities or regions. In this study, we report of the field work conducted in one of the co-creation sites: Bremen Osterholz.

In the following, we provide a brief theoretical introduction to the co-creation of digital public services. Subsequently we present and critically discuss our own co-creation methodology and process. We attend to the changing images of old age throughout the process. We conclude with some considerations about the roles of older adults in such a design process and reflect on the images of old age that were present throughout.

2 Review on co-creation of digital public services

The term co-creation has only recently gained attraction and is used mainly with regard to IS development and online services. In some cases, it is just another term for participatory software development or collaborative development. However, co-creation differs

in three aspects [Gomi13]: (1) Traditionally, end-users only provided information on needs and requirements and gave feedback while the experts (designers, software developers) performed the programming and design-related tasks. In co-creation, end users may also be involved in programming and design activities themselves. (2) End-users define or influence the architecture of the system, not only single features and interfaces. (3) End-users take over responsibility for the services and systems developed and may maintain (certain aspects of) it.

At the moment co-creation stands for a higher level of end-user contributions while the lower level of participatory design by occasional users has not been broadly achieved. So far, we find successful participation of citizens in the development of online services in cases where research teams play a moderating and supporting role. While participation in some co-creation initiatives is limited to co-design of the interface of an application, others also involve citizens in generating topics and contents. Participants can take different roles in the co-creation process. According to the literature [NaNa13] these roles may be: (1) Explorer: Identify problems to be solved; (2) Idea former: Generate solutions to well defined problems; (3) Designer: Design and/or develop implementable solutions; (4) Diffuser: Facilitate the adoption and diffusion of the developed solution. In our conclusion, we will also argue for a fifth role: Data editor. Generally, there is a variety of stakeholders involved in co-creation projects, covering different co-creation roles. In the following, we describe and discuss how older citizens co-created a digital district guide and how they assumed their designated roles in the process.

3 Co-creation for social participation of older adults

The focus of the co-creation activities in Bremen was on the socio-spatial aspects of social inclusion: This is a pertinent topic as the relationship and bond with their immediate living environment as well as the capability to move within a neighbourhood confidently become more and more important as people grow older. At the same time, there is an increased risk of loneliness as relatives and friends may pass away. Thus, older adults are in need to find places and opportunities for social interaction, leisure activities and civic participation, which are strongly related to their confidence of moving freely within their neighbourhood. Besides economic and health related resources and the public infrastructure, the availability of cultural and social capital significantly affects people's agency. Knowledge of the social space is an essential prerequisite for the sense of belonging, security and independence [WLGR12].

3.1 Field work in Bremen Osterholz

Bremen Osterholz is characterised by six very diverse neighbourhoods that give the district its multifaceted character. The neighbourhoods are important points of reference for the identity and movement of many people. These aspects were important to our co-creation process as the focus was on social inclusion and active participation in the district.

In May 2016 we began our co-creation process by recruiting 12 older adults living in the district. Our core-group consisted of seven women and five men; their age ranged from 55 to 80. They were comparably well educated, physically and psychologically healthy and all lived independently. Overall, the participants were familiar with digital technologies. Only one participant had never used a computer. Two participants were still employed. Almost half of participants engaged actively in political and volunteering work in the district. During our fieldwork (from May 2016 until January 2017), we conducted eight interviews with intermediaries, ten meetings with local stakeholders, two information events, 14 co-creation workshops with our core group of older adults and 12 supplementary focus groups with about 80 older adults in the district. In addition, 11 of our core participants completed a set of probes (for a description of the method see below) and were interviewed individually. We used an action research approach that included a reflective learning methodology. Most interviews and focus groups were audio recorded and transcribed. Each intervention was documented with respect to its date, length, participants, objectives, activities, observation notes, and learning outcomes. As we understand co-creation as a reflective practice, we reflected upon our interventions and adjusted the process continuously. These adjustments were also documented. The service idea that was developed, refined and implemented throughout the co-creation process was a digital, interactive neighbourhood guide.

In the following, we describe the co-creation process. We conclude with implications from our experiences for future co-creation processes with older adults. In doing so, we also reflect on the ways in which particular images about old age evolved in the process and how these images facilitated or contested the stereotypical images of older adults inscribed in ‘traditional’ software development. What was striking was that the participants’ self-perception as being old is essentially constructed through their differentiation from others; in particular, through the ways our participants understood themselves as trailblazers for future older citizens.

3.2 Processes of co-creation

Planning and evaluating co-creation

The planning and evaluation of co-creation interventions is a continuous process throughout. Key to co-creation as a successful reflective practice is the continuous documentation of co-creation interventions through a *protocol of activities* and/or a *reflection journal*. Questions to be considered for these types of documentation concern the aims of an intervention, their implementation and their outcomes; reflections on their effectiveness and appropriateness as well as corrective actions.

Another important stream of activity is the planning of the evaluation of co-creation interventions. From the start of the project, the core team should define *what* will be evaluated (e.g. process, product) and *how*. The evaluation is, of course, very much dependent on the context and domain in which co-creation activities take place and may be refined as the co-creation activities proceed.

Recruiting and engaging stakeholders

The engagement with stakeholders and the recruitment of co-creators proved to be a continuous activity throughout the process. While ideas developed, the service concept became more refined and the required data were defined and collected, complementary focus groups and engagement with additional local stakeholders (such as service providers or data owners) were required. However, the recruitment of the core group was mainly conducted via newspaper articles, where we addressed older adults in the district that were knowledgeable and/or interested in their district. Although we explicitly addressed people with and without experience with digital technologies, most of the participants were already using smartphones, PCs, tablets and/or the internet. All of them shared an interest in these 'new# media technologies.

To start the co-creation process we wanted to provide a notion of the project's objective and what kind of input, in particular local knowledge we would like participants to contribute. As these expectations are difficult to communicate verbally, we decided to begin the process with something tangible: An activity that would be fun and attract interest in the project, so that people would be encouraged to come again. We choose to develop a card game in order to (i) learn about the district, (ii) facilitate the communication between participants and (iii) provide low-tech engagement. At an *information event* participants were asked to fill out questions on the cards which related to their district. In doing so, they not only shared their knowledge about the district (e.g. what is beautiful in Bremen Osterholz) but also considered questions that could be relevant to others in the district. For a *kick-off workshop* we prepared a proper card game (with pictures) based on the participants' input. Their task at this workshop was to evaluate each other's input via blue and green points (for relevance) and leave remarks. For our process, it was important to establish the co-creators as experts of the district and to appreciate their local knowledge. This established an engagement of mutual respect between the project team and participants, as both parties wanted to learn from the other.

The participants appreciated the refined version of the card game, as they could see that their work had been valuable and were actively engaged with the card game. To see pictures of their district and discuss them seemed to motivate them. The card game as a method worked well to motivate the participants as the focus was laid on the district, not on technology. It enabled them to form a sense of community based on their shared practices of living and ageing in the district. At the same time, in interacting with the card game a shared notion of what it means to grow old in the district emerged that comprised of being interested in and care for the local environment and its people, being knowledgeable of people, places and institutions and being actively involved in the social and cultural life in the district.

Co-creating a service concept

The initial tasks associated with the co-creation of a service concept included a preliminary survey and analysis of existing services as well as the development of first ideas. The service to be developed was defined in the co-creation process, but we had to have a

concrete idea about

- What service domain we developed a service for;
- What the thematic space of the service was;
- Who the target user group was and what other stakeholders were relevant;
- What kind of technical solution was going to be developed (mobile app, website).

In order to address these kinds of questions, we had to understand the everyday practices of older people in the district better. To understand what it means to age in this particular place. While the card game offered a first interaction with our participants, there was a need to explore and learn about their everyday lives in a more structured way. For this reason, we developed a set of ‘cultural probes’ [GaDP99, BoGB12, JaMa18] which are descriptive and exploratory tasks that are (typically) based on self-reporting. In our case, the participants kept the probes for 10 days. They collected data on themselves, their lives and their socio-spatial and media use practices. Follow-up interviews were conducted individually to prepare and accompany the process and a de-briefing session (workshop) to supplement, validate and explore the data.

In contrast to more traditional approaches to probes which are used in user-centred design [SaSt08], probes in our project were used as a method and tool for co-creation. Hence, in addition to their inspirational function and tool for the requirement elicitation, we also used the probes as a communication and engagement tool for the subsequent co-creation process. In a follow-up workshop, the participants jointly reflected on the activity and their experience. The aim was to (1) jointly reflect on the probes activity and experience and to (2) identify some key characteristics that defined their everyday practices in the district.

One task concerned a neighbourhood map. The main aim of this probe was to understand social inclusion with respect to primary networks and space. Participants were asked to highlight where they live (red dot), where friends & family live (blue dots), where important places for their everyday are (yellow dots). What we were interested in learning from this map concerned, for example, how connected our participants felt to people/places and the spatial dimension of their primary networks (neighbourhood, quarter, district, clubs). We were also interested in learning which social networks the participants were part of and where they meet. The returned maps differed greatly with respect to the extent of the networks and the mobility patterns. The maps were supplemented with diaries and a set of seven maps in which participants documented their routes for a week.

When participants compared the individual maps during the workshop, they discussed what they believed to be differences and characteristics. Some of the key differences where: biographical (on whether somebody just recently moved to Bremen Osterholz), related to retirement/employment, living circumstances (alone vs. partnership vs. caring for partner) related to mobility & functional health, related to the financial situation and

how active people were in terms of charity work and hobbies. All these considerations were noted and informed the subsequent development of ‘personas’ and ‘scenarios’ [RoCa02, Carr00]. Importantly these ‘personas’ were not ‘prototypical users’ grounded in the stereotypes of software developers but were rather characters that were defined by characteristics deemed important and relevant to our participants with respect to ageing in in this district. For example, the biological age or gender did not play a role for identifying differences across the socio-spatial networks depicted in the map. Our participants rather pointed to specific place-making practices that resulted in the different maps.

For the participants the probes facilitated an awareness of everyday practices and practices related to the appropriation of the district when becoming older. They sensitised participants about certain aspects of their everyday practices and were hence tremendously helpful in identifying needs as well as resources. For the researchers they allowed to develop a better and more profound understanding of these practices. This demonstrated that probes were superior to interviews in which participants could, for most parts, only report on their everyday live without prior reflection.

The probes solidified the image of the older participants as being tightly connected in their neighbourhoods and strongly engaged with their socio-spatial environment. In addition, our participants put an emphasis on “being active”, e.g. the everyday diaries were full of activities; times of loafing almost did not appear. Furthermore, some participants were motivated to improve their physical exercise through the documentation of their mobility patterns [for a more detailed discussion on the use of probes in this project see JaGe17].

In the subsequent workshops, the personas provided a good basis to discover and discuss the information needs of the older citizens. They were helpful in order to encourage participants to think beyond their own wishes and needs and to relate to others who might be different from them. Furthermore, they allowed the participants to address sensitive issues by referring to a third person. Importantly, the personas were not developed through stereotypical ideas about older adults but rather in collaboration with them.

Overall, the result was a manifold of relevant object categories and attributes to be visualised on the map, which later turned out to be too numerous for the scope of the project. Further, the personas helped to generate ideas for the service definition. The main point here was that the participants felt that it was important to focus on the resources an older person has: They told us how they were helping friends, relatives and neighbours for example support in housekeeping or getting somewhere. Here it became eminent how the participants experienced and represented themselves as efficacious with respect to themselves and to others. One idea for a service was to support the exchange of time, goods, or abilities. These considerations were in stark contrast to most of the service developed for older adults that centre around their deficits and aim to support for example, health-related support service.

As part of the service and data definition, we held two further workshops: one on the informational content and one on interactive elements of the MobileAge app. The aim of

these workshops was to select the categories of objects to be shown on the map, to determine attributes for each category of objects and further to define the relevant information about these objects. During the workshop, we divided the participants in groups of 2 – 3 to work on different categories of objects. We had prepared lists of objects per category. As we were interested in considering what kind of information would be interesting about the objects, we had also provided supplementary information in form of leaflets and Websites print-outs to the groups. The workshop concluded with presentations and discussions of the results.

In a subsequent workshop we decided with the participants to develop a map-based service. We agreed that only a limited number of categories of objects could be included in the neighbourhood guide as only very limited data was available and hence an intensive data creation process was ahead of us. The decision was supported by the argument to focus on those categories of objects that are not currently systematically captured anywhere else (e.g. nice places, informal meeting places). This would constitute an added value, particularly with regard to the content (as making available informal local knowledge).

Working with (open) data

One of the first steps was to generate a report about the data that were available for our topic and determine how appropriate these were. Subsequently the stream of activity led to the collection and validation of data that were identified as relevant but were not yet open or needed to be collected across various data owners. A further activity included the creation and integration of new (open) data by the core project group and co-creating older citizens. Lastly, the service and collected data had to be presented in a meaningful way to users. Editorial work (such as descriptions about data objects) was necessary.

In order to start the co-creation of data on the selected categories of objects and respective attributes we created a matrix (table), selected the respective institutions included in a district reader and filled the table. Only data on a few attributes could be matched with available open government data, e.g. public benches close to nice places. Data for most of the attributes had to be specified and collected. For this purpose, we arranged different focus groups to amend and complete the list of institutions and data on their attributes. The data tables with attributes were central to our co-creation activities, with most activities providing input for their structure, completion, validation and subsequently visualisation.

According to the selection of categories of objects and relevant attributes, we decided to differentiate between two main kinds of objects, with differing attributes:

- Nice places and walks, with descriptions about what was considered particularly nice, and information about the availability of benches and toilets nearby as well as supplementary information on possibilities for exercising and BBQ.

- Informal meeting facilities, institutions and services in the field of culture, consultancy and advice as well as sports with data on the individual services and facilities, events, contact person etc.

For each object, we created a matrix with a line for each object and several columns for the different attributes. These two data tables became the central working tool for the data collection and co-creation process with two objectives: (1) *Completeness*, e.g. identify all the relevant objects in Bremen Osterholz for each category; (2) *Richness of relevant details*, e.g. to collect data on as many aspects as possible for each object. All the interventions mentioned above served these two purposes and gradually completed the tables. While information on attributes such as address, contact, website was evident and easy to collect, the description was the most difficult one. The purpose of the description was to communicate why a place is nice or a facility of interest to older people. For the description, our core group participants mainly had contributed keywords. In order to acquire this information, participants assumed responsibility for particular objects (e.g. places), validated the information (e.g. through going there) and creating data (e.g. photographs).

Overall, we had to realise that very little open government data was available on the content identified as most relevant by our participants (social, cultural, leisure activities). Some participants engaged heavily in collecting data, while others were happy to name objects of interest but not to collect or validate detailed data on attributes.

Co-creating software

The visual design and functionality of the app were co-created through a number of paper-prototyping exercises and slowly transformed into digital prototyping. A first step for the co-creation of software was to identify concepts and app ideas, then gather requirements from each stakeholder. These ideas became more refined as the service co-creation activities proceeded and relevant data sets were identified (and created). The stream of activities concluded with the testing and reviewing of the functionality.

In order to enable members of our core group to test the application prototype and to validate and complete the information, we provided the participants with tablets. In a workshop, we gave nine tablets to the members of our core group. The participants kept the tablets for eight weeks. They received a short introduction on how to use the devices and how to test the first prototype.

In the observations of their use practices and a focus group around the tablet use, we developed a more pronounced understanding of the participants' motivations to appropriate certain "new" media technologies. Our participants' overall curious attitude towards new media technologies was not primarily rooted in an enthusiasm for these technologies themselves. Rather they shared a self-perception of socially engaged and politically interested citizens and they were aware of the growing importance of the internet and digital devices for society at large and social relations, in particular. In order to be able to fully participate in today's society they felt the need (and to some extent social

pressure) to keep up with these technological developments. In this regard our participants perceived themselves as pioneers/trailblazers in their generation and felt a sense of responsibility to convince “off liners” to start using mobile devices and the internet (i.e. by showing funny YouTube videos on the smartphone).

In particular, those participants who only had a desktop computer and no mobile device appreciated the opportunity to test a tablet not only for the purpose of our project but beyond. The introduction of tablets and the opportunity to test the co-created website was an important step in the process. Besides the experience to use a tablet, they could experience how their efforts and input had been integrated and valued.

Regarding the technical solution, it was necessary to consider the technological infrastructure available in the specific area. This included internet coverage as well as the supply of devices. Furthermore, the engagement with technology among the concerned older population had to be taken into account. This was partly done by reviewing statistics/studies on technological infrastructure and access for the particular region/area.

The city district guide for older citizens had to meet several requirements with regard to content and technical functions. With respect to content, the relevant objects had to be covered as comprehensibly as possible, e.g. all existing places and meeting points with all the relevant attributes. With regard to functionality, it had to be easy to find these objects. To meet these two requirements, different competences in the project team were required as there are in professional app development (e.g. for content, functionality, design). While for some design questions it was appropriate to present different existing websites, for other aspects paper prototyping was more adequate. It turned out that the exercise with an open screen and several paper elements for possible menus, left room for discussion of many associated issues. This exercise only came to a result once the researchers intervened and moderated the discussion. While some participants enjoyed the paper prototyping others were hesitant to „glue“ their proposition on paper. For those who were not too acquainted with digital media the design task appeared to be too tedious. For those that regularly used digital media the ideas about design were mainly derived from their own experience with existing websites and applications.

Exploiting the service

For the initial planning of co-creation activities, a first definition of targets, outputs and value propositions was defined. This also included initial considerations about the sustainable deployment of the service and its required data and technical infrastructure. Subsequently we developed ideas on how the service might be maintained beyond the end of the project. We agreed that the city information portal would maintain the app and technical aspects, whereas a group of local stakeholders would be responsible in maintaining the content.

4 Conclusion

4.1 Implications for engagement

Overall the recruitment and engagement mainly involved already active senior citizens (e.g. through computer clubs or charity work). Participants may be actively involved as explorers and idea formers, but the degree of participation decreases for design activities, and may increase again for diffusion. The older co-creators mainly selected from a number of given alternatives, and to some extent selected from self-defined options. Overall, participants' needed to find their new role from a customer/user of a service to a service designer/co-creator. Regarding older citizens' possible roles in a co-creation process, our experiences demonstrate that the role model proposed in traditional participatory design projects focuses too much on technology design and disregards the co-creation of the content of a service.

Relevant data are not provided by a single open source but are distributed across various stakeholders and organisations or are not open nor available at all. Often there is no quality assurance of data sets. Hence, data sources have to be investigated and validated thoroughly. In the few cases where open data are used, the data are provided by authorities already involved in the projects (e.g. public transportation) and the participants are not involved in the creation of data as was suggested by others. Rather, one of the key tasks of participatory open data projects seems to be the co-creation and opening of data sets. A new role for co-creators in such projects could then be the role of data collector and creator.

In projects driven by the administration or in data-driven projects, where the content is clear and the aim of the co-creation process focuses on the development of a technical system to distribute certain available data, these roles might be adequate. However, in a citizen driven co-creation process where the citizens define the services to be developed, the task of data co-creation needs to be added. We therefore extend this model with the role of a data editor, which comprises the tasks of data definition, collection, creation, integration, validation and maintenance.

4.2 Implications for innovating co-creation

The involvement of older adults in processes of developing new services is most essential and fruitful in the beginning of the co-creation processes when the service to be developed is defined. In this early phase, the sphere of influence is biggest and it is decided whether the outcome will be meaningful and have an impact. Furthermore, in this phase no technical skills and competencies are necessary whereby potential barriers for participation are reduced. However, the early involvement of older adults in the co-creation process has some implications with respect 1) to the recruitment of participants and 2) to the procurement of data.

1) In order to provide for substantial participation, the result of a co-creation project

needs to some extent be left open in the beginning. On the other hand, it is important to explicate expectations, duties and tasks when recruiting.

2) When involving older adults in the definition of the service to be developed, service providers cannot rely solely on open government data. Since the needs, wishes and interests of future users might not be met by the data available, service providers and developers need to consider other data sources as well as the co-creation of data. So far, the task of data procurement has been underestimated: In open data projects, there was no need for it because of a supply-driven approach to service innovation.

4.3 Implication for our understanding of old age

While co-creating the digital neighbourhood guide “for and with older adults” we had to negotiate with our participants - explicitly and implicitly - what it means to grow old. In the different phases of the process, the participants positioned themselves with regard to their neighbourhood, technology and other people, and thereby created their own images of age and ageing. The main characteristics of these images comprise of the outstanding importance of the local environment, different forms of being active (physically as well as politically or culturally) and keeping up with current (technological) developments. With regard to all of these characteristics, our participants viewed themselves as different to other older adults and thereby formed a shared identity as being old/ageing differently to others: They felt that they are more interested and knowledgeable than others about the district, more actively engaged and more open-minded towards new media technologies. Not surprisingly, we can relate these images to current dominant discourses of ‘successful ageing’ and the accompanying alternative images of ageing as a process of physical, mental and social decline. It is noticeable that all participants strive to fill their daily lives with as many and varied activities as possible. This applies to physical and mental activities as well as active engagement in social, political or cultural areas and came to be represented in the types of objects displayed in our digital district guide (nice places, meeting places, culture). The active and self-responsible work on one's own body and mind, as well as the effort to keep-up with current developments and to fill one's spare time - after many years of professional and/or domestic duty - with honorary and non-profit activities, also point to current discourses on ‘active’ or ‘successful’ ageing. The ideals of lifelong productivity and self-management are often associated and critically questioned in gerontological research with current trends such as the dismantling of the welfare state and the demand for greater self-responsibility. In this perspective, we find that the co-creation approach does not automatically lead to the contestation of hegemonic discourses and related stereotypes. Since the images of ageing and old age co-constructed in the co-creation process described, heavily influenced the service defined and the software developed, it remains to be seen, how older adults actually adopt applications such as the digital neighbourhood guide, how and with which consequences such technologies are used.

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