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Juliane Jarke

Co-creating Digital Public Services for an Ageing Society

Evidence for User-centric Design

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Co-creating Digital Public Services for an Ageing Society

Evidence for User-centric Design

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Für meine Großeltern.
Traudel und Werner Kohl
Gertrud und Kurt Nitzsche

I am not "in" this body. I am this body.
Ursula Le Guin

The dynamics of computational artifacts extend beyond the interface narrowly defined, to relations of people with each other and to the place of computing in their ongoing activities. System design, it follows, must include not only the design of innovative technologies, but their artful integration with the rest of the social and material world.
Lucy Suchman

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Introduction

Few societal trends are as ambivalent as demographic ageing and the increasing digitalisation of social life. On the one hand, there is an alarmist rhetoric around ageing societies in the Global North emphasising increasing demands on social security and health care systems; on the other hand, economists promise economic growth because of a growing consumer market—the so-called silver economy. Similarly, on the one hand, digitalisation and associated advances in robotics and artificial intelligence are depicted as solutions to "social problems" such as an ageing society; on the other hand, warnings are raised about a sustained "digital age divide" in which older adults remain largely excluded from many forms of social participation in this brave new digital world. The dangers of this digital age divide seem more relevant than ever in light of the current global COVID-19 pandemic which requires physical distancing and strong reliance on digital communication channels (e.g. for using public and commercial services, and for enabling social proximity).

This poses particular challenges for the digitalisation of the public sector: Increasingly services are provided in digital form; their take-up however remains well below expectations. In particular, amongst older adults the need for public services is high while at the same time the uptake of their digital counterparts is lower than expected. One of the reasons for why many older citizens do not use the internet so far, is because they do not expect to find services relevant to them (e.g. Kubicek & Lippa, 2017). In addition, many digital public services (or e-services) do not respond well enough to the life worlds, use contexts and use practices of its target audiences. One reason for the mismatch between the actual needs of older citizens and the digital services offered by public administrations—as technologies for circulating information and interacting with citizens—is based on the disparity between those designing systems and the experiences and use practices of a service's target audience: Digital public services are based on classifications that do not correspond to the life worlds of their target user groups, but rather represent bureaucratic ways of organising and thinking. This has been called "administrative

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burden"—a cognitive burden inflicted on citizens to make sense of a classification not based on their own lived experience but on the oftentimes opaque work organisation of bureaucracies. It has been argued widely that the administrative burden of digital public services has to be reduced in order to ensure a higher uptake (Holgersson & Karlsson, 2014). Hence, over the past decade, the emphasis shifted from an administration centric view of "simply" digitising existing public services to a view that considers user experience first (European Commission, 2009, 2016; Kubicek, Gerhard, & Jarke, 2019).

There is hence a need for design approaches that lead to user-friendly and meaningful digital public services. In recent years, co-creation has become a buzzword that came to be considered "a cornerstone for social innovation" in the public sector (e.g. Bason, 2010; Brandsen, Steen, & Verschuere, 2018; Britton, 2017; Damodaran & Olphert, 2006; de Jong, Neulen, & Jansma, 2019; Degnegaard, 2014; Holgersson & Karlsson, 2014; Osborne, Radnor, & Strokosch, 2016; Voorberg, Bekkers, & Tummers, 2015). The interest in co-creation by public authorities and governments is occurring against a background of financial cuttings, the complexity of problems and the availability of new technologies (European Commission, 2014). It is part of increasing efforts to keep up with the digital transformation of our society while at the same time ensuring that no citizen is left behind. This is prominent in particular in two public policy fields: eGovernment[1] and Open Government. Within eGovernment there has been a shift towards citizen-driven, citizen-centred service development to increase the uptake of services (Axelsson, Melin, & Lindgren, 2010; Holgersson, Melin, Lindgren, & Axelsson, 2018). Within Open Government, there is a call to more transparent governments and open public administrations in which a variety of civil society actors participate in "collaborative governance" (Ansell & Gash, 2008). Following collaborative governance, public agencies directly engage non-state stakeholders in a collective decision-making process throughout all stages of the policy life-cycle (Aichholzer & Strauß, 2015; Toots et al., 2017).

It has been noted however, that in particular older adults lack the willingness to participate in the design of digital public services (public e-services). One of the reasons is their modest use digital services, the other is their lack of experience in participating in co-design projects (Holgersson & Karlsson, 2014). Indeed, there is little experience in the co-creation of digital public services with older adults. Most studies or projects engaging older adults stem from participatory or user-centred design research focussing on the design of single artefacts. Those studies lack scalability when it comes to public sector innovation and its associated complex socio-technical arrangements (e.g. Oostveen & van den Besselaar, 2004; Torfing, Sørensen, & Røiseland, 2019). Hence, there is an articulated need to engage (older) citizens in the design of digital public services, but a lack of evidence concerning successful participation approaches.

[1] Electronic government.

This book addresses this gap by providing evidence from three co-creation projects with older adults. It is based on the EU-funded project Mobile Age[2] in which older adults co-created map-based digital public services. The book includes in-depth accounts of two projects from Bremen, Germany and one comparative case from Zaragoza, Spain. All projects have a focus on information services concerning neighbourhoods in urban settings and relate to policy objectives such as the World Health Organisation's Age-friendly Cities and Communities framework (GNAFCC). The projects ran over a similar length of time while following different governance structures, engagement strategies, and co-creation methods. In order to understand the challenges and opportunities of co-creating digital public services with older citizens, the book attends to the following three aspects when analysing, evaluating and comparing the three projects:

1. *Governing co-creation and sharing control*
   There is a long tradition of citizen participation in the planning, design and delivery of public services (e.g. Arnstein, 1969; Bovaird & Loeffler, 2012). However, very few studies have attended to the specific challenges of co-creating *digital* public services, and how control over design decisions and/or service delivery may be shared between governments and citizens. The difference to experiences from non-digital service co-creation is important, as there exists a tension between the local, customised and flexible use of information services on the one hand and the need for standards in public information infrastructures in order to ensure continuity and sustainability on the other (Star & Ruhleder, 1996). It is this tension that this book wants to explore further, by attending to the *implications of different modes of governing and managing co-creation as well as how specific methods facilitate the sharing control.*
2. *Sharing expertise*
   In order for co-creation projects to be successful, interventions are required that facilitate a role shift from older adults as (potential) users to co-creators. So far, our understanding of how citizens may be engaged in meaningful ways is still relatively limited (Gooch et al., 2018). Gidlund (2012) argued that there was "little systematic discussion of who users are, what they do, how they interact and what it means to use eGovernment services" (p.12). In fact, if citizens do become engaged in co-creation, their education, income, and socio-economic status are still strong, positive predictors of their civic engagement (Kavanaugh, Carroll, Rosson, Reese, & Zin, 2005). This book evaluates *how a variety of stakeholders can be engaged in meaningful ways* and identifies *specific challenges and opportunities for sharing (lived) experience to co-create digital public services for older adults*.
3. *Enabling change*
   Co-creation is based on the assumption that engaging future users in design leads to more user-friendly outputs and increases adoption. Voorberg et al.

[2] Mobile Age has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 693319.

(2015) conclude in their review of 122 reports, that in the majority of cases, co-creation is considered a virtue in itself. There is too little evidence of what co-creation can actually deliver and how it may be undertaken. This book explores the *suitability of different kinds of public services for co-creation and to what extend they may ultimately enable individual and/or social change*.

In order to attend to these questions, the book is structured in the following way. The *next chapter* reviews the intricate relationship of demographic ageing and technological innovation. It argues that these are not two separate and independent phenomena, but that age is performed in relation to technology use and design (and vice versa). Chapter 3 introduces key traditions for involving citizens in the planning, design, and provision of digital public services. These include the co-production of public services, the co-design of information systems and the civic use of open (government) data. The chapter summarises and compares the different rationales for participation in these approaches, and reviews how they understand the sharing of control, the sharing of knowledge and the enabling of change. Chapter 4 introduces the Mobile Age project. It presents our framework and methodology for co-creating digital public services. The chapter introduces the problem focus of the three co-creation projects, their target audiences, resources and activities. Subsequently, each of the co-creation projects is presented in a separate chapter. Each chapter begins with a short summary of the respective co-creation project. The *two chapters about Bremen* provide in-depth accounts of the two co-creation processes. The *chapter about Zaragoza* provides a comparative case. Chapter 8 reflects on the learnings from these three co-creation projects and attends to the research questions listed above. The *book closes* with a general conclusion about how older citizens can be involved in co-creation processes in meaningful and prolific ways. This leads to a different understanding of old age and the co-creation of alternative, more inclusive socio-technical futures.

Ageing Societies and Technological Innovation

Concepts of Ageing Society and Old Age

Demographic change has been declared as one of the main challenges for Western societies by politicians, journalists, industry and academia alike (Harper, 2006). The fact that societies are ageing is demonstrated through the growing number of older citizens relative to the rest of society. For example in Europe, the percentage of citizens aged 65 and above is projected to rise from 16% in 2010 to 29.3% in 2060 and the percentage of citizens aged over 80 is projected to increase from 4.1% in 2010 to 11.5% by 2060 (Creighton, 2014).

Most stakeholders agree that this change entails consequences for our health care and social systems as well as "labour supply, family and household structures, health and welfare service demand, patterns of saving and consumption, provision of housing and transport, leisure and community behavior, networks and social interaction" (Harper, 2006, p. 1). Associated fears of the financial burden to social security and health care systems are prominent. At the center of the discourse are "calls for action on the 'ageing society'" (Moreira, 2017, p. 2) to tackle the "demographic burden" (Harper, 2006, p. 19). However, scholars in critical and social gerontology argue that most of the alarmist rhetoric about demographic ageing and projected social implications are based on flawed assumptions about older people (e.g. their ability to contribute to their communities) and the ageing process (e.g. as solely described in terms of decline and long-term care needs) (Harper, 2006; Moreira, 2017). For example, Harper (2006) argues that the provision of health care for older people is only one aspect of demographic change, as most people will live the remainders of their live after retirement in "reasonable health, with limited disability". She proposes to shift focus, e.g. to inflexible retirement systems which cause a rising dependencies of older people rather than their unwillingness or incapacity to work.

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Who is considered old, differs substantially across countries, depending for example on the median age and life expectancy. Neugarten defined in 1974 a distinction between the "young-old" versus the "old-old" (Neugarten, 1974), which was later adopted by Laslett in his distinction between the third and the fourth age (Laslett, 1987, 1991). Persons in their third age, usually starting with retirement, are still relatively healthy and have time to follow their hobbies, social activities and for life-long learning. In contrast, persons in their fourth age are characterised by declining mental and physical health, ending in final dependence, decrepitude, and death. Hence, there is a

> principal binary opposition in the way later life is represented; namely the distinction between a fit, healthy and productive later life and an old age dogged by ill health, incapacity and neediness (Higgs & Gilleard, 2015, p. 10).

Whereas Laslett considered the third age a distinct life stage, he did not see it bounded by chronological age. Rather the transition from third to fourth age is a fluid and contingent process only depending on a persons' abilities. Others have operationalised the idea and calculate the third-fourth age division by "the chronological age at which 50% of the birth cohort are no longer alive" (Baltes & Smith, 2003, p. 125 as cited in Higgs and Gilleard (2015)). Higgs and Gilleard (2015) argue that both concepts can be understood as social imaginaries about what it means to grow old. In the third age, social agency plays a critical role, it is very much influenced by lifestyle choice and identity:

> Third age narratives and practices often sustain different identities and lifestyles and draw upon points of reference unrelated to agedness – such as one's sexuality, gender or ethnicity, or the uses of one's cultural and social capital – many implicitly reference ageing and old age (Higgs & Gilleard, 2015, p. 117).

There are a number of dividing practices between the third and fourth age which are reiterated in public discourse but also individual identity building. Most notable is the discourse around "successful ageing", often also called "active ageing" which ascribes in an almost normative way a particular set of practices to performing third age identities. The distinction has received some criticism: On the hand it is argued that it destroys the "bond" between old people and their "shared experience of discrimination and social and cultural marginality" (Higgs & Gilleard, 2015, p. 11). Others have pointed out that the distinction between third and fourth age, conceals other, more fundamental differences such as socio-economic divisions in society (e.g. financial capital, social capital etc.). Holstein, Parks, and Waymack (2011) argue that

> the paths to old age are deeply shaped by social location with some locations providing the foundation for a 'successful' old age while others make it very difficult especially for lower income women and people of color (p.xv).

In contrast, Higgs and Gilleard (2015) argue that much of the distinction between third and fourth age "lies outside these classical sociological structures" as for example "the cultures of the third age cannot be easily read off from an infrastructure of class, cohort and community" (Higgs & Gilleard, 2015, p. 115).

Increasingly the image of the frail, lonely and dependent elderly is accompanied by the notion of an active, healthy and capable older person. This has had a strong influence on how people perceive of themselves and their ageing bodies.

> How we experience our aging bodies is thus complex, influenced by structural, institutional, and cultural forces and the myriad interactions that occur in the overlapping and discrete contexts in which we live. Our embodied selves shape and are shaped by these forces and interactions (Holstein et al., 2011, p. xiv).

The process of ageing is hence not only biological but also a symbolic, discursive and cultural phenomenon (Höppner & Urban, 2018; Wanka & Gallistl, 2018). Certain expectations and bodily norms—such as ageing actively and healthy—provide the basis for how age is being performed as social practice, through interactions with other people (Schroeter, 2005; Schroeter & Künemund, 2010). In this understanding old age is conceptualised as a social imaginary, which is a way

> people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations (Taylor, 2003, p. 23).

What is receiving increasing scholarly attention is the materiality of age and ageing in the context of everyday life (e.g. Höppner & Urban, 2018). It moves away from social constructivist approaches to extent the frame of analysis beyond discursive practices, to ageing bodies and material environments: Within material gerontology things, technology and spaces are considered as part of sociomaterial assemblages. Ageing is understood as a "material-discursive practice" (Barad, 2003, 2007); it does not exclusively happen in a human body, but rather

> […] age and ageing are co-products of human interactions, discourses, things, technical artifacts, possessions, and mobilities, among other things. From such a perspective, ageing becomes a complex process in which human bodies and all kinds of materiality can be involved (Höppner & Urban, 2018, p. 2).

For the purpose of this book age has "analytical value" as it identifies "birth-cohort membership" and the potential of shared life-experiences such as the introduction of particular technologies during specific life events like childhood, youth or work life (Harper, 2006, p. 3). Bolin (2017) proposes the term "media generation" and argues that people of the same age group share media experiences throughout their life-course: "media technologies and content have become increasingly important components in everyday life, and hence also in the process of generation formation" (p. 5). Since age and ageing are co-products of human interactions, shared experiences, discourses and technologies, a "generational identity" is formed and shapes certain habits and modes of media use. Similarly, Hepp, Berg, and Roitsch (2017) argue that the concept of media generation is useful to describe groups of people who share specific experiences based on their personal "media biographies" and hence "developed a shared self-image as a media generation" (p. 109).

Ageing and Information Technologies

Overall are controversies about the "ageing society" not only a sign of its importance for our societies, but also shape "the way in which we approach, understand and manage ageing processes in society" (Moreira, 2017, p. 5). Moreira recommends to study the knowledge making practices, tools, technologies and knowledge making institutions that co-construct different positions about the "ageing society". Similarly others have argued that in and of itself ageing is not a problem for which a solution is required, but for example, technology-driven discourses frame ageing in this particular way (Höppner & Urban, 2018; Neven & Peine, 2017; Neves & Vetere, 2019; Wanka & Gallistl, 2018). For example, older adults have become a key target group for technology design in the area of medical and assistive technologies (Bischof, 2017; Cozza, De Angeli, & Tonolli, 2017). Not surprisingly have many sought to develop technological solutions as response to the perceived challenges and opportunities of an ageing population (e.g. robot companions to address loneliness as discussed by Turkle, 2011). Most of these technological solutions frame ageing "as a 'problem' that can be managed by technology" (Vines, Pritchard, Wright, Olivier, & Brittain, 2015, p. 2). However, the relation between ageing and technology has been conceptualised in very different ways.

Technology Acceptance as Reasoned Action

The rational choice paradigm is the most commonly used paradigm in social gerontology (Wanka & Gallistl, 2018). It explains the differences in the uptake of technologies as a matter of individual choice, determined by the subjectively perceived usefulness and the subjectively perceived ease of use/level of difficulty of any given technology (e.g. Davis & Venkatesh, 1996; Wang, Rau, & Salvendy, 2011). In particular, the aspect of "ease of use" has been picked up by a number of technology companies, developing user-friendly digital media technologies (Peine, Rollwagen, & Neven, 2014) and aiming to overcome people's conviction that certain types of technology are "obviously not for me" (Neven, 2010).

This paradigm however, underestimates the influence of social structures on active ageing and technology use as it solely focuses on individual factors, which are based on economic models (Wanka & Gallistl, 2018). Yet, the technology acceptance model (TAM) is widely used and several iterations have been proposed (Legris, Ingham, & Collerette, 2003; Venkatesh & Davis, 2000). The initial model (Fig. 1) was later refined to also include "social influence" and amended by factors such as "attitude towards" technology (Legris et al., 2003). It stays close however, to the original assumption of a user as an individual whose preference and usage of a technology can be determined through rational choice.

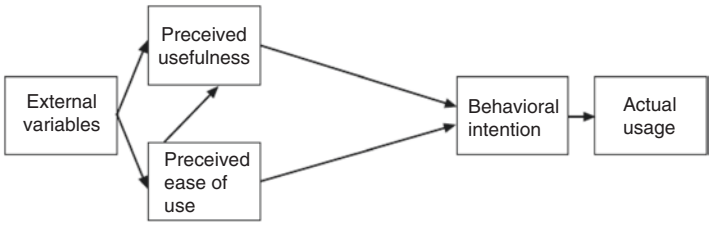

Fig. 1 Original technology acceptance model (Davis & Venkatesh, 1996)

Technology Use as Embedded in Structural Arrangements

A second paradigm to understanding old age and technology is based on structural-institutional theories, which argue that differences in technology use stem from differences arising from social inequalities (Wanka & Gallistl, 2018). These inequalities are not individual but are based upon structural arrangements which lead, amongst others, to differences in access to knowledge and a "digital divide" (Friemel, 2014; Neves, Amaro, & Fonseca, 2012; Zillien & Hargittai, 2009). In Europe's Digital Progress Report 2017, the European Commission reports that

> [i]n 2016, regular internet use grew particularly fast among disadvantaged groups: 63% of the total in 2015 compared to 60% a year earlier. 57% of those aged 55-74 went online at least weekly […] despite ongoing improvements, the elderly and those with low education levels or on low incomes continue to be at risk of digital exclusion (Human Capital p. 4).[1]

The European Parliament also pointed to the still existing age divide in 2015: From 2005 to 2014 the percentage of internet users among the population has grown for all age groups almost equally and the age gap has remained about 30%.[2] The full size of this dynamic, however, does not become visible, as the statistics exclude citizens above 74. However, a representative German survey shows that the age of 70 can be considered the turning point where "offliners" become the majority (DIVSI, 2016). While 87% of those aged 60–64 years have used the internet, only 39% aged 70–74 years have, and only 11% of those older than 80 years were at least occasional internet users.

The European Commission and Member States are aware of an uneven distribution of access and use with regard to gender, age, education and ethnic characteristics as well as regional differences since the late 1990s. The main reason for political action in the field of e-inclusion is the risk of excluding those citizens that are not digitally literate and do not use digital media from the ever-increasing number of digital public services. Based on the assumption that digital exclusion will increase social exclusion several programmes have been set up, to create an "Information Society for all." From the European Council resolution on e-inclusion in October

[1] Europe's Digital Progress Report Human Capital Chapter.pdf.

[2] EU Parliament Briefing December 2015: Bridging the Digital Divide in the EU.

2001 and the European Actions Plans to the recent Digital Agenda three areas of action have been highlighted:

- Provide easy and cheap access to the internet from home (broadband) as well as public places,
- Extent and improve digital public/e-government services as incentives,
- Enhance digital skills and literacy for all age groups (lifelong learning).

Overall the factors, listed above are not independent: low awareness of potential benefits from accessing the internet at home prevents people from acquiring the necessary skills and spend money for equipment and access (Kubicek & Lippa, 2017; Rice & Katz, 2017). According to the European Digital Progress Report (EDPR):

> The three main reasons evoked by households for not having internet access continue to be the lack of need or interest (46% of households without internet access in 2016), insufficient skills (42%) and the high costs of equipment (26%) and access (22%).

One of the main strategies to overcome the investment dilemma of older adults and to offer the chance of experiencing the benefits of online services have been Public Internet Access Points (PIAPS) at the local level: Libraries, youth and senior centres, community centres and other organisations provide desktop PCs with Internet connection and often some kind of introductory training. According to a survey by Telecentres Europe there were more than 25,000 e-inclusion organisations in the EU 27, one for every 2,000 inhabitants. However, in the age of mobile internet and mobile devices, stationary PIAPS can no longer provide the chance to discover the benefits of this new generation of ICT (Kubicek & Lippa, 2017).

This paradigm hence provides "life-course perspectives on social inequalities and technology use" (Wanka & Gallistl, 2018, p. 3). It leads to a construction of old age as a potentially active and autonomous stage, however this potential can only be realised through the appropriate technical solution (Wanka & Gallistl, 2018). It is in this way, demographic ageing is depicted as promising financial opportunities through the so-called "silver economy" which spurs technical innovation, new products and services (Harper, 2006).

Performing Age Through Technology Design and Use

A third paradigm relates to post-structural theories (Wanka & Gallistl, 2018). In this paradigm, researchers move away from "biological and biomedical models of age to re-imagine the complex subjective and culturally mediated ways in which age is embodied, measured, and expressed in multiple and non-chronological ways" (Marshall & Katz, 2016, p. 146). Within this paradigm, scholars have turned to

focus on ageing as a social practice—age "is something that people do, not something they are" (Wanka & Gallistl, 2018, p. 4).

Following Schatzki (2002); Schatzki, Knorr-Cetina, and Von Savigny (2001), the use of technology is understood as a teleoaffective practice—e.g. communicating with family and therefore using a digital messenger. Using a tablet computer does not only rely on the relevant knowledge and skills to use it, but also requires a specific self-image and self-efficacy as a skilled and legitimate user. This self-image or agency is in turn created by actually using a tablet. Low perceived self-efficacy requires targeted actions to enhance digital literacy and have to be much more responsive to individual living circumstances and capabilities (see also Kubicek & Lippa, 2017).

In a comprehensive review of 644 papers covering human-computer interaction (HCI) and older users, Vines et al. (2015) find that most research and design reinforces particular stereotypes of ageing and subsequently limits "our understanding of how older people might experience, live with, use and actively shape and design technologies both now and in the future" (p. 16).

Most software development projects are based on the designers' assumptions regarding older people's needs. Östlund, Olander, Jonsson, and Frennert (2015) warn that by using such technologies dependencies may be reinforced and older users are kept "hostage". For example, Vines et al. (2015) emphasise the risks associated with reductionist accounts of human beings as users of IT systems:

> While defining the user of a new technology can be beneficial in characterising its use cases, it has been long argued that this comes with the danger that heterogeneous and multifaceted human beings are reductively portrayed only in relation to the systems they use and how they are allowed to use them (Vines et al., 2015, p. 2).

Critical scholars in Science and Technology Studies (STS)-inspired social gerontology but also human-computer interaction (HCI) hence demand a more critical engagement with technology design for older adults (e.g. Bischof & Jarke forthcoming; Neven, 2011; Peine, Faulkner, Jæger, & Moors, 2015; Vines et al., 2015). In particular, scholars question the representations of "age" that are often scripted into technologies and call attention to the potential consequences of their use. For example, Lucy Suchman (2007) pointed out that information technologies are "sociomaterial configurations" that join together social imaginaries and materialities. Engaging older adults prior to the design process, embraces alternative measures and attributes of "success" in later life and reframes how and which imaginaries are being scripted into technologies (Vines et al., 2015, p. 20; Maaß & Buchmüller, 2018; Jarke & Gerhard, 2018).

Thus, the step towards a participatory design perspective is viewed as tremendous progress in the area of technology design for older users. Researchers, developers as well as funding agencies consider the social context of technology development and use as integral part of their agendas.

Policy Responses in Ageing Societies: Age-Friendly Cities and Communities

There are a number of policy responses to demographic ageing ranging from later retirement age and lifelong learning to approaches on local level covering age-friendly cities and communities. According to the World Health Organization (WHO), a more supportive and enabling social and physical environment is essential for people to age in better conditions. The WHO Age-friendly Cities and Communities approach proposes a framework of eight interconnected domains that shall help to identify and address barriers to the well-being and participation of older people: built environment and outdoor spaces; housing; transportation; social participation; respect and social inclusion; civic participation and employment; communication and information; and community support and health services (Fig. 2).

By adapting environments to the WHO approach, the following objectives are pursued:

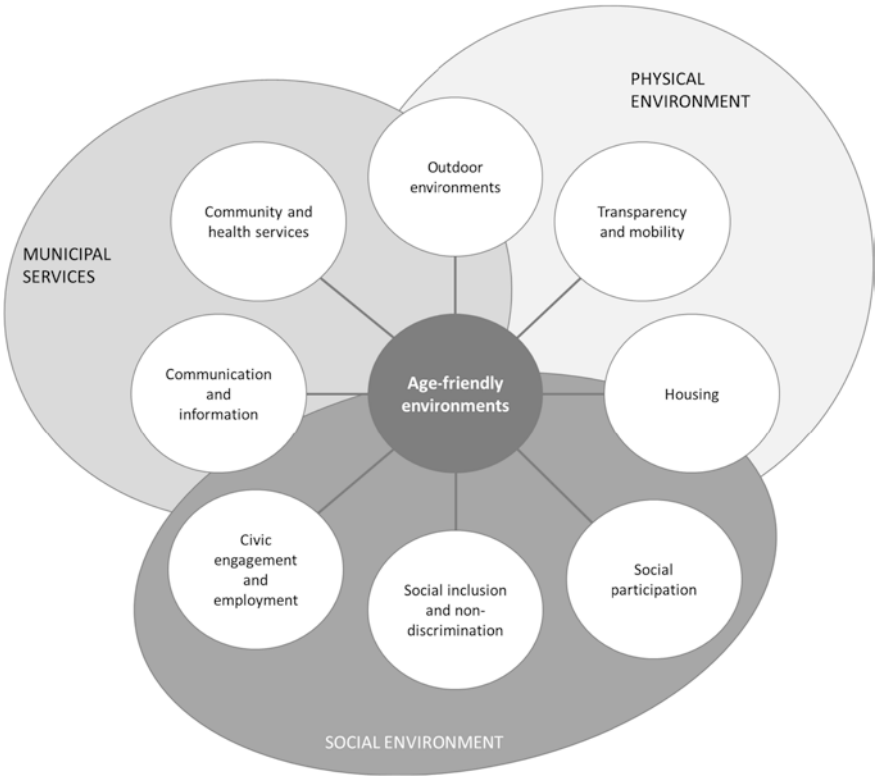

Fig. 2 WHO age-friendly cities guidelines (adapted from WHO, 2017)

- Enable older workers to remain at work for longer even those facing chronic diseases, reduced mobility or other limitations in their daily activities; enable workers who care for older relatives (often women aged 50+) to remain at work for longer, protect their own health and build a decent pension for their own old age.
- Empower older adults to age in better physical and mental health, promote their social inclusion and active participation and help them maintain their autonomy and a good quality of life in their old age even when they become frail(er) and suffer from chronic and age-related diseases.
- Lower the pressure on traditional care and assistance services, and support longer independent living.
- Create new jobs and growth opportunities through demand for innovative solutions in the silver economy sectors such as health and long-term care, housing, transport, culture, tourism, IT.

Technology, however, has not been sufficiently addressed in the WHO model. For example, the fields "social inclusion" and "civic participation and employment" do not include "essential features related to technology" (Marston & van Hoof, 2019, p. 7). This book demonstrates that questions around social inclusion as well as social participation are inherently also questions of digital inclusion and digital participation. Hence, participation in the design of technological futures is important for ensuring social participation. One policy field in which this becomes increasingly important are smart cities. A number of civil society organisations such as the AGE Platform Europe, the EU Covenant on Demographic Change, and organisations such as the WHO Global Network of Age-Friendly Cities and Communities (WHO GNAFCC) already promote a more inclusive approach to smart city developments. Co-creation may be one way to follow-up on the promise of engaging older citizens in inclusive future-making.

Co-Creating Digital Public Services

Introduction

Co-creation is understood differently across domains of application and research fields. For example, in the management and business literature co-creation is often described as a business model that allows responding effectively to changing consumer demands: Instead of companies creating or influencing a demand, customers co-create innovative solutions and value. In contrast, in research fields such as (collaborative) learning, co-creation is mostly related to the co-creation of (shared) knowledge. Overall, the role of technology in co-creation differs: Whereas in some domains technology is understood as an enabler of co-creation (e.g. knowledge or value co-creation enabled through digital platforms), in others technology is the goal of co-creation (e.g. co-creation of digital artefacts). The co-creation of digital public services differs insofar from these examples, as technology is understood as an enabler as well as an objective: It aims to co-create (public) value for public administrations and citizens through the co-creation of digital public services.

This chapter reviews the key literature and concepts relating to the co-creation of digital public services. For this task, it is firstly important to consider *what kind of digital public services may be suitable for co-creation*. In order to do so, the first section of this chapter defines what a digital public service is (e.g. with respect to different types of service providers, different types of services and service delivery) and considers what kind of digital public services allow for meaningful citizen participation. To better *conceptualise different degrees participatio*n, the subsequent section reviews Arnstein's (1969) "ladder of citizen participation" and related work. This allows distinguishing between different degrees of non-participation, (consultative) participation and beyond. Thirdly, the chapter reviews *traditional participatory approaches that provide the basis for the co-creation of digital public services*: (1) co-production of public services, (2) co-design of technology and (3) civic open data use.

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Co-production of public services refers to the collaboration of at least two parties (public administration and citizens) and has to be distinguished from other forms of civic self-empowerment such as volunteer work or self-organisation, because the public administration is not taking part in such activities. In general, co-production refers to the long-term involvement of citizens in the planning, building and provision of public services. It aims to increase efficiency, effectiveness and user/customer satisfaction of a service. Co-produced services can be substitutive for or additive to existing services. The majority of co-produced public services involve physical objects and direct human interaction (e.g. garbage separation for recycling). Digital services have so far received little attention in co-production.

Co-design refers to the tradition of user involvement in the design and development of information systems since the 1970s. There are three, partly overlapping co-design approaches, each granting different levels of control over design decisions to users: User-Centred Design (UCD), Participatory Design (PD) and User Innovation (UI). Whereas participation of users is mostly limited to the role of informants in user-centred design, their scope of action can be substantial in participatory design projects. So far, co-design projects are mainly conducted within an organisation or directed towards single digital artefacts. What has received little attention so far is the extent to which such approaches are transferrable to public sector innovation.

Civic open data use is a new mode of government-citizen collaboration that emerged as part of the open government movement and the provision of open government data for civic use. Many public administrations and governments provide part of their data under open licenses, so that technology-savvy citizens may use and re-use it. While the role of public administrations is somewhat reduced in this approach, civic tech organisations and individual activists design and develop digital tools ("civic technology") to solve particular civic/social problems. However, technology-savvy activists who run most projects do not necessarily consider or engage a wide range of user groups (e.g. older adults are rarely considered as partners or participants). In addition, the approach is lacking, so far, a participation framework between government and civil society actors that ensures the development of sustainable and scalable digital solutions.

Reviewing those three approaches to co-creation allows to identify specific challenges but also ideas for the co-creation of digital public services. The chapter hence proceeds to consider the *framing conditions for co-creating digital public services* such as existing public information infrastructures, existing collaborations, budget constraints and corresponding policies. The subsequent section of this chapter considers *different roles citizen may assume in co-creation processes*. These roles include for example explorers, data creators, designers, or diffusers. *The chapter closes with an examination of how the three traditional approaches respond to the three aspects that will guide the further analysis of this book's empirical examples*: (1) the sharing of control with citizens, (2) the sharing of lived expertise and (3) the enabling of individual and social change. Our own approach and framework for co-creation is described in detail in chapter four, followed by the accounts of our three co-creation projects in chapters five, six and seven.

Digital Public Services

The understanding of what digital public services are and how their maturity may be assessed has changed over the past two decades. Twenty years ago, the maturity of eGovernment services was understood with respect to the technological and organisational complexity of ICT systems against their actual integration into governmental organisations. Layne and Lee (2001) for example, argued that the maturity of eGovernment services may be assessed according to its level of integration (from the provision of information, to transactions to back-office integration; see Fig. 1).

A similar model was developed by Moon (2002) that features five stages: (1) Information/dissemination catalogue, (2) two way communication, (3) service and financial transactions, (4) vertical and horizontal integration, and (5) political

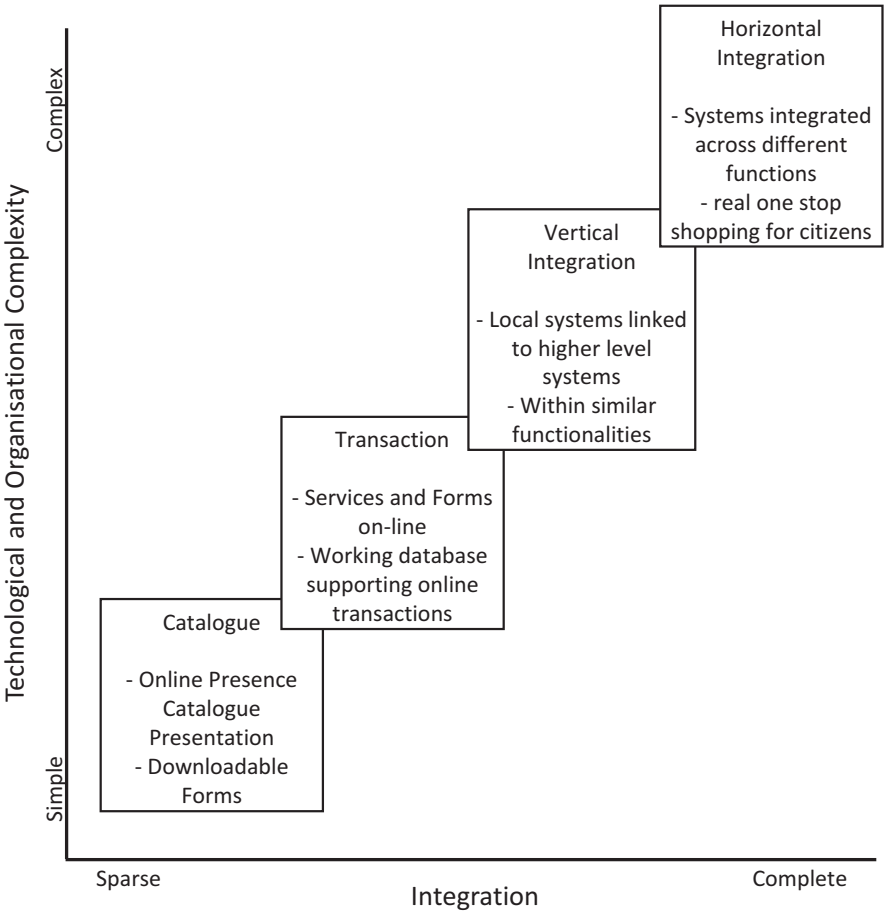


Fig. 1 Dimensions and stages of eGovernment development (Layne & Lee, 2001)

participation (e.g. online voting). Both models emphasise the complexity of eGovernment projects in transforming public sector service delivery as a transformation of its organisation through the integration of more sophisticated technology.

In contrast, the model proposed in the 2009 Benchmark Report by EU Member States emphasises a different rationale: user-centricity (European Commission, 2009). It describes the evolution of eGovernment services along policy concerns with regards to citizens as customers and designers of public services.

In this model, the early approaches to eGovermnent services focussed on their availability (*administration centric*), including the inclusiveness and accessibility of these services. In the Manchester declaration of the biannual Ministerial eGovernment Conference (2005), "user-centricity" was first introduced:

> A user-centric approach can contribute towards reductions in the administrative burden on businesses (especially SMEs) and citizens, can improve quality of life and can contribute towards trust in government and democracy.

The aim was to develop eGovernment services in a way that by 2010 "all citizens, including socially disadvantaged groups, will have become major beneficiaries of eGovernment". eGovernment was meant to contribute to higher "*user satisfaction with public services*" in general. At the Ministerial Conference in Portugal (2007) it was declared:

> It is imperative for governments to ensure citizens and businesses benefit from these investments. Understanding and recognising the importance of citizen-focused services and the reduction of administrative burden is therefore crucial to success.

In 2009 (Malmö) the ministers agreed on the following policy objectives to be met by 2015: (1) eGovernment services should be designed around the needs of users (citizens or businesses) and in collaboration with third parties; (2) eGovernment services should be user-centric, catering for the different needs of users (flexible, personalised, multi-channel, inclusive) and delivered in the most effective ways; (3) public administrations should actively seek collaboration with third parties on the development of eGovernment services in order to stimulate innovation and maximize public value.

The Benchmark Report of 2009 introduced the term "user experience" for the first time which goes beyond usability and accessibility. eGovernment initiatives were meant to include a "user satisfaction monitoring"; service development needed to be driven by "user-empowering technologies".

> Our future challenge will be to change the mindset of Administrations, and change the model of public services delivery to one that is clearly engaging and involving the customer in all aspects of the process. This opens the door to opportunities to reduce the cost-to-serve the customer, and improve service quality. We must go over a 'tipping point' to reap such rewards, and in so doing move from an Administration-centric to a Customer-centric service delivery model.

However, the 2017 declaration (European Commission 2017) is rather reserved. It is stated that the most recent EU eGovernment Action Plan (2016) has been a "significant step in this transformation journey". However, "more needs to be done and faster to ensure its implementation". The accompanying Benchmark Report shows

no progress in user experience. In addition to more user-centricity, it also asks for *citizen engagement*: That digital means are used to empower citizens and businesses to voice the views, allowing policy makers to collect new ideas, involve citizens more in the creation of public services and provide better digital public service.

In addition to the demand to more citizen engagement, there is the legitimate question whether there is a restriction on the types of public services that are suitable for co-creation. In the maturity model depicted in Fig. 2 we find no differentiation between different types of services. Rather, there is a general assumption that all eGovernment services need to be citizen-centric and citizen-driven. It does make sense, however, to differentiate between different types of public services as certain services are more suitable for co-creation. In general, public services can be distinguished by three criteria:

- The kind of interaction between service provider and user
- The kind of service provider
- The area or domain of the service

Different types of eGovernment services may be distinguished according to the *kinds of interaction* they enable between service providers and users. Layne and Lee (2001) introduced the categories of information, communication, transaction and integration. The bi-annual benchmarking of eGovernment services in EU-Member States uses a similar five stages maturity model. Each stage is connected with different technical, organisational and legal requirements and not equally suited for co-creation with civil society organisations or citizens as end user: *Horizontal integration* is achieved, when different services are integrated, that are regularly used together in a certain life situation, e.g. when people are moving from one place to another, they have to provide changes of their address with many offices and businesses. With horizontal integration, they have to enter these data

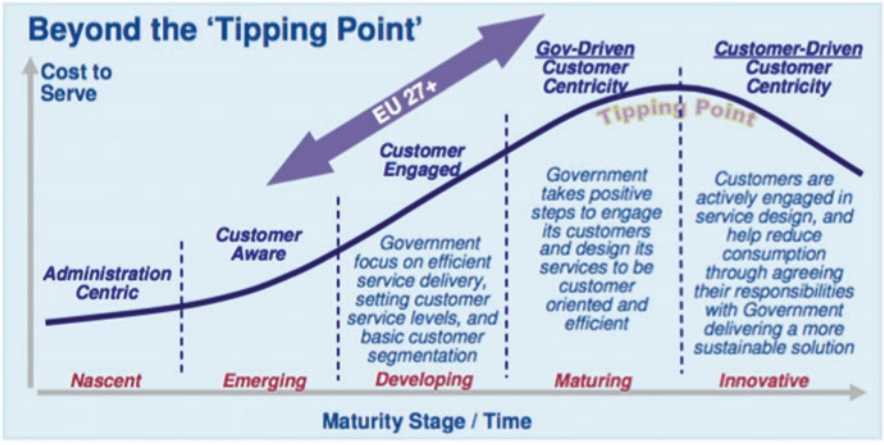


Fig. 2 eGovernment maturity model. A pathway to customer-driven centricity (European Commission, 2009)

only once. *Vertically integrated services* automatically catch data from central registers and relieve users from entering these data at all. Both ways require interoperability between the different services. If they are run by different government agencies, there is a need for inter-organisational coordination. It is difficult to imagine that individual citizens can be of any help for advancing such service integration, as these are intra- and inter-organisational processes. In contrast, *information services seem more suitable for co-creation between service provider and prospective service users.*

A second distinction of public services refers to the *kind of service provider*. In the eGovernment context, the main focus is on government agencies at national, regional or local level. Many of the services provided by these agencies are regulated by law; their development and design is governed by public procurement regulation, co-determination of employees representatives and accessibility guidelines. However, the term public service also applies to *services of public interest*, which may be provided by government agencies, social welfare organisations or other civil society organisations. Examples for such services are pre-schools, civic meeting centres, consultation services, which may be partly under government licence and with government funding. In most cases, *such service providers have more autonomy over the information services they provide and therefore may allow for more openness in a co-creation project*.

Finally, a third criterion refers to the *area or domain of a service* such as social welfare, health, environment etc. These areas are *regulated to different degrees* with respect to which information have to be provided and which information may not be published. For example in Germany the publication of information on "hygiene control in restaurants" has been forbidden by court.

In sum, citizen-driven service development of public services has been promoted greatly at European and national level for the past decade. The examples above provide a glimpse into the ways in which Members States and the European Commission reiterate the importance of customer-centricity:

> […] the importance of user presence is repeated over and over again in different shapes: involvement, empowerment, collaboration, flexible and personalized user satisfaction" (Gidlund, 2012, p. 12).

In order to allow for meaningful engagement in the co-creation of digital public services, the term *public service needs to be extended to services in the public interest and offered by social welfare organisations and other non-profit civic society organisations*, which complement governmental services. Within the narrower frame of eGovernment services, it is information services, which offer most scope for action for citizen engagement. This engagement or participation can have different levels of intensity. These levels are reviewed in the next section.

Citizen Participation

There exist different typologies for modelling the degree/level of citizen participation in participatory projects. The initial "ladder of citizen participation" was proposed by Arnstein (1969) and subsequently amended for contexts such as research (von Unger, 2014) or open government (Prieto-Martín, 2014). What these models have in common is that they all distinguish between four overall degrees of participation (including non-participation).

The first level, *non-participation,* can be depicted through different modes of civic engagement. While Arnstein proposed (1) manipulation and (2) therapy; von Unger listed instrumentalisation and instruction. None of these modes of engagement substitute for genuine participation although we do find self-proclaimed citizen engagement projects employing such methods. For example, *manipulation* occurs when citizens are placed on "rubberstamp advisory committees or advisory boards for the express purpose of 'educating' them or engineering their support" (Arnstein, 1969, p. 218). This is similar to von Unger's framing of non-participation in which citizens are *instrumentalised* to carry out specific tasks and follow *instructions* of those in power. *Therapy* is a mode of engagement in which citizens are engaged in activities that distract from the real cause of issues concerning citizens.

Arnstein (1969) defined the second level as degrees of tokenism towards participation. Prieto-Martín argues this stage on the participation ladder may also be understood as *consultative participation* rather than Arnstein's somewhat "pejorative" token participation. He argues that public authorities cannot abandon "their role as guarantor of the 'general interest' and the rights of minorities" (p. 5) and hence rightly points out to connote this stage more positively as it may be the most appropriate approach for certain participation contexts. Overall, the stage includes information, consultation and advice: *Informing* citizens about their rights and responsibilities can be seen as a first step toward legitimate citizen participation. However, as Arnstein points out, very often, this is a one-way process in which those in power inform citizens without seeking to be informed themselves and hence not providing any feedback channels. The *consultation* of citizens may be a legitimate step towards participation, if it is combined with other modes of engagement. However, if consultation solely relies on surveys, neighbourhood meetings or public hearings without a transparent decision-making process, then this mode of participation remains symbolic at best. Arnstein states "when powerholders restrict the input of citizens' ideas solely to this level, participation remains just a window-dressing ritual. People are primarily perceived as statistical abstractions, and participation is measured by how many come to meetings, take brochures home, or answer a questionnaire" (p. 219). *Advice* is the last of the three levels of consultative participation. Here a few, selected members of a community are allowed to participate, they are, however, not accountable to a constituency. Alternatively, they may be involved in the planning of a service and advise decision-makers; it is however the decision-makers that ultimately judge the legitimacy or feasibility of the citizens' advice/suggestions (Arnstein, 1969; Prieto-Martín, 2014). With all of these

degrees of consultative participation, the decision-making power lies ultimately with public authorities.

(Collaborative) participation begins when power is (re-)distributed between citizens and public administrations (Prieto-Martín, 2014). The initial degree of participation is "collaboration" (Prieto-Martín, 2014) or "partnership" (Arnstein, 1969).

> *Partnership* [or collaboration] can work most effectively when there is an organized power-based in the community to which the citizens leaders are accountable (Arnstein, 1969, p. 221, emphasis added).

The outcomes of collaboration (or partnership) should influence final decisions in a meaningful way. Prieto-Martín speaks of "honest cooperation" to signal all participants collaborate to "find and develop the best solutions" (p. 6). *Partial decision-making* power and *delegated power* allow citizens to reach (dominant) decision-making authority of a particular plan or program. Participatory budgeting, in which citizens determine by majority vote which of a set of proposed actions should receive funding, are one example. Finally, if *citizens take control*, e.g. community controlled schools or neighbourhood programs, their power goes beyond a participatory framework (Fig. 3).

Of course, the stages proposed in this ladder are not as clear-cut as they have been described. Rather, within participation projects, there is often no sharp distinction between the stages and we find many forms of citizen (non-)participation that are partly overlapping. Hence, these stages should be rather understood as an analytical framework for analysing and evaluating participation projects. In addition, this typology depicts those in power and the powerless as homogeneous groups that

Fig. 3 Ladder of citizen participation in digital public service co-creation. Adapted from (Arnstein, 1969; Prieto-Martín, 2014; von Unger, 2014)

juxtapose each other. In reality, we find many divergent views, competing interests and different capabilities in each of the groups. However, as Arnstein argues, "in most cases the have-nots really do perceive the powerful as a monolithic 'system', and powerholders actually do view the have-nots as a sea of 'those people'" (p. 217). Examples of such discourses may be found in most policy frameworks promoting the engagement of "the civil society" or "the ageing population" as described in the previous chapter.

Co-Creation and Co-Production

In order to understand how these different types of participation play out, Manzini (2015) developed a map of citizen involvement that locates different modalities of participation with respect to (1) the degree of collaboration between service providers and service users (low to high degree of collaboration) and (2) the degree of active participation of service users in the planning, design and delivery of public services. The *degree of active involvement* ranges from passive to active participation. In the case of passive participation, citizens are seen as passive users of a service; other stakeholders play the role of active providers of services. In this scenario users are served by providers. The *degree of collaborative involvement* ranges from no collaboration to intensive collaboration between service providers and service users. The outcome is a map which depicts four different modalities of citizen involvement (Fig. 4):

1. *Being served* represents the mode of least engagement and depicts the traditional mode of service design and provision. Citizens are not involved in its planning, design or provision, they are service users.
2. *Co-management* represents a mode with low involvement of citizens as service users, they are however selectively included for collaborative tasks (e.g. in the provision of a service).

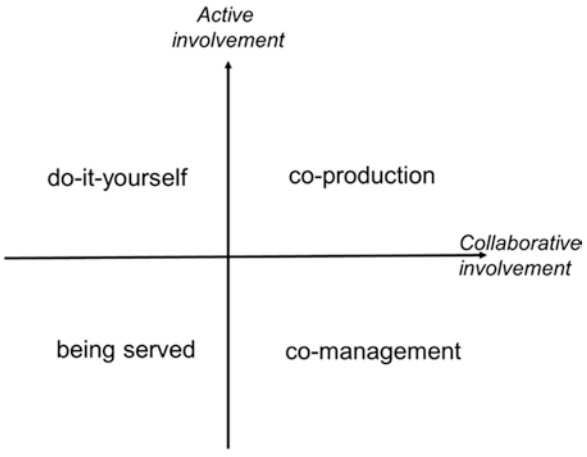


Fig. 4 Map of citizen involvement (adapted from Manzini, 2015)

3. *Co-production* represents a mode of engagement in which citizens are actively and collaboratively involved in the planning, design and delivery of public services.
4. *Do-it-yourself* represents a mode in which citizens are simultaneously provider and users of a service.

The concept of co-production is related to public services in the sense that since public services are characterised through a merger of production and consumption, they always depend to a minimum on the involvement of citizens. Osborne, Radnor, and Strokosch (2016) define

> co-production as the voluntary or involuntary involvement of public service users in any of the design, management, delivery and/or evaluation of public services (p. 640).

In their understanding, any service delivery process is always co-produced, be it voluntary (and willingly) or not, and argue that "a service does not have any intrinsic value to its users" but that its value is co-produced. They understand co-creation only as the co-creation of value through the co-production of services. Others have argued that co-creation can be understood as a process of active citizen participation and hence similar to Manzini's understanding of co-production as an active and collaborative undertaking (de Jong, Neulen, & Jansma, 2019; Voorberg, Bekkers, & Tummers, 2015). Here, co-production is

> the provision of services through regular, long-term relationships between professionalized service providers (in any sector) and service users or other members of the community, where all parties make substantial resource contributions (Bovaird, 2007, p. 847).

Hence, co-production refers to the collaboration of at least two parties (public administration and citizens) and has to be distinguished from other forms of civic self-empowerment such as volunteer work or self-organisation ("do-it-yourself"), since in those activities the administration is not taking part. It refers to the long-term involvement of citizens in problem definition and solving (see Fig. 5). Crucially, the planning stage concludes with a definition of a problem that needs to be solved. Subsequently a solution is being developed.

Bovaird and Loeffler (2012) identified two types of co-production: *substitutive co-production* as the outsourcing of work (and costs) and *additive co-production* as activities of the administration to enhance the impact of civic engagement. In this view co-production is understood as an impact-oriented form of collaboration between public administrations and citizens, that aims to unfold the capacities, potentials and strengths of all parties concerned with the objective of enhancing the quality of life in neighbourhoods, cities or regions, and to achieve efficiency gains jointly (Löffler, 2015, p. 319). It also aims to trigger "behaviour change" and preventing "future problems" (Bovaird & Loeffler, 2012). Thereby the rapid development of ICTs can support attempts to co-produce public services as it facilitates access to public data, enhances transparency and enables closer relationships and new forms of interaction between government and citizens.

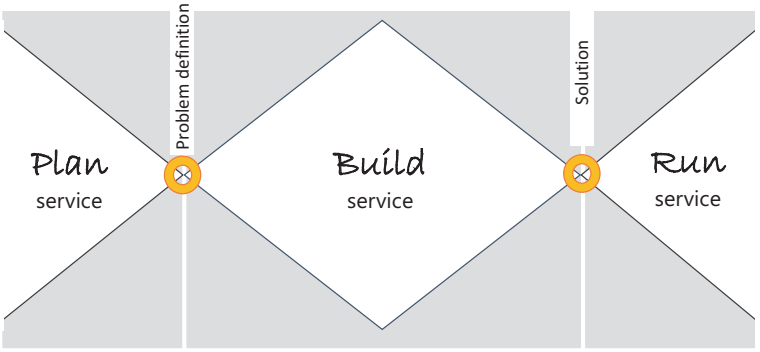


Fig. 5 The co-production of services comprises all stages of service planning, design and provision

In a comprehensive literature review on the co-production of public sector services, Voorberg et al. (2015) undertook a detailed analysis of 122 reports[1] covering different public sector domains, with a dominance in health care (30 cases) and education (15 cases). In 52% of the contributions, no objective is mentioned at all. Twenty-nine percent of the cases wanted to gain more effectiveness or efficiency, 8% aimed for more customer satisfaction and only 7% aimed to increase citizen involvement (Table 1). The authors assume that in those cases where no objectives were mentioned explicitly co-production itself was the goal and the justification, independent from any outcome (ibid, p. 1341). Voorberg et al. identify the following critical factors for achieving the goals of a co-production project on the governmental side:

- Compatibility of public organisations with citizen participation, mentioned in 47 reports (46%)
- Open attitude towards citizen participation (22%)
- Risk-averse administrative culture (18%)
- Presence of clear incentives for co-creation (win/win situation) (14%)

In addition, on the citizens' side:

- Characteristics, e.g. skills, intrinsic values, marital status, family composition, level of education (33%)
- Customer awareness, feeling of ownership, being part of something (30%)
- Presence of social capital (30%)
- Risk aversion by customers, patients, citizens (7%).

[1] Voorberg et al. (2015) based their review on 5358 articles in English-speaking journals and book chapters which appeared between 1987 and 2013 and which contained the word "Co-creation" or "Co-production" in its title or abstract. They found 1337 reports on co-creation and 4021 on co-production. Further selection criteria were involvement of citizens, public sector services, empirical findings, among others and finally led to 122 reports for detailed analysis (Voorberg et al., 2015, p. 1338).

Table 1 Goals and outcomes of co-production (Voorberg et al., 2015, p. 1341, 1345)

Co-production objectives	Goal explicitly named (n = 122)	Outcome reported (n = 24)
Gaining more effectiveness	22 (18%)	14 (59%)
Gaining more efficiency	13 (11%)	1 (4%)
Gaining more customer satisfaction	10 (8%)	1 (4%)
Increasing citizen involvement	8 (7%)	6 (25%)
Strengthening social cohesion	n.a.	1 (4%)
Democratizing public services	n.a.	1 (4%)
Others	5 (4%)	n.a.
No objective mentioned	64 (52%)	n.a.

Arnstein (1969) argues that "roadblocks" to "genuine" participation lie on both sides: On the side of government and public authorities these include racism, paternalism and a resistance to power redistribution; on the side of citizens they include the political socio-economic infrastructure, in particular in poor communities and difficulties in organising accountable representation. Actions to overcome barriers on the citizen side found in the reviewed literature include lowering the thresholds for participation, e.g. by offering a plebiscitary choice instead of asking citizens about complicated policy issues or following an inviting policy to generate a feeling of ownership. Often times, providing financial incentives are coupled with futility, alienation, and distrust in government. The review of Voorberg et al. (2015) mentions influencing factors such as social capital and the need that government explicitly invites, encourages and supports citizens in a co-creation process. They conclude that government not only has to overcome internal barriers but also has to enable, encourage and support citizens to get involved.

Although 50% of the reports mentioned some kind of objective only 24 (20%) report an outcome or impact. Among the different dimensions most frequently effectiveness is reported, i.e. the number of people reached, the amount of garbage separated or knowledge improved (Table 1).

Voorberg et al. (2015) embarked their review in order to identify whether the big hopes for co-creation (as co-production)—they speak of a „magic term" can be based on evidence in order to help public sector decision makers decide whether and how to initiate such processes. In sight of this review, Voorberg et al. (2015) conclude that it is not clear whether co-production does indeed contribute to the outcomes it claims to accomplish. They further question, "if there is a relationship between several degrees of citizen involvement (co-implementing, co-design and initiator) and the outcomes of social innovations" (p. 1348). The result is that in the majority of cases, co-creation is considered as a virtue in itself (see also de Jong et al., 2019).

Overall, co-production is about increasing efficiency, effectiveness and user/costumer satisfaction of a service (no matter if public or private). Co-creation in contrast can include some of these aspects but goes beyond them; the participation of citizens is an end in itself, because it aims to intensify one of the fundamental principles of democracy and civic participation. Hence, while co-production of public

services is a promising and innovative idea and an option to respond to "bureaucratic burden", incomprehensible administrative forms and procedures, we learn from the literature review conducted by Voorberg et al. (2015) that in general there is no evidence that the idea really works (for digital services) and that the desired results are achieved. The cases of co-production reported dealt mostly with physical objects and direct human interaction (for example garbage separation for recycling reasons). In order to understand, how user participation may be performed for the design of digital services, two approaches to co-design are now reviewed: participatory design and user-centered design.

Co-Creation and Co-Design

So far, there has been little attention to user participation for the design of digital public services (Karlsson, Holgersson, Söderström, & Hedström, 2012). However, there is a long tradition of user involvement in Information System Development (ISD).[2] Ever since the users of Information Systems (IS) became a different group of professionals from those that design and implement such systems, there was a gap between the expertise of professional software systems developers and prospective users.

In general, we can distinguish between three, partly overlapping user participation approaches: User-Centred Design (UCD), Participatory Design (PD) and User Innovation (UI). The level of control (as described in Arnstein's participation ladder) over design decision increases for participating users from user-centred design to participatory design to user innovation. In the following, I will only review participatory design and user-centred design as these two approaches assume some sort of collaboration between those developing systems and those using the systems. Both approaches are reviewed with respect to the modes of participation and levels of control they allow as well as citizens' willingness and ability to participate.

Participatory System Design (PD)

The classical model of PD dates back to the late 1970s with at least three different origins and approaches.[3] To date, there are different directions of this approach. However, they share 11 overall goals as illustrated by Karlsson et al. (2012) in Fig. 6 below.

[2] Since 1990 there is a bi-annual international conference on participatory design, started by Computer Professionals in Social Responsibility. The proceedings are available online at http://ojs.ruc.dk/index.php/pdc/issue/archive and show the great variety of thoughts and research findings on participatory design over 25 years, which cannot be summarised exhaustively in this section.

[3] The approaches can be compared by contributions of their proponents in a reader edited by Schuler and Namioka (1993).

As one of the first, Enid Mumford at Manchester Business School described case studies of information systems which were not meeting the objectives of users, because system developers had a too narrow understanding of the requirements and identified a knowledge gap between users and systems developers. To achieve a knowledge symbiosis, she worked as consultant and organised co-operative system development processes, published best practice cases (Mumford, 1981; Mumford & Henshall, 1979) and developed the *ETHICS-Method*. In this approach, "system" was conceived as a socio-technical work system, which has to meet the needs of an organisation and of the employees. Karlsson et al. (2012) identified this as the overarching goal of participatory design: To ensure a better fit between technology and the ways people (want to) perform their work (PD-G1, see Fig. 6 below). The way to achieve this is structured into seven steps from (1) needs assessment, (2) identification of constraints and (3 and 4) specification of technical and social objectives via (5) check of compatibility between different technical and social solutions to (6) the detailed technical and work design and (7) evaluation (Mumford & Weir, 1979). As such Mumford describes three levels of participation so that users participate in decision-making (PD-G11, Fig. 6 below): users as advisors (PD-G6, Fig. 6 below); selected users as representatives who make design decisions (PD-G7, Fig. 6 below) and participation as consensus between all users concerned (PD-G8, Fig. 6 below).

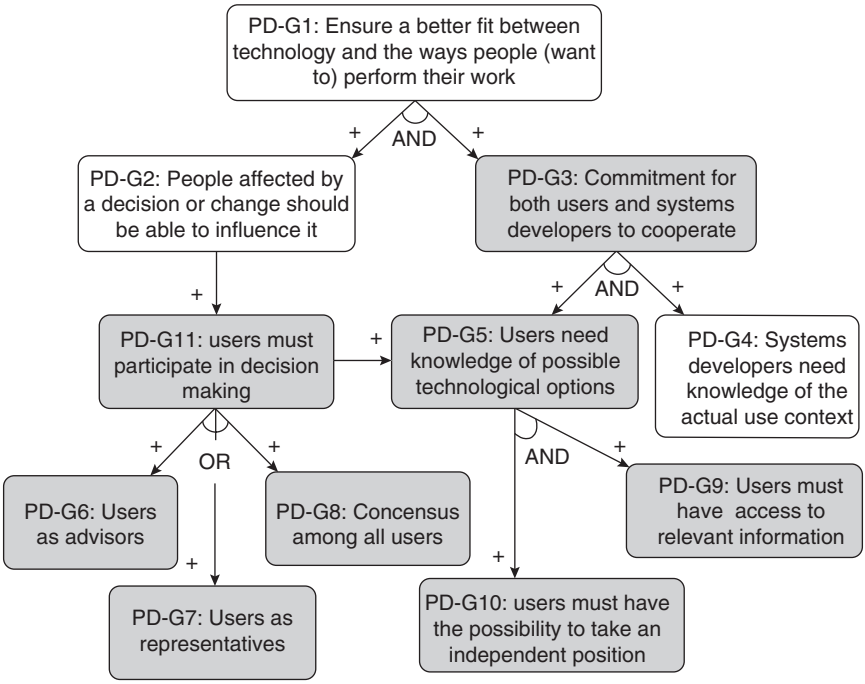


Fig. 6 Goal analysis of participatory design approaches (Holgersson & Karlsson, 2014; Karlsson et al., 2012)

In contrast the *Scandinavian approach* was based on political and philosophical considerations, emerging from a trade union perspective (Greenbaum, 1993; Kubicek, 1980). Within the context of office automation on the one hand and Industrial Democracy on the other, trade unions in Norway, Denmark and Sweden questioned whether the participation of employees should take place under the control of management and capital owners. They were in doubt on whether such processes would indeed meet workers' interest, since such systems could potentially replace them (Bjerknes & Ehn, 1987; Ehn, 1988). Starting from the claim that those affected by a technology should be able to influence it (PD-G2, Fig. 6 below), participation had to be regulated by technology agreements, negotiated by trade unions and management, including job security, health and ergonomic issues of computer work stations and visual display units, qualification programs and more. In cooperation with a computer science department, trade unions set up projects to explore user participation in this contexts and developed new methods (PD-G3, Fig. 6 below). Most famous are the *DEMOS* and the *UTOPIA Projects* (Ehn, 1988).[4]

In the US, elements of the British and the Scandinavian approach were integrated in the *Quality of Work Movement*. Because of the much lower degree of unionisation there was no chance of union involvement in systems and work design (Greenbaum, 1991). Rather the transfer was limited to the idea of merging the different views of system analysts and users in particular for the development of (management) information systems where users have much more discretion in how they use the information and functions of these systems compared to more deterministic legacy systems in accounting or for order processing. Greenbaum speaks of "*Cooperative Design*" (Greenbaum & Kyng, 1991). However, there was still a commitment for users and systems developers to cooperate (PD-G3), in particular for users to know of possible technological options (PD-G5). In addition, according to Karlsson et al. (2012) users must have access to relevant information (PD-G9) and have the possibility to take an independent position to the problem (PD-G10).

Despite differences between the approaches, they all focus on the development of individual software for intra-organisational information systems within a company. The development is conducted either by an internal IT Department or via an individual contract with a software development company. In such processes, the user departments are well-defined; representative users can be assigned to such participatory or cooperative design projects.

In recent years, this setting has changed as software projects target users outside of organisational boundaries (e.g. digital public services). This has led to new challenges with respect to participation and cooperation between software developers and prospective users. Information systems for eGovernment services target users

[4] Morton Kyng and colleagues from the Computer Science Department at Aarhus University in Denmark collected new methods for cooperative design between computer specialists and employees, which had been developed in these trade union projects such as Future Workshops, Organizational Games, Mock-up-Designs and Cooperative Prototyping in order to allow for a full understanding of the future system in the planning process by the participating employees and systems analysts at the same time (Bødker, Grønbæk, & Kyng, 2012).

who are not members of a specific organisation. Yet, the development of such services faces similar challenges with respect to understanding prospective use context and use practices.

A main challenge to software development for extra-organisational users is that traditional PD models relate to intra-organisational development of intra-organisational information systems: Internal users can easily be identified, are assigned by their managers to a project, which takes place at their work place and during paid working hours. They are motivated to participate because they learn first-hand about changes of their future job and have a chance to influence this change. In contrast, external users are more difficult to identify and motivate. They use an online service only occasionally and can potentially opt-out. Kubicek and Taube have called them "occasional users" (Kubicek & Taube, 1994). For a number of reasons it is more difficult to involve extra-organisational users in the co-design of information systems:

1. Participation requires time and usually requires a commute to where the co-design intervention takes place;
2. Participation requires to engage with people that do not necessarily know each other;
3. Participation requires engagement with software developers and software development, a topic area not familiar to most people.

There is only very little research on co-design with external occasional users. Early case studies of a school information system and a one-stop government service centre in Germany demonstrated that in both cases, users (parents and citizens) were reluctant to participate in the design of these systems (Breiling, Haunhorst, & Membrey, 1979). Stark (1998) reports on financial, schedule and information barriers and doubts the legitimacy and effectiveness of the participation of patients in the development of a patient health card.

In an interview study with 99 citizens from age 18–84 years, Holgersson and Karlsson (2014) determined criteria for citizens' willingness and ability to participate in participatory design projects. The experience of citizens with respect to technology design and use was documented. They determined that the oldest age group of their respondents (70+) showed little interest in participating in the design of digital public services according to participatory design principles. As the main reason they listed their modest use of digital public services. For example, one respondent stated: "If you do not use a service you will not see any problems with it either', and 'to participate in development of a service you never use and never will be using would be very odd" (p. 7). However, those citizens who had prior positive experience of collaborative forms of design, favoured participatory design over other approaches. In addition, Holgersson and Karlsson (2014) identified personal incentives and a "strong social commitment and feeling of obligation to participate when called upon" (p. 7) as the main drivers for citizens' willingness to participate in PD projects.

User-Centred Design (UCD)

In the last 30 years, software development has moved from an individual craft to industrial production. Instead of developing bespoke software, organisations now purchase standard software products (e.g. from SAP or Microsoft). In these cases, there is not much discretion regarding the design of functions and interfaces on the organisation's side and therefore only limited options for participative or cooperative systems design. In contrast, work processes often have to be adapted to the software system and this re-design and process re-engineering may become subject to employee participation.

As one alternative to participatory design, user-centred design emerged in the 1980s. It was part of the area of human-computer interaction and has become increasingly relevant in the design of digital public services (Kubicek, Gerhard, & Jarke, 2019). Iivari and Iivari (2011) list four principles according to the ISO 13407 standard:

> [t]he active involvement of users and a clear understanding of user and task requirements; an appropriate allocation of function between user and system; iteration of design solutions; and multidisciplinary design (p. 126).

They observe that these principles are quite ambiguous and develop a framework of four dimensions of user-centeredness based on a review of 347 papers.

- User-centeredness as user focus;
- User-centeredness as work-centeredness
- User-centeredness as user involvement or participation;
- User-centeredness as system personalisation.

Extending this analysis further, Karlsson et al. (2012) identify nine goals related to user-centered design. They analysed and categorised the goals and highlighted all those goals, which could potentially be controlled by users/citizens in grey (Holgersson & Karlsson, 2014). Overall, user-centred design aims to develop systems that serve their users (UCD-G1, see Fig. 7 below). As outlined in ISO 9241 the system's interfaces should relate to the needs of users (UCD-G3, Fig. 7 below). Holgersson and Karlsson (2014) argue that in early UCD research "developers were promoted as being system designers and builders" (UCD-G4, Fig. 7 below) whereas "users were seen as passive advisors who respond to the developers' needs" (UCD-G7, Fig. 7 below). In order to gain sufficient knowledge about the domain in which a system was ought to be deployed (UCD-G6, Fig. 7 below); developers had to spend sufficient time in this domain to appreciate users' needs (UCD-G5, Fig. 7 below). Recently, the role of users has become more active by involving a small number of users as representatives (UCD-G9, Fig. 7 below). Hence, users may participate to a varying degree in the decision process (UCD-G8, Fig. 7 below).

In their study, Holgersson and Karlsson (2014) determined that those citizens that said they prefer user-centred design approaches over participatory design approaches did so because of (1) a lack of time for a more time-consuming process, (2) a general satisfaction with existing services or (3) only infrequent or little use of digital public services. They mostly favoured participation as advisors over the

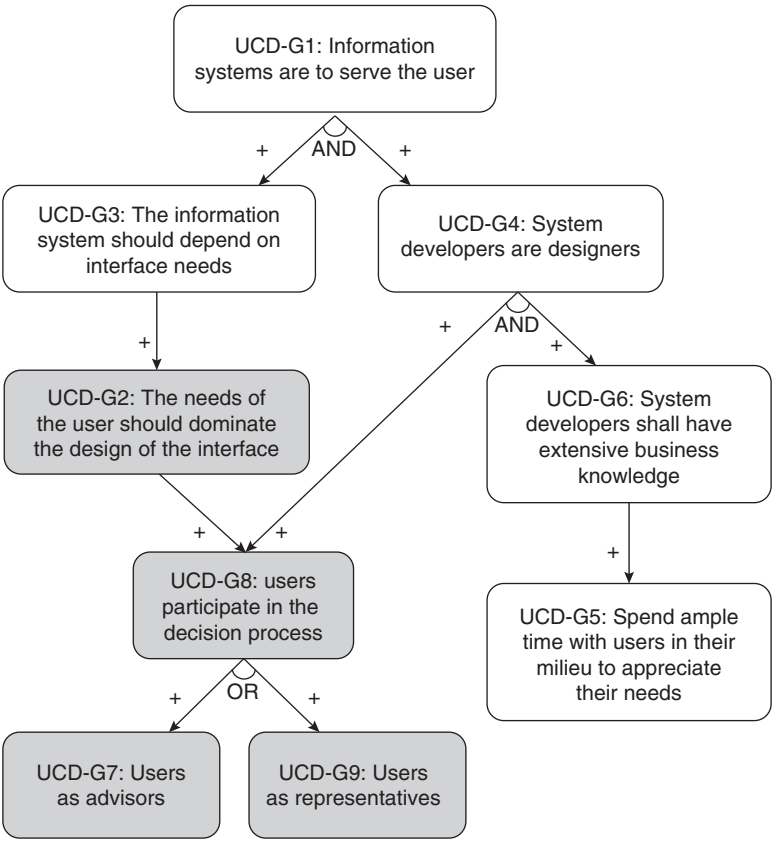


Fig. 7 Goal analysis of user-centred design approaches according (Holgersson & Karlsson, 2014; Karlsson et al., 2012)

more time consuming and demanding participation as representatives. Hence it allowed for a more passive and reactive form of participation.

Summary

In sum, the co-design of digital public services corresponds to design thinking-approaches that first aim to develop a joint understanding of the "right problem" (first phase) and subsequently develop the "right solution" (second phase). Such projects start from a general problem focus (first circle in Fig. 8) and through the analysis and understanding of the future use context and users, a concrete problem definition is developed (second circle in Fig. 8). The first part of the first phase allows for exploring the *problem area* and opening up of the problem space (divergent thinking); the second part of the first phase defines a specific area to focus upon

and concludes with a *problem definition* (convergent thinking). Only then, do participants embark on exploring and developing potential solutions (divergent thinking), which is converging through prototyping and the refinement of a specific *solution*.

Co-Creation and Civic Open Data Use

A new mode of government-citizen collaboration has emerged as part of the open government movement and the provision of open government data for civic use (e.g. Baack, Djeffal, Jarke, & Send, 2020; Emaldi, Aguilera, López-de-Ipiña, & Pérez-Velasco, 2017; Toots et al., 2017). Many public administrations and governments provide part of their data under open licenses, so that technology-savvy citizens may use and re-use it. While the role of public administration is somewhat reduced in this scenario, so-called civic hackers are "deploying information technology tools to enrich civic life, or to solve particular problems of a civic nature" as Hogge (2010, p. 10) noted in a study commissioned by the Open Society Foundation. These civic hackers are political activists that aim to support their communities through digital means; they are—in a way—an "elite" that is capable of apprehending the meaning and possible uses of open data, and subsequently act on it (Schrock, 2016).

Civic technology is strongly associated with the digitalisation of the public sector in general and the idea of "open government" in particular. 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. In the

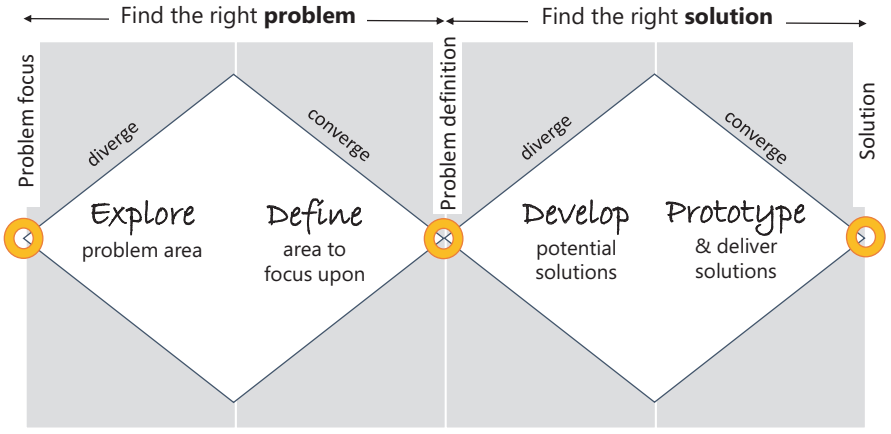


Fig. 8 Co-design process corresponds to "design thinking" approaches

past decade the idea of "open government" (European Commission, 2014; House - Oversight and Government Reform, 2007; Office of the President, 2009; Presidential Directives EO 13392, 2005) 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 using open government data.

There are different models on how government and citizens may interact with respect to open data. Sieber and Johnson (2015) distinguish four modes:

- *Data Publishing*: Governments provide data as open data via local or national portals. According to the requirements of the Open Knowledge Foundation, Open Data should be freely available to everyone to use, re-usable and re-publishable as users wish, and absent mechanisms of control such as restrictive licenses.[5]
- *Code exchange*: Government explicitly encourages the development of saleable or internally useful products based on its provision of open data as mentioned in the introduction. The provision of data is accompanied by promotional or other forms of supportive activity and is often framed in the context of an "app" contest, i.e. apps developed by a developer community, including private businesses and civil society. It is the "outsourcing app-development by government".
- *Civic Issue Tracker*: In this model, the direction of interaction is reversed. Government invites citizens to report problems like potholes or noise complaints or to give feedback on published data and documents. This mode may be applied independently from the two previous modes, but can also be combined, when citizens are invited to act as „sensors of their environments "and report data on phenomena they are physically close to in a crowdsourcing approach.
- *Participatory Open Data*: Here open data is reciprocal. Data provision from authoritative sources may be followed by a request for additional data and be amended by citizen-generated data that can support service delivery and open a new channel for discussions about policy. This can take place in a co-management framework and includes the on-going co-creation of raw data between both governments and governed and the co-production of services.

Sieber and Johnson (2015) see governments "at a crossroad" taking a choice between these modes, as they are driven by different motivations: The *first two modes are motivated by the call for transparency* based on freedom of information requirements and/or providing resources for economic development. The *third mode is motivated by a concern for a more responsive relation* of government to its citizens while the *fourth mode demonstrates a fundamental change of the role of government* and calls for a degree of flexibility, which is hardly found. However, the authors promote the "Participatory Open Data Model", because the first two modes

[5] See for example also Open Knowledge Foundation.

pose the risk that governments „outsource themselves“. If, for example, Google collects all transport data and offers public transport information, people may start asking why they pay taxes if others provide public services for free. In the authors´ view, the fourth model is a necessary reaction to ongoing changes in the digital word and in line with the principles of the Open Government Partnership.

Nevertheless, this model is in conflict with the established structures of representative democracy and the rule of law: If citizens are invited in this way as co-producers, they expect that government will follow their suggestions and contributions. However, it is open how to deal with conflicting demands and how to give the silent majorities a voice. For example, issue trackers (such as FixMyStreet) are much more widely used in those parts of a city where people with higher socio-economic status live. Studies have demonstrated that after the introduction of issue trackers, those parts of the city are more likely to receive attention by public authorities, because their issues become visible, whereas issues in other parts of the city remain invisible (Marres, 2017).

Those who volunteer as co-producers have no mandate from their co-citizens but may pursue their individual interests. They are not accountable to their communities in Arnstein's sense. According to the existing law, the decision which services are provided by local government has to be taken by the elected council within the approved annual budget according to procurement law. Any proposal for new services has to be considered and finally decided within these limits. This may be one of the reasons why the fourth model has almost not been realised so far.

In sum, public authorities and governments on all levels (local, regional, and national) are placing an increasing emphasis on opening their data repositories to encourage new and collaborative forms of service design and delivery (Shakespeare, 2013). However, such open data is normally read-only (that is, citizens are usually not able to suggest changes, correct errors, etc.) and there is little return for local governments (M. Lee, Almirall, & Wareham, 2015; Hunnius & Krieger, 2014; Kubicek & Jarke, 2020). Often developers anticipate the needs and wants of citizens based on their own experiences with lack or insufficient knowledge about prospective user groups. In order to create value that benefits administrations as well as citizens, it is crucial to engage citizens in the process of open data service app development, especially those who are often forgotten when it comes to technological innovations. So far, the field of civic open data use (civic tech/civic hacking) is mainly dominated by younger and tech-savy "civic hackers" that develop services for their communities and cities (Gooch et al., 2018; Lee et al., 2015). Older citizens—if at all—are often only marginally involved in such kind of civic technology engagement. In those cases where citizens are involved they mainly act as data collectors (e.g. Gooch et al., 2018).

Thus, 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. The articulation of this need may be found in the publication of several funding lines (of e.g. the European Commission) in which research and innovation projects are proposed that co-create public digital services. Mobile Age,

the research and innovation project upon which this book is based, was one of such projects.

Framing Conditions for Co-Creating Digital Public Services

The first part of this chapter provided an overview about the objectives of some of the roots of co-creation: co-design, co-production and civic open data use. Those approaches cover different phases in the life cycle of service planning (plan), design and provision (run). Figure 9 situates the three approaches along those phases, the first white triangle depicts the scope of activity in the planning phase (from general idea to a problem focus), the last the provision of a service (from the roll-out to the provision of a service). The design phase has been given more room in this figure because it is the heart of co-creation activities and user engagement. It starts with a general problem focus and spans over four steps: exploring a problem area, defining an area to focus upon which leads to the developing of potential solutions and prototyping. Participatory design (and other co-design approaches) provide a phased model of the design process that does not start with a well-defined problem to only develop a solution, but rather demands that users come to be involved in the identification and definition of a problem. In contrast, co-production projects often start from a pre-defined problem and are interested in co-producing solutions which are also provided in partnership. This long-term view on the sustainable provision of a solution is not something that is well covered in the participatory design literature, which tends to focus on research-led design projects. Co-production initiatives on the other hand are often driven by public-sector stakeholders. Civic open data projects include, by definition, civic stakeholders already in the planning phase and

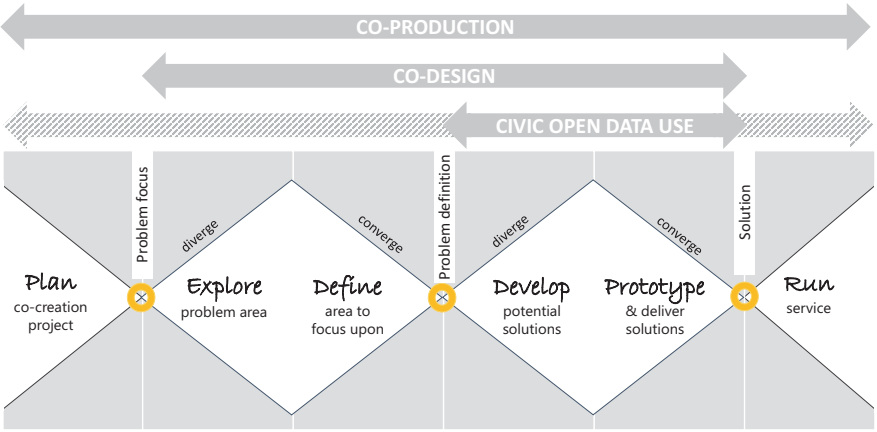


Fig. 9 An overview of digital public services co-creation and how traditional approaches feature in the process of service planning, design and provision

cover the design and running of a service. However, it has to be noted, that they rarely include non-tech savvy citizens. The sustainable maintenance and running of a civic app poses a major challenge as they rarely get integrated into eGovernment portals (Lee et al., 2015).

Co-creating digital public services goes beyond the design of a stand-alone application/a digital prototype as is often the case in co-design projects. What makes the co-creation of digital public services so challenging is that these services need to be integrated in eGovernment service platforms in order to be sustainably maintained, they have to align and be compatible with the existing public sector information infrastructure.

However, rather than understanding such an infrastructure as something that is "'just there', ready-at-hand, completely transparent, something upon which something else 'runs' or 'operates'" (Bowker, Baker, Millerand, & Ribes, 2009, p. 99), infrastructures need to be considered as an array of activities consisting of often invisible (maintenance) work and continuous negotiations between various stakeholders. In the case of public sector information infrastructures, existing collaborations between various stakeholders, existing policies and strategies, the existing IT and (open) data infrastructures, procurement laws, interoperability requirements, budget constraints and other legal and organisational restrictions need to be considered. Co-creation activities will lead to new or amended collaborations, new knowledge and amended (open) data sets, which need to be maintained. Finally co-creation activities produce one or more technical outputs such as apps. These need to be embedded into the existing information infrastructures such as eGovernment or Open Government portals.

Conceptually, Star and Ruhleder (1996) have listed a number of aspects that define an infrastructure: It is embedded in other structures, social arrangements and technologies, it is transparent to use in that it does not have to be re-invented or assembled for each task and it has a certain reach or scope. Using an infrastructure and being acquainted with its structure and inner logic, means that its use is *learned as part of membership* in a specific community of practice. In the case of an eGovernment infrastructure this relates to the community of civil servants that have learned to use the infrastructure in a specific way or the communities of citizens and businesses using it in different ways (usually with the public servants being the service providers and citizens and business being the service users). The use of such an infrastructure hence links to particular *conventions of practice*, for example of what is required for a tax return. Infrastructures also *embody standards*. These standards allow, for example, for different infrastructures to be interoperable. Furthermore, it is *build on an installed base*. Optical fibres for example, often run along old rail lines; the Internet coverage in rural areas is many times sketchy. Often infrastructures only *become visible upon breakdown*. As long as an infrastructure runs smoothly, many people will not notice their existence (or will pay no attention to its existence). Finally, *changes occur in modular increments*. An infrastructure is never changed all at once or globally, because it means different things locally and is hence complex and layered. Any changes require negotiations between various stakeholders and hence take time.

The following Fig. 10 provides some of the aspects of public information infrastructures that influence the openness and scoping of co-creation projects. Areas in white depict the scope for activities allowing for divergent and convergent thinking; areas in grey depict framing conditions.

Overall, information infrastructures are systems of classifications and as such enact certain representations of the world.

> The design and use of information systems involves linking experience gained in one time and place with that gained in another, via representation of some sort. Even seemingly simple replication and transmission of information from one place to another involves encoding and decoding as time and place shift. Thus the context of information shifts in spite of its continuities; and this shift in context imparts heterogeneity to the information itself. Classifications are a very common sort of representation used for this purpose. Formal classification systems are, in part, an attempt to regularize the movement of information from one context to another; to provide means of access to information across time and space (Bowker & Star, 2000, p. 290).

These classifications are important objects for cooperation across social worlds (e.g. between civil servants and citizens). Bowker and Star (2000) have demonstrated this comprehensively in their seminal book "Sorting things out": Classification systems organise and are organised by work practices. Public information infrastructures that provide, for example, digital public services such as eGovernment services, are most commonly organised around the silo structure of public administrations. This means that citizens who want to use a government service have to understand-to some extent-how public administrations work and how service portfolios are organised. They need to understand and know the "conventions of practice". Since many citizens do not use the same public services on a regular basis, they may lack an understanding of the conventions under which a public information infrastructure was designed. Kubicek et al. have described this as a mismatch between the view of

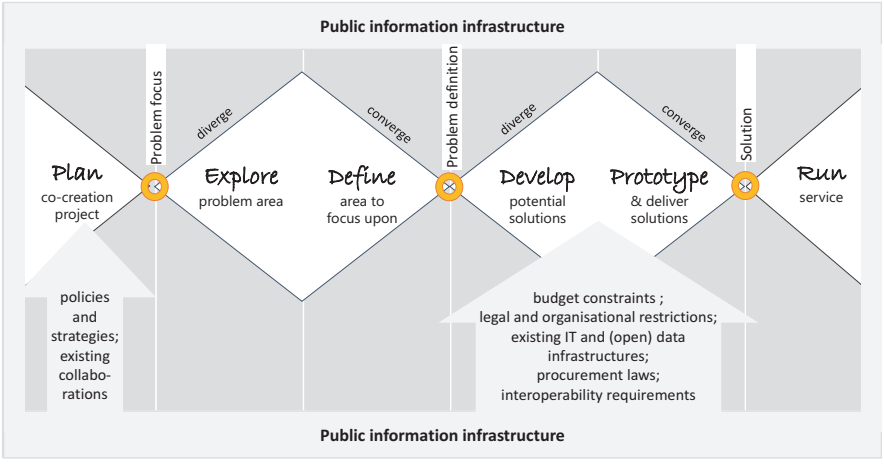


Fig. 10 Aspects of public information infrastructures influencing the openness and scope of co-creation projects

information recipients and information providers. Bowker and Star (2000) argue that "one of the interesting features of communication is that, broadly speaking, to be perceived, information *must* reside in more than one context" (p. 290, emphasis in original). This means that public information infrastructures, and digital public services more specifically need to be meaningful to both parties—service users and service providers. Citizens' misunderstanding of digital public infrastructures, their inability to make sense of the "conventions of practice" is perceived as "administrative burden". Bowker and Star (2000) observed that

> People often cannot see what they take for granted until they encounter someone who does not take it for granted (p. 291).

Part of the reason for this mismatch is the way in which information systems are designed and structured. Widely known in information management is the knowledge pyramid which was first sketched by Russel Ackoff in 1988 (Weinberger, 2011). It depicts the relation between the world, data, information knowledge and wisdom. Each of the layers signifies a process of classification (reducing, abstracting, processing, organising, analysing, interpreting, and applying) that configures our perception of the world. While most scholars agree with the order of world, data, information, knowledge and wisdom; the interrelation between them is contested (e.g. Frické, 2009; Kitchin, 2014) (Fig. 11).

World-Data Within critical data studies, scholars have argued that data are not mere and objective representations or by-products of the (social) world but that the relationship is recursive. In order to grasp the entanglement of data and world, Kitchin (2014) introduced the concept of "data assemblages". He argues that data do not simply exist as neutral, objective entities, but are always framed technically, economically, ethically, temporally, locally and philosophically. Data do not exist independently of the knowledge and the ideas, instruments, practices and contexts within which they are generated, processed and analysed (see also Borgman, 2015; Gitelman, 2013).

> One way to make sense of data is to think of them as the central concern of a complex sociotechnical assemblage. This data assemblage is composed of many apparatuses and elements that are thoroughly entwined, and develop and mutate over time and space (Kitchin, 2014, p. 24).

The data-world relationship is recursive, because data capture and represent world, however, their role in meaning-making and decision-making processes also shape and change (our understanding of) the world (e.g. Beer & Burrows, 2013; Jarke & Breiter, 2019; Selwyn, 2015). For example, Rajão and Jarke (2018) demonstrate how open government data about deforestation of the Amazon do not simply represent deforestation but allow environmental NGOs to assume a more active role in policy-making while at the same time place governmental agencies in a more vulnerable position. In addition, patterns and practices of deforestation changed because of the use of satellite imagining by law enforcement agencies: The size of individual deforested areas decreased (so to avoid detection by certain satellite imaging systems) while the overall size of deforested areas increased. Hence by

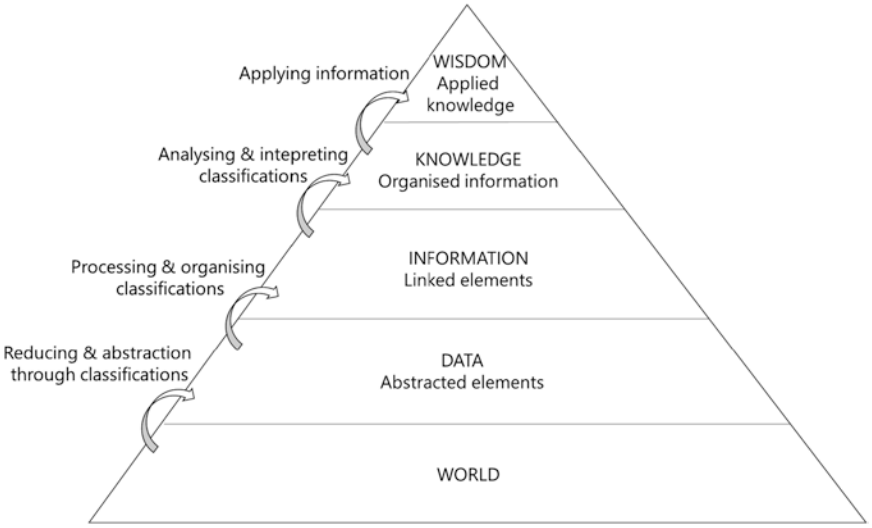


Fig. 11 Knowledge pyramid (adapted from Kitchin, 2014)

making deforestation—a fuzzy and ambiguous social phenomenon—available as object of knowledge and intervention, satellite images and associated data infrastructures produce particular (new) kinds of deforestation within a recursive data-world relationship (Rajão & Vurdubakis, 2013).

Data-Information In contrast to the more simplified version of information in the knowledge pyramid, there exist many different understandings to the concept of information. A prominent one was proposed by Buckland (1991) who distinguishes between three different aspects:

- *Information-as-process*: This understanding relates to the ways in which what a person knows is changing when he or she is informed. Information is understood as informing somebody.
- *Information-as-knowledge*: Here information is understood as the element that is being sharing in information-as-process. It is the knowledge which is communicated.
- *Information-as-thing*: In this understanding, information is an attribute for objects such as data or documents if they are regarded as "informative".

In the most common understanding information "extends beyond data and facts through adding value that aids interpretation" (Kitchin, 2014, p. 10). Information adds meaning to data through the ways in which data are organised and processed.

Information-Knowledge Similar to the other concepts, knowledge is also understood differently. Some have depicted knowledge as something that can be easily extracted and moved around. The learner or knowledgeable individual is seen to be a passive container in which knowledge is entered.

> As if it were food or money, this perspective implies, knowledge exists prior to and independent from the knowing subject, who creates no knowledge in the act of appropriation. That is, the production, circulation and consumption of knowledge are viewed as autonomous activities (Gherardi, 2000, p. 212).

This cognitive- or container-view on knowledge inhabited discourses in knowledge management studies where knowledge was seen as a "production factor distinct from the traditional ones of capital, labour and land" (Gherardi, 2000, p. 212). For others, knowledge is more than this. Polanyi (1966) conceptualised tacit knowing as something highly personal and difficult to communicate: It is embedded in the experiences of individuals (such as the knowledge on how to ride a bike or how to swim) and includes mental models and beliefs. These models and beliefs are often taken-for-granted assumptions about the world. Based on the idea of tacit knowing, Polanyi (1966) famously stated: "We can know more than we can tell" (p. 4). Explicit knowledge, in contrast, is defined as articulable and objective; it can be codified, stored in databases and libraries, and ultimately circulate easily. The difference between tacit and explicit knowing may be summarised in the following quote: "The knowledge that I have of my own body differs altogether from the knowledge of its physiology" (Polanyi, 1966, p. 20). Yet, as Polanyi argued these two modes are not separate but constitutive of each other (e.g. my knowledge of the physiology of human bodies will shape the way in which I experience and know my own body and vice versa).

In co-design research, it has been argued that it is difficult to "extract" user's knowing and that often users do not know what they know and want. This is because users and those designing and providing services belong to different "communities of practice" (Lave & Wenger, 1991). Membership in a community of practice is based on the learned performance and knowledge of a community's shared practices. This learning is situated in practice and part of the ongoing sociomaterial reconfigurations of the lived-in world.

> Activities, tasks, functions, and understandings do not exist in isolation; they are part of broader systems or relations in which they have meaning. These systems of relations arise out of and are reproduced and developed within social communities, which are in part systems of relations among persons. The person is defined by as well as defines these relations. Learning thus implies becoming a different person with respect to the possibilities enabled by these systems of relations. To ignore this aspect of learning is to overlook the fact that learning involves the construction of identities (Lave & Wenger, 1991, p. 53).

Participants of co-creation projects belong to different communities of practice: social care service providers, local government, software developers, and also older adults. They also belong to multiple communities. For example, somebody may belong to a community of practice of older residents of a particular neighbourhood which shares practices of moving around in this neighbourhood (e.g. by bike, on foot or public transport) and knowing which places to go to for recreation and which places to avoid. Simultaneously they may belong to a community of practice of older adults using digital devices to coordinate their hobbies (e.g. WhatsApp groups for sports or knitting clubs). Such practices may not necessarily be easy to communicate and are sometimes not even apparent to those performing them. They are only

meaningful when regarded in context with our interactions with the world (Rouse, 2001). Hence, knowledge is not something that is possessed by a community but rather an activity through which its practices are performed and put into context. In other words, our practices are dependent on the very situations and contexts in which they are performed.[6]

It is hence important to consider how information systems and information infrastructures as systems of classification are produced. Data about the world reduce complexity within specific contexts and "data assemblages" (Kitchin, 2014). The ways in which data are being organised, produces particular information classifications. If future users of a system are not involved in the design and decision-making about what classifications an information system should include, they may find it difficult to impossible to make sense of it. The following Fig. 12 illustrates this challenge.

Co-creation provides the opportunity to service providers to allow for encounters that demonstrate what should not be taken for granted when it comes to designing digital public information services.

From Citizens as Users to Citizens as Co-Creators

Figure 2 depicted an eGovernment Maturity Model, which mapped out a "pathway to customer-driven centricity". In contrast to previous maturity understandings, the most mature eGovernment services are those, which are "customer-centric" and "customer-driven". This move toward customer-driven customer-centricity requires different ways of planning, building and providing services. Above different roots for the ideal to co-create digital public services with citizens were described: civic participation in the *co-production of public services*, user participation in the *co-design of digital information systems* and civic engagement in *civic open data use*. There are a number of challenges associated with those approaches: So far, experiences in co-producing public services are mainly limited to physical objects and direct human interaction (for example garbage separation for recycling reasons). Voorberg et al. (2015) question in the conclusion of their comprehensive review, if the positive outcome and impact of co-production can indeed be demonstrated. The challenges to co-producing public services are different, when it comes to co-designing digital services. Above, some of these challenges have been discussed in relation to co-design (be it participatory or user-centred design approaches). One of

[6] This claim relates back to Wittgenstein's argument that 'if a lion could talk, we could not understand him' (Wittgenstein, 1984: PI 223). This seemingly paradox argument (surely if a lion could speak, we could translate from its language into our own) rests upon the assumption that every sentence has a clear meaning. Yet Wittgenstein argues that the meaning of words only derives from its use: 'The meaning of a word is its use in the language' (PI 43). The practice of speaking is only learnable through a shared usage and hence a shared cultural context. Something we do not share with animals.

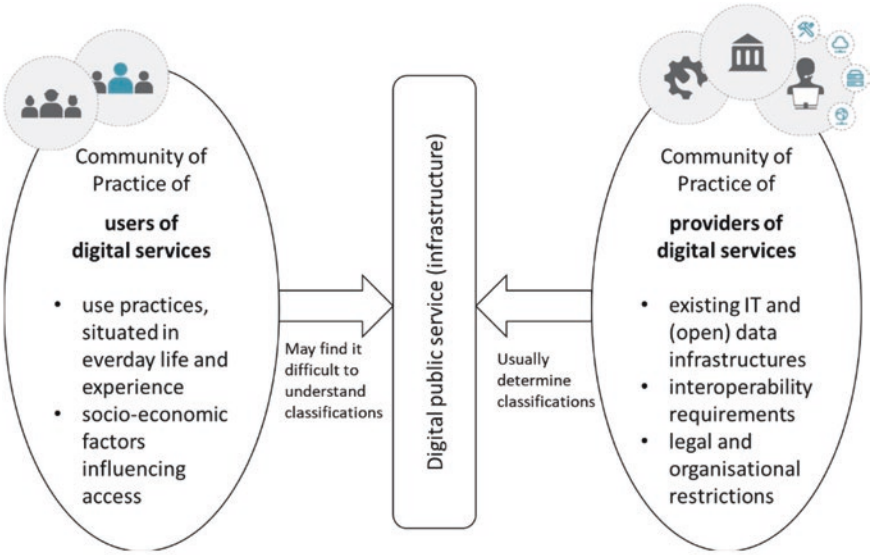


Fig. 12 Different perspectives on digital public services as classification schemes

the biggest challenge using co-design approaches as starting point for the co-creation of digital public services is that design studies are usually based on small-scale projects or conducted within a particular organisation that has a clearly identified user base (e.g. Oostveen & van den Besselaar, 2004). With respect to the civic use of open government data, sustainability is a major challenge (Lee et al., 2015).

So far, there are only few examples of successful user involvement, usually working with communities and leaving a dominant role to the researchers/designers (Bason, 2010; Britton, 2017; Damodaran & Olphert, 2006; DiSalvo, Nourbakhsh, Holstius, Akin, & Louw, 2008; Merkel et al., 2004). The success of such participatory projects depends on the involvement of appropriate and representative users (Gidlund, 2012). However, the ways in which users are constructed in each of the co-creation approaches are very different. The roles citizens as future users of a digital public service may assume differ from other forms of citizen participation but also from other forms of participatory software development as their involvement spans over the service planning, design, and provision (Gomillion, 2013):

- 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.
- End-users define or influence the architecture of the system, not only single features and interfaces.
- End-users take over responsibility for the services and systems developed and may maintain (certain aspects of) it.

While participation in some co-creation initiatives is limited to then co-design of the interface of an application, others also involve citizens in generating content. Hence, participants can take different roles in the co-creation process. In general, the *roles citizens may assume have been either defined along the service design and provision process*—plan, build, run (e.g. Voorberg et al., 2015):

- Citizens as initiator
- Citizens as co-designers
- Citizens as implementers

or *with respect to specific tasks*—exploring, forming ideas, designing, diffusing (e.g. Nambisan & Nambisan, 2013):

- Explorer: Identify problems to be solved
- Idea former: Generate solutions to well-defined problems
- Designer: Design and/or develop implementable solutions
- Diffuser: Facilitate the adoption and diffusion of the developed solution

These roles may be assumed at different times of a co-creation process. During the planning for a co-creation process, citizens may be involved as initiators or explorers, while in the subsequent phase they may be involved as idea formers and co-designers. Lastly, citizens may be involved as implementers or diffusers of services. In addition, the role of a data curator (as defined in the approach to civic open data use) was also relevant to our project.

Differences Between Co-Creation and Other Participatory Approaches

The three approaches presented above (co-production, co-design, civic use of open data) do not only differ with respect to the types of contributions they expect and enable, they also pursue different goals or objectives. These include moral as well as pragmatic considerations. There are three overall goals, which will guide the further analysis of this book's empirical examples: (1) the sharing of control with citizens, (2) the sharing of lived expertise and (3) the enabling of individual and social change. In the following, I review the differences between the traditional participatory approaches and co-creation with respect to these three aspects. This will allow to better analyse the specific challenges and opportunities of co-creating digital public services.

Sharing Control with Citizens

Rooted in the political agenda of Scandinavian participatory design, one of the main aims of participatory approaches is the destabilisation of power structures by sharing control over the design process and outcome (Vines, Clarke, Wright, McCarthy,

& Olivier, 2013). This is grounded in a moral proposition: Participatory design is commendable because "the people whose activity and experiences will ultimately be affected most directly by a design outcome ought to have a substantive say in what that outcome is" (Carroll & Rosson, 2007, p. 243). Humans ought to be regarded as "actors", not "factors" (Bødker, 2006). This moral imperative is present in many of the calls by funding agencies such as the European Commission and has been inscribed into policy frameworks. It is hence important to consider the institutional framing of participatory projects in order to understand "the sources of power and influence different project participants were able to mobilize" (Bratteteig & Wagner, 2016, p. 429). This includes for example considerations about the (hidden) agendas participants may have.

When considering what is meant with the sharing of control in the context of co-creation projects, there are two questions to be answered: How can control be shared in a multi-stakeholder process, and what decisions in a co-creation process are covered? This relates on the one hand to questions around the types of engagement methods employed and on the other to the openness and scope of a co-creation project.

The following Table 2 summarises the relevant goals for sharing control for the different participatory approaches presented: Participatory Design (PD), User-Centered Design (UCD), co-production and the civic use of open data. For each of the approaches, the table provides (1) the rational for sharing control, (2) the anticipated parties to be involved, (3) the role(s) of users in decision-making, and (4) the requirements for users to act. The rationale differs from moral considerations in participatory design (those affected by a system should be able to influence its design) to considerations about the effectiveness and usability of a system in the three other approaches. In all cases, the parties involved include users and either service providers (co-production) or system developers (PD, UCD and civic open data use). The roles of users in the decision-making process range from users as advisors to users as representatives (of a larger population). In PD, there is also the proposal to seek consensus among all users. In the civic use of open data, users do not only participate but actually steer the development of services. For all approaches, a sense of ownership and knowledge about possible options is required.

The degree of user participation, their agency and control differs substantially across participatory design contexts. For the purpose of this book, it is not only important to consider potential roles citizens (or other co-creating stakeholders) may assume but also how these roles may be performed and what is feasible in the context of digital public services.

> As the unicorn, the participating citizen is easily imagined but difficult to track down in practice. The betrayal is, however, two-folded, not only do the symbolic and discursive nature of 'citizen-driven development' fail co-creation facilitators, but citizens are also failed in several ways. The abstract concepts of use and user put forward in images and ideographs legitimate particular practices while discouraging others. In this case citizens might be motivated to participate in a number of areas but when they do so these are not acknowledged and made visible since they are not estimated profitable by the public authority (Gidlund, 2012, p. 18).

Table 2 Summary of relevant goals concerning the sharing of control for different participatory approaches

	PD goals (e.g. Karlsson et al. 2012; Vines et al. 2013)	UCD goals (e.g. Karlsson et al. 2012)	Co-production (e.g. Voorberg et al. 2015; Bovaird & Loeffler, 2012)	Civic use of open data (e.g. Sieber & Johnson, 2015)
Rationale for sharing control	*People affected by a decision or change* should be able to influence it	The information system should depend on *interface needs* The needs of users should dominate the *design of the interface*	Substitutive co-production as the *outsourcing of work* Additive co-production as activities of the administration to enhance the impact of *civic engagement*	Exploiting potential of open data Allow for user-centred and creative ways of open data-based service development Cost-efficient way of service design and delivery
Parties involved	Commitment for both *users and systems developers* to cooperate	Systems developers steer process and allow for selective user involvement	Collaboration between public *service provider* and *citizens/service users* through regular and long-term relationships	Different modes of interaction between data providers and citizens as service developers
User roles in decision-making	*Users must participate* in decision making – Users as advisors – Users as representatives – Consensus among all users	*Users may participate* in decision process – Users as advisors – Users as representatives	Users participate – Voluntary or involuntary – Collaboratively or on their own	Users steer the development of services
Requirements for users to act	Users need knowledge of possible technological options – Users must have access to relevant information – Users must have possibility to take an independent position	Not applicable	Feeling of ownership	Citizens take ownership

Arnstein (1969) developed the ladder of citizen participation for many different types of activities. For the purposes of this book, which is interested in civic participation in the planning, design and delivery of digital public service, we need a more nuanced understanding of those in power (e.g. government/public authorities or social care service providers) and those sought to participate (e.g. service users). In addition, we need to consider the type of service and service domain, for which citizen participation is sought. Hence, we need to look at the types of decisions to be made in participatory service design and scope of action that participants may have. Lee et al. (2018) propose a framework on design choices for co-creation based on a number of co-creation projects conducted by the team of authors. These design choices relate to four different aspects:

- The *preconditions of the a co-creation project*, which relate to the purpose of a co-creation project, its openness and the scope of design,
- Its *prospective participants* relating to the diversity of their knowledge, the differences in their interests and the distribution of power over design decisions,
- The *anticipated project results*, in particular its outputs as well as outcomes, and
- The way in which *co-creation events ought to be organised* (the setting for co-creation and the types of activities).

Of course, these categories are interrelated. Depending on the openness of the task, the solution is more or less predictable. The abilities and interests of the people involved are also an important aspect to consider. People can get creative at varying levels in different stages of the process and with respect to their expertise and interest in certain tasks. Finally, co-creation projects will differ in their structure, frequency and duration of interaction. With regard to the creation and design of public online services, for example, there may be a series of workshops with different objectives and participants or a regular project with a defined goal and termination, running over several months with the same team.

Sharing Expertise with Citizens

By involving users in software design, their specific expertise about their work processes (or own relevant circumstances) and how they may be supported can be fed into the requirements' specification. Although user involvement usually involves higher costs, there is agreement that the outcome of such involvement leads to higher user satisfaction and take-up. Raditionally, the sharing of expertise was hence defined as one of the main objectives and rationale of co-design and co-production approaches. Establishing citizens as experts and providing a space for them to contribute their experience turned out to be one of the most important motivations for participation in our co-creation project. To include future users' input in the design process makes also sense pragmatically as it said to increase the chances of a successful design outcome by taking into account their "expert perspectives and

preferences regarding the activity that the design will support, and most likely transform" (Carroll & Rosson, 2007, p. 243) (Table 3).

In the following, I outline, how expertise may be understood in the context of co-creation projects and what implications this has for the choice of engagement and design methods. Whereas expertise used to be defined as something logical, our understanding has moved towards ideas of expertise as something practical: "something based in what you can do rather than what you can calculate or learn" (Evans & Collins, 2008, p. 23). If this tacit knowing of future users is of interest in co-creation projects, in particular beyond the obvious and conscious needs or desires of users, then the question arises how reflection about and articulation of this knowledge may be facilitated. One answer may be found in Orlikowski's (2006) account of "material knowing". Similar to Polanyi who stressed the proximal character of tacit knowing, Orlikowski (2002, p. 249) argues that knowledge is not something static or a stable disposition, but something that is continuously produced and reproduced in everyday practice. A practice view on knowledge leads us to understand

> […] knowing as *emergent* (arising from everyday activities and thus always 'in the making'), *embodied* (as evident in such notions as tacit knowing and experiential learning), and *embedded* (grounded in the situated socio-historic contexts of our lives and work). And to this list I want to add another critical dimension, and that is that knowing is also always material. […] Everyday practices and the knowing generated as a result is deeply bound up in the material forms, artifacts, spaces, and infrastructures through which humans act (Orlikowski, 2006, p. 460, emphasis in original).

This understanding of knowing-in-practice relates to the arguments of scholars in material gerontology that understand ageing as a sociomaterial practice and process not happening exclusively in human bodies, but also "in and through material environments as well as due to social ascriptions of meanings" (Höppner & Urban, 2018, p. 5). Knowledge about ageing is produced in interaction with the social and material world.

Table 3 Summary of relevant goals concerning the sharing of expertise for different participatory approaches

Overall goal	PD goals (e.g. Karlsson et al., Vines et al.)	UCD goals (e.g. Karlsson et al.)	Co-production (e.g. Voorberg et al., Bovaird & Loeffler, 2012)	Civic use of open data (e.g. Sieber & Johnson, 2015)
Sharing expertise	Systems developers need knowledge of the actual use context Systems developers need to enable users to share knowledge	System developers shall have extensive use context knowledge System developers should spend ample time with users in their milieu to appreciate their needs	Citizens or civic organisations have the expertise to deliver specific public services	Citizens or civic organisations have the expertise to design and deliver digital services

In co-creation projects, we hence need to provide materials that allow participants to act on, and in so doing, perform their knowing. Design artefacts such as mock-ups or prototypes may be understood as "boundary objects" binding different communities of practice engaged in co-design activities together (Björgvinsson, Ehn, & Hillgren, 2012, p. 105). Star and Griesemer (1989) proposed the concept of "boundary objects" in order to understand the ways in which they enable collaboration between different communities of practice. Boundary objects are used across communities or work domains and are "plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites" (p. 393). In use, these objects become strongly structured and differentiated through work practices, yet they remain recognisable to the different worlds. Star and Griesemer (1989) originally described four types of boundary objects which Gasson (2005) discusses with respect to software development projects:

- *Repositories*, such as libraries, which allow differences in the unit of analysis used by different groups. Star (2010) suggests that repositories come "from the need for an assembly of things that are conceived iteratively" (p. 603). Heterogeneity of the things assembled can be maintained without becoming confrontational. The advantage of a repository is its modularity.
- *Standardised forms*, methods, and procedures, which enforce normative work practices across knowledge boundaries and provide a shared format for solving problems. As such, these objects circulate easily and provide a standardised way of collecting information.
- Models or *ideal types*, which provide an abstraction that works for all knowledge domains. It can be a diagram or other description which does not accurately describe any details about anyone locality or thing but which is adaptable across sites because of its vagueness. It can hence facilitate communication and cooperation across different sites.
- *Coincident boundaries*, such as a district or country, which provide a common boundary of analysis while permitting different internal contents. "The result is that work in different sites and with different perspectives can be conducted autonomously while cooperating parties share a common referent" (Gasson, 2005, p. 411).

Star (2010, p. 603) later refined the concept stating that an object is not just a thing but that its materiality is derived from action. Objects are "a set of work arrangements that are at once material and processual" (p. 604). Interpretive flexibility grants objects the ability to overcome boundaries, to become "boundary objects". These objects are viewed differently, for example by different professions allowing them to communicate. Hence "these common objects form the boundaries between groups through flexibility and shared structure" (Star, 2010). The term boundary is not meant to divide between two communities of practice but rather signifies the shared space in which they meet. They form boundaries between groups through flexibility and shared structure.

One of the big challenges in any software development project is the coordination of expertise. In this respect, it is important to consider the aggregation and coordination of individual expertise (Faraj & Sproull, 2000, p. 1555). Boland and Tenkasi (1995, p. 356) suggest that boundary objects facilitate processes of "perspective making" and "perspective taking". Perspective making describes a process in which a community specifies and refines its knowledge domains and related practices. Through this process, they are able to collate and align their perspectives and thereby develop common meaning structures (ibid). Boland and Tenkasi describe perspective making as a social practice, often based on narratives of experience and grounded in reflexivity. Ultimately, perspective making leads to some form of representation which explicates the knowledge (e.g. in the form of boundary objects).

Perspective taking, in turn, starts with an understanding of what others know and requires an interpretive reading of the accounts that others have given.

> For perspective taking, we need a shift in emphasis, to focus on the individual's ability to make his or her own understanding visible for self-reflection. Once a visible representation of an individual's knowledge is made available for analysis and communication, it becomes a boundary object and provides a basis for perspective taking (Boland & Tenkasi, 1995, p. 362).

One example of a boundary object that Boland and Tenkasi provide is that of a cause map depicting a physician's understanding of quality in medical care. By drawing the map, the physician makes his or her perspective visible (possibly even for him or herself). The map can then be exchanged with other physicians in different departments of the hospital. As such, this map (or boundary object) allows for perspective taking across different communities of practice (p. 362). Figure 13, was adapted from Boland and Tenkasi (1995) and depicts their concept of perspective making and perspective taking.

In Mobile Age we have used and amended a number of methods to allow us the facilitation of perspective taking and perspective making amongst the older participants as well as between older participants and the Mobile Age teams. Some of these methods will be introduced in the next chapter and discussed in the chapters presenting the three co-creation projects.

Enabling Individual and Social Change

Finally, all approaches (co-production, co-design, civic open data use) recognise that participatory processes are motivated by enabling (or enforcing) some kind of change. This change may either be on the individual or social/organisational level. In order to creating a lasting impact, co-creation needs to understand peoples' current practices, experiences and how future design products may become appropriated (ISO 9241-210, 2010; Vines et al., 2013). Table 4 below summarises the goals from all four approaches with respect to kinds of change they are pursuing.

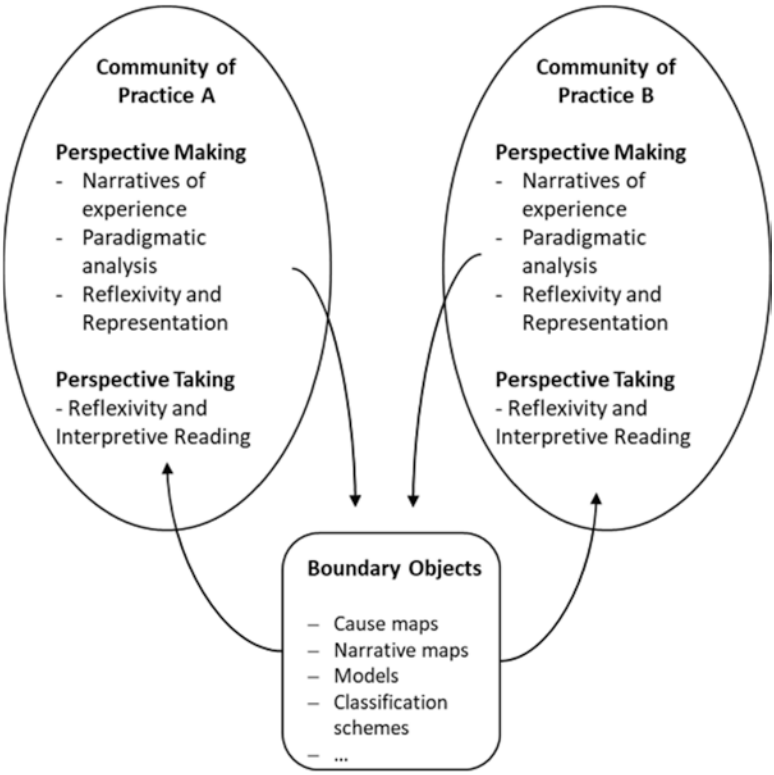


Fig. 13 Perspective making and perspective taking (adapted from Boland & Tenkasi, 1995)

Individual Change In particular participatory design and user-centred design aim to induce individual change and ensure the uptake of a design solution through user involvement. Co-creation aims to create value beyond the mere development of technical artefacts. In the three co-creation projects described in this book, the value proposition of the co-creation processes related to more age-friendly communities and neighbourhoods which allow for social participation. To assist older adults to remain in their communities and neighbourhoods with some level of independence, rather than in residential care homes, requires to consider not only their immediate housing options but also 'transportation, recreational opportunities, and amenities that facilitate physical activity, social interaction, cultural engagement, and ongoing education' (Wiles, Leibing, Guberman, Reeve, & Allen, 2012). Appropriate information about the available resources in a neighbourhood can have a positive effect on social participation, if it relates to the (mediated) information practices, the abilities and limitations of older adults (Beneito-Montagut, Cassián-Yde, & Begueria, 2018). A study conducted by Wiles et al. (2012) characterises "ageing in place" by the positive perceptions of older adults as a sense of attachment and social connection, a sense of security and familiarity and a sense of identity, linked to independence and autonomy. Hence, mobility and social connectedness within the

Table 4 Summary of relevant goals for enabling change for different participatory approaches

Overall goal	PD goals (e.g. Karlsson et al., Vines et al.)	UCD goals (e.g. Karlsson et al.)	Co-production (e.g. Voorberg et al., Bovaird & Loeffler, 2012)	Civic use of open data (e.g. Sieber & Johnson, 2015)
Individual and social change	Ensure a better fit between technology and the ways people (want to) perform their work	Information systems are there to serve the user	Gain more effectiveness Gain more efficiency Gain more customer satisfaction Strengthen social cohesion Democratise public services Change behaviour to prevent future problems	Shift responsibility to civil society organisations Allow for open collaboration

immediate environment are particularly relevant when engaging older adults (Manchester & Facer, 2017; Wiles et al., 2012).

Social Change As such, the output of a co-creation process (e.g. digital public service) refers to a socio-technical innovation in the form of software and data that is embedded into a larger public information infrastructure and provided to (all) citizens. The value of such a service for older adults needs to meet a value proposition and provide a more relevant service of higher quality and better usability than existing ones. Above all, and this is the tension that I alluded to above, the service needs to be sustainable. True change may only be implemented, if the co-created service is provided on a permanent basis. Co-creation methods hence need to be evaluated against their ability to contribute to a service's sustainability and enabling lasting change.

Mobile Age: Co-creating Digital Public Services with and for Older Citizens

Introduction to the Project

The co-creation projects reported in this book were part of the EU-funded project Mobile Age[1] in which digital public services were co-created with substantial participation of older citizens. The overall aim of Mobile Age was to develop and test methods for *co-creating open digital services for age-friendly cities and communities*. This included objectives such as

- enabling civic open data use of older adults,
- increasing digital inclusion of older adults, and
- co-creating sustainable digital public services for older adults.

So far, older adults are using the internet and in particular, eGovernment services to a much lesser degree than other age groups (digital divide as age divide). Mobile Age assumed that a way to make digital services more attractive and beneficial for older adults was to involve them in the process of identifying, conceptualising and designing relevant and usable digital services. As such, Mobile Age followed and extended an approach to co-creation that exceeds traditional ways of citizen participation. It explored, developed and tested new methods and tools.

This book is based on three of the six co-creation projects conducted in Mobile Age: two in Bremen, Germany and one Zaragoza, Spain. In a first phase, a pilot co-creation project was conducted in Bremen (district Osterholz) from May 2016 to February 2017. The learnings from this project fed into the planning and implementation of two further projects from May 2017 to February 2018: In a second district in Bremen (Hemelingen) and in Zaragoza to experiment with different forms of engaging stakeholders, project governance and methods. In this book, I have selected the two co-creation processes from Bremen for an in-depth analysis and the

[1] https://mobile-age.eu/.

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_4

co-creation process from Zaragoza as a comparative case. The reason is that both, Bremen and Zaragoza, had a focus on information services concerning the neighbourhood in urban settings by relating to policy objectives such as age-friendly cities and communities. The projects ran over a similar length of time while following different governance structures, engagement strategies and co-creation methods. There is hence enough commonality and difference to provide a meaningful comparison between the three projects in relation to the sharing of control and expertise as well as the enabling of change.

A Framework for Co-creation

A co-creation project can be roughly split into four phases (1) a planning phase in which a *problem focus* of the project is determined; (2) a phase in which the problem area is explored and co-creators decide on a joint *problem definition* and articulate a value proposition; (3) a phase that develops and evaluates *possible solutions*; and (4) the post-project phase in which the service runs (Fig. 1). The chapters that report on our co-creation projects in Bremen and Zaragoza are concerned with the second phase (find the right problem) and third phase (find the right solution). Because of the logic of funded research projects, much of the planning had to be done prior to the project start for the funding proposal (see also Bischof & Jarke, forthcoming). In a first attempt to receive project funding, we left the planning deliberately open in order to increase the scope for action in the co-creation projects. This was however rejected by the funding agency because proposals needed to be very specific on how and why they would spend taxpayer money. In the project proposal that received funding, we provided a frame for the problem focus, the problem definition itself was co-created with older adults, social care service providers and local governments during the co-creation projects. The running of the service also lies outside of the scope of a funded research project. However, we allowed ample time to ensure the sustainability of the services developed. For now,

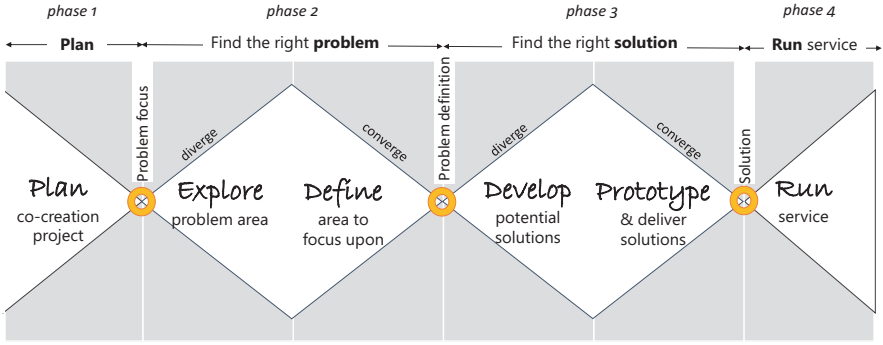


Fig. 1 Four phases of a co-creation project

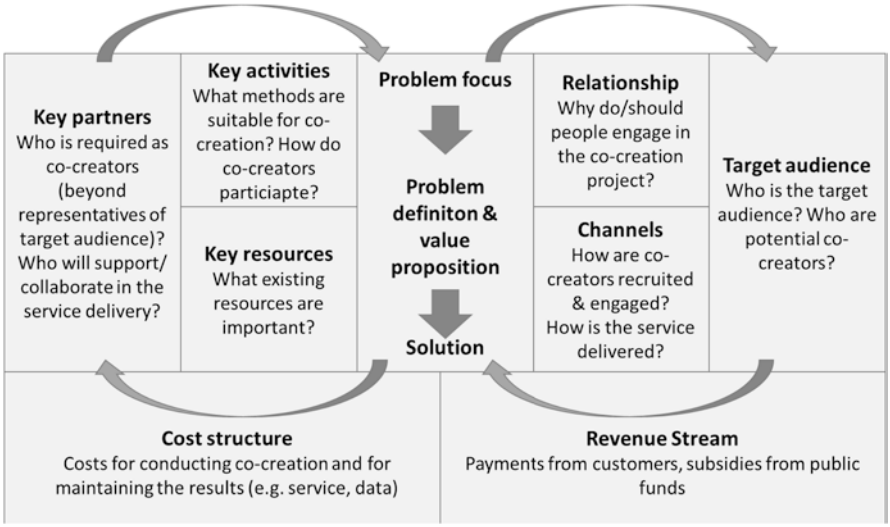


Fig. 2 Adapted business model canvas to describe co-creation process and output

I outline the results of the first phase (the problem focus) as this had implications for the choice and adaptation of methods in the subsequent phases.

When considering and planning a co-creation project (*phase 1*) there are a number of aspects to consider which frame and determine the project. Similar to a business model canvas one can depict the key dimensions of a co-creation project in a canvas (see Fig. 2). Initially, there needs to be a general idea about the *problem focus* and *target audience*. As the co-creation project proceeds the problem focus will become more refined (*phase 2*—find the right problem) and a solution is being developed (*phase 3*—find the right solution). This process is at the heart of co-creation and shaped by those engaged from the target audience and by *key partners*. The role that co-creators assume in a co-creation project depends on the *relationship* they have to the problem area and their willingness and ability to become engaged. Another relevant aspect are the *communication and engagement channels* (e.g. how citizens are approached and recruited to the co-creation project; how the service will be delivered). In addition, it is important to consider the *existing resources* (e.g. of a neighbourhood) that may support a service and what *kind of activities* are suitable and required in order to engage with the target audience and key partners in a meaningful and targeted way. For the sustainability and maintenance of the proposed solution (*phase 4*), the *revenue streams* and *cost structure* need to be evaluated.

These aspects are described in more detailed in the following. I will start with the *problem focus* of Mobile Age and detail the specific foci of Bremen and Zaragoza. Subsequently the *target audiences* and *key partners* are described. I provide a summary of *key resources* and subsequently refine the *problem definitions & value propositions*. This includes a summary of the *solution*: output, outcome and sustainability of the co-created services. Finally, *key activities* are reviewed considering how

methods from e.g. co-production, co-design and civic open data use may be adopted to suit the needs of our co-creation projects. The chapter concludes with a summary of the Mobile Age co-creation methodology.

Problem Focus

One of the basic assumptions of Mobile Age was that if digital services are more relevant to older adults and more user-friendly, they may raise interest in and use of digital public services (even for those with little or no digital skills). The corresponding term in the digital agendas of the European Commission and EU Member States is "e-inclusion". The main reason for political action in the field of e-inclusion is the risk of excluding those citizens that are not digitally literate and do not use digital media. In other words e-exclusion increases social exclusion. Thus, social inclusion and e-inclusion were two mutually depending policy aims of the Mobile Age project and the co-creation processes. The co-creation processes described in this book focused in particular on "social participation" (Bremen) and "a safe and accessible city for older citizens" (Zaragoza).

Problem Focus: Social Participation (Bremen)

Social participation is a societal (or political) goal that aims to enable any person—no matter what age—to participate in the social, political, economic and cultural life (Naegele, Olbermann, & Kuhlmann, 2016). It hence links to the promotion of citizens' empowerment and participation (as individuals, as groups or communities). Factors that may hinder the social participation of people are a "combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime, poor health and family breakdown" (Lyons & Huegler, 2013).

While there are several policy-related measures on the macro-level aiming at social participation (e.g. social policies, labour market reforms), the focus of Mobile Age was on the meso-level (neighbourhoods & districts) and micro-level (individual & families). On an individual level, social participation may be understood as participation in (Naegele et al., 2016, p. 45):

- *economic* (participation in work life, sufficient financial funds and right to make decisions);
- *political* (participation, civic engagement, possibility for decision making);
- *cultural* (access to cultural life and related education);
- *social* (informal and personal integration in primary networks such as family, friends and social activities in society;
- *socio spatial* (relationship and bond with respective living environment: happiness, identity, bonding).

The British ELSA report proposes the term "social detachment" to measure the disadvantage on six indicators of social participation: (1) contacts with other people, (2) social support, (3) civic/political involvement, (4) participation in culture, (5) participation in recreational activities/hobbies and (6) participation in leisure (Banks, Breeze, Lessof, & Nazroo, 2008; Tomaszewski & Barnes, n.d.). In this perspective, improving social participation is meant to be achieved by strengthening social capital and circumventing social detachment through appropriate neighbourhood development. The neighbourhood not only affects outcomes such as education, employment and health, but also the opportunities for building social capital (Atkinson & Kintrea, 2000). Enabling older adults to remain in their communities and neighbourhoods allows them (1) to connect and interact with other locals and to be part of a "safety net of people who look out for you and would come if something was wrong", and (2) know "where specific resources (e.g. health services and shops) are and how they work" (Wiles, Leibing, Guberman, Reeve, & Allen, 2012).

The study conducted by Wiles et al. characterises "ageing in place" by the positive perceptions of older adults as a sense of attachment and social connection, a sense of security and familiarity and a sense of identity, linked to independence and autonomy. In the WHO framework, social participation is an issue of neighbourhood development in terms of public infrastructure, the availability and quality of local institutions and services in each of the action areas. To assist older adults to remain in their communities and neighbourhoods with some level of independence, rather than in residential care homes, requires to consider not only their immediate housing options but also "transportation, recreational opportunities, and amenities that facilitate physical activity, social interaction, cultural engagement, and ongoing education" (Wiles et al., 2012).

Hence, neighbourhoods play a central role for social participation/inclusion as social exclusion is often concentrated in certain neighbourhoods of a city or region (Ellen & Turner, 1997; Pickett & Pearl, 2001). Some European governments (e.g. Germany, UK) fund so-called neighbourhood managers in deprived communities who among other things collect:

- Evidence of residents' identified needs and priorities, and
- Evidence of the quality, level and performance of local public services and any gaps in provision or issues with performance.

They are also called "pathfinders", as one of their functions is to give evidence-based recommendations to local government which services in their neighbourhoods are missing or are of poor quality in order to improve social cohesion and combat poverty. A British evaluation report found that from the experience of neighbourhood management pathfinders it has become clear that

> […] baseline information at neighbourhood level is not always available, or not very accessible […] improving information about levels of service and service expenditure at neighbourhood level continues to be a challenge (The National Evaluation of the Pathfinder Programme, 2006, p. 14).

Social participation can hence be understood as an interplay between the resources of a neighbourhood and the resources of older people living there. People with low social and cultural capital, little financial resources and poor health will use the local resources to a lesser degree and participate less in (public) social life. If there is a lack of services and facilities in a neighbourhood even a high degree of personal resources does not lead to high a degree of social participation. Appropriate information about the available resources in a neighbourhood can have a positive effect on social inclusion, if it meets the media habits and abilities of the target audience.

Problem Focus: Safe and Accessible City for Older Citizens (Zaragoza)

In Zaragoza, the problem focus was specifically on a safe and accessible city for older citizens. The rationale for Zaragoza's problem focus was linked to the idea of "ageing in place" and the importance of neighbourhood for older residents as described for Bremen. It was also linked to Zaragoza's strategic policy objectives of becoming a WHO age-friendly city.

On March 27, 2009, the City Council unanimously approved the integration of Zaragoza into the WHO Global Age-Friendly Cities and Communities Network (GNAFCC). In March 2011, the accession to the network was formalised, with Zaragoza being the second Spanish city to be included. In a first phase of work, a "participatory diagnosis process" about high-impact areas was carried out using a methodology established in accordance with the Vancouver Protocol (Investigation-Participation-Action). This diagnosis (or baseline report) included quantitative and qualitative research on the city, taking into account the eight different WHO areas. In the process, the city government collected information on every aspect of the city affecting older adults, and subsequently conducted focus groups with older citizens to seek their opinion on this information. The mechanisms and areas of participation of senior citizens in the process were defined in order to develop a diagnosis that would allow to measure the age-friendliness of the city with older people involving the participants in the analysis process and improvement proposals regarding programs, services and characteristics of the city for its older residents and to generate a series of proposals that would allow a plan of action adapted to the needs and demands of older citizens.

The development of the first phase of action generated a diagnostic document of the city, which not only evaluated its age-friendliness, but also analysed in each of the areas defined in the Vancouver Protocol the strengths and weaknesses in the opinion of its older residents, in addition to proposing improvement actions.

This information allowed the development of 25 proposals, with different levels of detail. These proposals informed an Action Plan. One of the projects in this Action Plan concerned "Walk and discover a safe and accessible city", relating to the articulated needs of older adults to increase security and accessibility in the city.

Participants in focus groups proposed the co-creation of "age-friendly routes" which could be digitised and accessed through the City Council's web page. An age-friendly route was defined as follows:

- *The route is frequently used*: Co-creators need to identify a route that older residents use routinely and often in their daily life in the neighbourhood. The Senior Citizens Centre of the district was taken as a point of reference.
- *The route is safe and accessible*: Co-creators need to identify and assess aspects that make routes safe/unsafe and accessible/inaccessible.

Target Audiences and Key Partners

At the start of the Mobile Age project, the target audience was defined as older adults (>60). In chapter "Ageing Societies and Technological Innovation", I argued that even though older adults are not a homogeneous group and differ for example with regard to their personal resources (e.g. social capital, financial resources), aspirations and abilities, it does make sense to group them as a "target audience" of public services—based on life events—and of digital public services—based on their birth-cohort shared experiences with (media) technologies.

A digital application on its own cannot solve social problems. As discussed in chapter "Ageing Societies and Technological Innovation", the striving to "fix" social problems through technology, produces its own manifestations of these "problems" (e.g. old age as problem that needs to be fixed). Rather, a digital information service can only complement and inform about existing (neighbourhood) resources and/or support local service providers in their service provision. *Hence, the target audience of a digital information service, mainly includes those older adults who are also targeted by the resources it provides information about.* People in their Fourth Age (Laslett, 1987, 1991) can benefit from neighbourhood-related digital information services when *intermediaries* (such as family and service providers) are considered as well. For example in the case of Bremen, neighbourhood managers, as well as community managers and social care service providers can use digital information services in the communication with older adults. Apart from older adults as co-creators broadly representing the target audience, other *key partners* had to be involved in order to develop a service, which is comprehensive, sustainable and embedded in the neighbourhood.

The roles as depicted in Fig. 3 are partly overlapping. *Intermediaries* serve as *information brokers* and provide information about services, events and resources in digital or printed form to different groups of older adults. They may be professional neighbourhood managers, social workers in the field of elderly care or volunteers in community building, editors of community newsletters or city web portals, but also family members and acquaintances. In addition to older adults, intermediaries are the second target audience and user group of the services to be developed (as it should support their daily work). Considering the digital divide, they play an

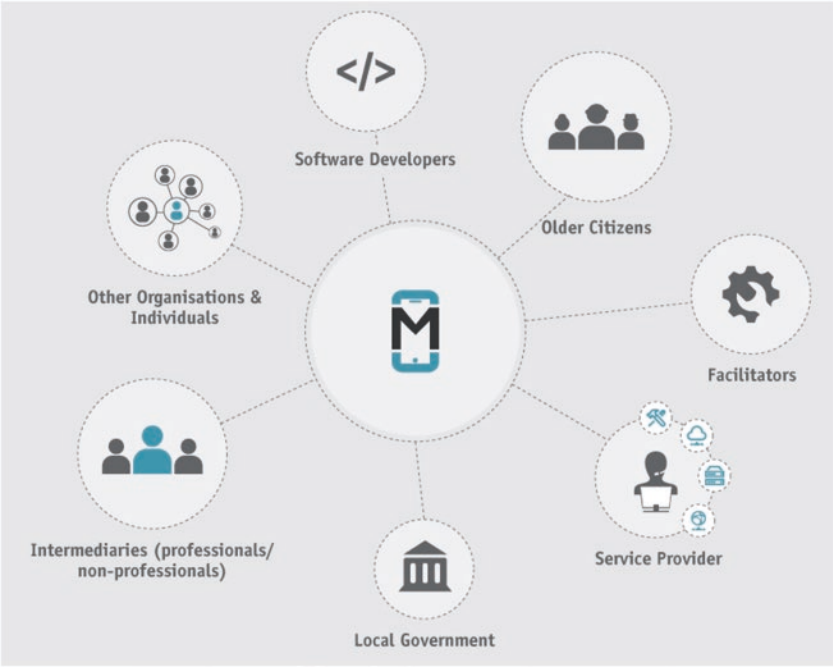


Fig. 3 Stakeholders in co-creation of open data-based public services

important role in making the content of a co-created digital service available to older citizens. It is hence important, that they provide input for specific tasks in the co-creation process.

Social care service providers are offering services to older adults in the neighbourhood. They include government units, utilities such as transport providers, social welfare organisations, religious congregations, NGOs, and commercial business (cafés, pharmacies etc.). They are the subject of the information service to be co-created. They may provide information about themselves and the details of their services and they have to agree to the publication of these data. In many cases, *local/ regional government* and *public administrations* will be initiating and managing the co-creation activities to provide financial resources, become the owner of the new service and maintain it.

A co-creation process needs *facilitators* as convenors and moderators. Facilitators in Mobile Age were either researchers (in Bremen) or experienced individuals in the work with older adults and/or groups (in Zaragoza). They supported the co-creation activities through, for example, running workshops, focus groups, and interviews. A digital service needs to be developed by *software developers***.** Developing a user-centred application may be undertaken by IT-departments of the local government (Zaragoza), research institutes (Bremen), commercial companies or civil society organisations such as the Open Knowledge Foundation.

Finally there are *other organisations & individuals* that have to be engaged in order to provide missing information, financial resources or support the use and outreach of the service, including for example senior citizens' organisations, senior citizens' clubs (e.g. computer clubs) but also media and journalists that may report about their co-creation activities and the service and politicians engaged on social policy and elderly care.

Key Resources: Information About the Neighbourhood

Overall, the problem focus and domains of interest in the Mobile Age project related to different domains for age-friendly cities and communities as proposed by the World Health Organisation (WHO). Between the pilot sites, we had an overlap of topics as Bremen and Zaragoza shared an interest in map-based services and the importance of local infrastructure for supporting ageing-in-place. These services related to digital information and communication services (and not transaction or integration) about existing neighbourhood resources.

Figure 4 depicts the interrelation of age-friendly neighbourhood resources and the personal resources of its older residents. There exists a plethora of information about the resources of a neighbourhood, however in order to participate in social life and use those resources, they need to be accessible to older adults. A digital service

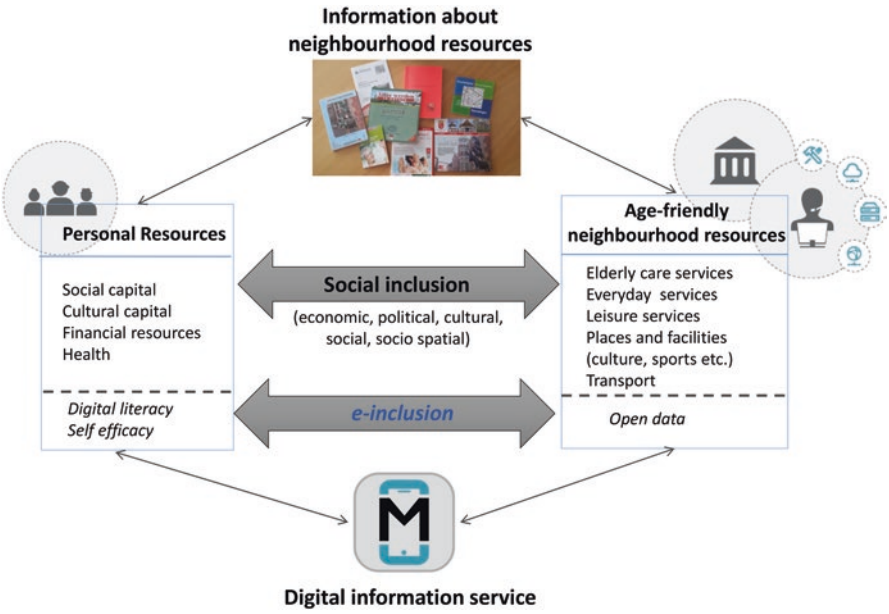


Fig. 4 Co-creation of a digital public information service as conducted in Bremen

may complement the information about these resources (but cannot substitute for them).

For engaging senior citizens to co-create a digital service that meets their needs and that offers gratifications to a larger group of older adults, *information about the resources in their immediate neighbourhood* has proven to be a good starting point. The co-creation process as conducted in Zaragoza also allowed for a communication service in that the citizens could propose changes to the built environment (addition grey arrows) (Fig. 5).

Problem Definition and Value Proposition

The *value proposition* summarises in a few sentences in which respect the planned service will solve a particular problem and in which respect it is better than existing services. In most cases, a service may provide benefits not only to older adults, but also relieve family members or caretakers and/or save the costs of service provision for local government or social welfare organisations. Therefore, it is important that for each target audience a value proposition is defined. The problem definitions and value propositions for each of the three co-creation projects are described in detail in the respective chapters.

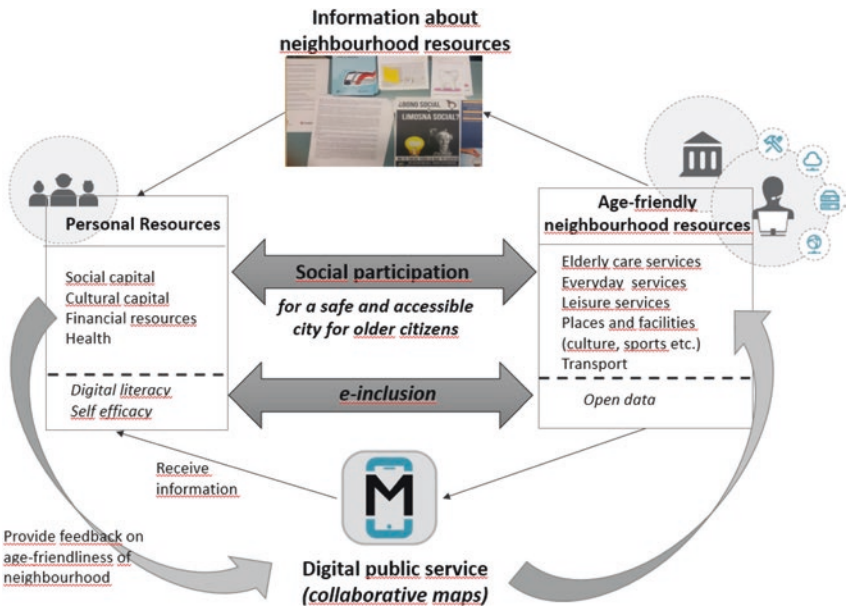


Fig. 5 Co-creation of digital public service allowing information and communication as conducted in Zaragoza

Solution: Output, Outcome and Sustainability
In Mobile Age, we defined the co-created services as "*solution*" to the co-created *problem definitions*. The "output" of the projects were a demonstrator app and the co-created data, the usage of the service is its "outcome" in quantitative and qualitative terms (e.g. number of users and immediate benefits). Depending on who provides the service, quite different outcomes are to be expected. For example, in Zaragoza the map-based service was part of the local government's online service portal from the beginning and was continued after the project without any interruption or modification. In contrast, in Bremen, the map-based district guides were developed by the Mobile Age technical partner FTB on their own server and were—after several months of pilot operation—migrated to the city's information portal featuring the same data, similar functionality and look & feel. A more detailed account on the output and outcome of the each of the co-creation projects is provided in the subsequent chapters.

Expected Impact
The usage of the new digital public services is an important aim in itself but in the context of public services at the same time a means to achieve more general social policy objectives such as social participation or age-friendly environments. These kinds of impacts are difficult to assess but an important argument for local governments to invest in the co-creation such digital services. However, it is possible to collect assessments by different *key partners* involved in the respective fields of elderly care and social work as well as local government. This assessment is provided for each of the three co-creation projects in the subsequent chapters.

Key Activities: Adopting Methods for Co-creation with Older Adults

In Mobile Age, we identified a number of streams of activity that need to be considered for the co-creation of digital public services. These streams of activity are not sequential but run in parallel and inform each other.

- The first stream of activity concerns the *governing and managing of a co-creation process*. This includes the exploring and scoping of the project, the planning of resources as well as considerations about ethics.
- The second stream of activity covers the *continuous recruitment and engagement of stakeholders* throughout the co-creation process.
- The third stream concerns the *co-creation of a service concept*. This includes the development of ideas about the service to be co-created based on the needs and requirements of older citizens and intermediaries, the definition of a (rough) service concept and the subsequent refinement of this concept. This is based on approaches to *co-producing public services*.

- The fourth stream is concerned with (*open*) *data*. It includes the identification of existing and missing data, the collection, validation and quality checking of data, the creation and integration of open data as well as the editing of data and information. This is grounded in work on *civic open data use*.
- The fifth stream is concerned with the *co-creation of software*. This includes the identification of desired functionalities, prototyping and user testing and is based in approaches to *co-design*.
- The sixth stream of activity concerns *evaluating the co-creation process and its results*. This is a continuous activity throughout the whole process and includes formative as well summative evaluation.
- In addition, a co-creation process needs to include activities pertaining to *exploitation and dissemination*. Finally, the *service provision* needs to be considered.

These streams of activity need to facilitate the sharing of knowledge and control amongst participants and across participants and facilitators as well as enable opportunities for individual and social change. In the co-design literature, there exists a manifold of research papers and studies presenting tools and methods to involve users through e.g. *cultural probes* (e.g. Boehner, Vertesi, Sengers, & Dourish, 2007; Jarke & Maaß, 2018); *personas and scenario-based design* (e.g. Alexander & Maiden, 2004; Carroll, 2000; Neate, Bourazeri, Roper, Stumpf, & Wilson, 2019) or *walks* (e.g. Hunter, 2018; Kanstrup, Bertelsen, & Østergaard Madsen, 2014). However, there is only limited experience in the adaptation of these methods for digital public service design, which comes with its specific requirements in terms of scalability, accountability and sustainability.

One of the most common ways of eliciting users' expertise in co-production as well as co-design projects are workshops in which teams of researchers, service providers, future users and other stakeholders come together to identify challenges and develop new ideas. Depending on the design context and the quality of user participation, the interpretative weight of the design team differs. For example, Bødker, Grønbæk, and Kyng (2012) doubt whether personas are helpful in designing public services because those defining the personas cannot really comprehend and represent the heterogeneity of the target population and future users. This is in line with reports that in the case of user participation in government services, government officials doubt the relation between user participation and later acceptance because nobody can tell to which extent the people who are interested to participate represent the target user group of a service (Gidlund, 2012). Overall, there are three challenges to user participation in digital public service design, that need to be considered: (1) the target user (segments) need to be identified clearly; (2) the modes of participation need to be in line with democratic goals and (3) if citizens lack sufficient ability and skills the successful outcome may be endangered (Karlsson, Holgersson, Söderström, & Hedström, 2012).

Each of the phases in a co-creation process has its own conditions; they each require different types of methods. Figure 6 provides an overview about the four distinct stages of co-creating a digital public service (as described in Fig. 1): its planning, its design (defining the problem and developing a solution) and its

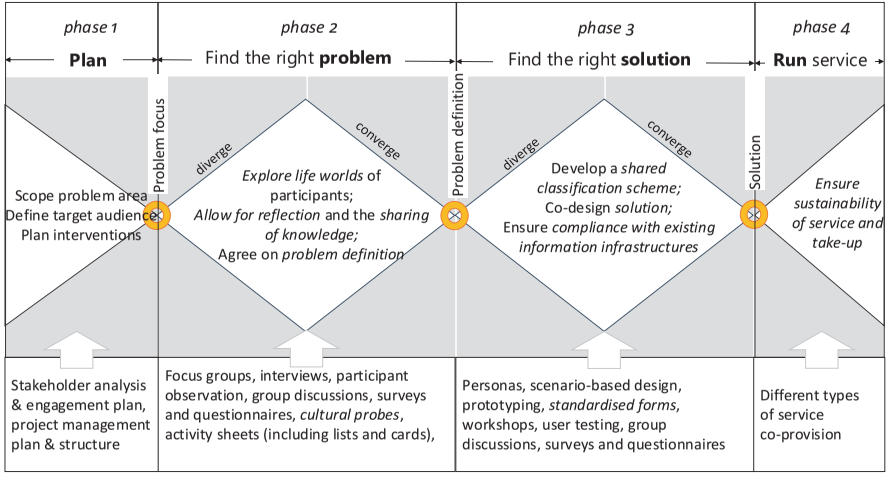


Fig. 6 Overview of different objectives per co-creation stage and potential methods to achieve those goals

provision. The figure lists some indicative methods for each of the phases and related objectives. A detailed description of each of the methods can be found in the interactive guidebook we developed after the finalisation of the Mobile Age project.[2]

The abstract concepts of use and user as promoted in many participatory projects, encourage particular practices while discouraging others (Gidlund, 2012, p. 18). It is hence important to consider how different methods produce different subject-positions of citizens as co-creators. Interviews, focus groups, prototyping or user testing are well-known methods in design projects and power relations have been well-covered (e.g. Carroll, 2000; Carroll & Rosson, 2007; Neate et al., 2019; Oates, 2006; Sanders & Stappers, 2008; Simonsen & Robertson, 2013). In the following, attention is paid to methods that are less known for their use in co-creation settings and it is explored how they can be adapted to contribute to the objectives described above in Fig. 6:

- *Probes* as method for
  - exploring life worlds of participants;
  - allowing for reflection and the sharing of knowledge;
  - developing a shared problem definition.
- *Standardised forms* as method for
  - developing shared classification schemes;
  - co-designing solutions.
- *Data walks* as method for
  - exploring life worlds of participants;
  - allowing for reflection and the sharing of knowledge;
  - developing a shared problem definition;
  - developing shared classification schemes;
  - co-designing solutions.

The focus is on phases 2 (find the right problem) and 3 (find the right solution). Probes, standardised forms and data walks are introduced below and their application in Mobile Age described in the respective chapters reporting from our co-creation projects in Bremen Osterholz (probes and standardised forms), Bremen Hemelingen and Zaragoza (walks and standardised forms). In chapter "Learning from Co-Creation Practice", the methods are analysed and discussed across the three co-creation projects, considering their suitability for facilitating the sharing of power, the sharing of expertise and the enabling of individual and social change in co-creation with older adults.

[2] https://co-creation.mobile-age.eu/.

Probes[3]

Probes were originally conceived by a group of researchers/designers within an EU-funded project to engage older adults in user-centred design (Gaver, Dunne, & Pacenti, 1999): The cultural probes—a pack of maps, postcards, a camera, a photo album and media diary—"were designed to provoke inspirational responses from elderly people in diverse communities" (p. 22). Gaver et al. conceived of probes as something like astronomic or surgical probes, which are left behind when researchers leave and over time return fragmentary data. The probes were part of an experimental design, in which a group of researchers wanted to explore new ways for designing technology for unfamiliar user groups.

> Understanding the local cultures was necessary so that our designs wouldn't seem irrelevant or arrogant, but we didn't want the groups to constrain our designs unduly by focusing on needs or desires they already understood (Gaver et al., 1999, p. 22).

In contrast to scientific probes, cultural probes were meant to be a source for inspiration, not information. The approach aims to be a resource for surprise and creativity.

In subsequent years, probes became widely adopted in user-centred and participatory design and were amended to include concepts such as "design probes" (Mattelmäki, 2006), "technology probes" (Hutchinson et al., 2003), "mobile probes" (Hulkko, Mattelmäki, Virtanen, & Keinonen, 2004) or "digital probes" (Koch & Maaß, 2018). For Boehner, Gaver, and Boucher (2012); Boehner et al. (2007) probes are different from other social research methods as they embrace uncertainty and ambiguity and therefore invite interpretations by designers and participants:

> They [probes] aim to open up possibilities, rather than converging towards singular truths, and can be understood as part of a conversation among designers and the people and places for which they design (Boehner et al., 2012, p. 185).

One way in which probes came to be appropriated was as a tool for data collection. Most studies, as Boehner et al. (2007) point out in their review, adopt probes as part of their initial investigation for understanding a particular use context. Often they are coupled with interviews and at times supplement ethnographic approaches. Some studies integrate probes in participatory design exercises; for example, similar to our approach in Mobile Age, Maaß and Buchmüller (2018) discuss the probe returns with participants. Hence across different use contexts, probes are either used to understand current use situations or for ideation and prototyping (Jarke & Maaß, 2018).

Some studies take the participatory aspects of probes further and insist that participants should also be involved in the translation of the probes into design ideas (Boehner et al., 2007, p. 1079). Others see probes as a possibility to allow participants to reflect on their own practices and to express these reflections (Boehner et al., 2007; Vetere, Davis, Gibbs, Francis, & Howard, 2006, p. 1477). Participants decide and control what information they record and share, and in so doing secure their privacy.

[3] This section is part of an article published by Ulrike Gerhard and myself (Jarke & Gerhard, 2018).

Importantly are probes not an alternative formal or objective method for simply "getting data" but rather "frame an alternative account of knowledge production in HCI design" (Boehner et al., 2007, p. 1078). In their review of how HCI researchers have appropriated probes, Boehner et al. (2007) suggest that there has been a shift in the definition and interpretation of probes from response to representation: "from seeing interpretation as a researcher responding to what was expressed by the researched to seeing interpretation as a researcher ascertaining facts about the research" (p. 1082). The idea of *interpretation as response* understands the process as dialogical in the sense that researchers articulate their research questions and instruments, which are interpreted by the participants. The participants in turn respond by expressing their interpretations; researchers respond by expressing their interpretations through potential design ideas. There is never an attempt to "fix the true meaning of any particular response". In contrast, the idea of *interpretation as representation* aims to "fix the true meaning of what users said, who they are, what they do, and what they need" (p. 1083). Boehner et al. (2007) criticise that "a major focus of probes' uptake in HCI has been to use probe returns to develop objective, factual descriptions of user needs" (ibid).

In the context of co-creation, I want to propose a different understanding of the role of interpretation when using probes. Probes as boundary objects that enable/facilitate the articulation of users' tacit knowing and the shared interpretation of their accounts. Others have pointed to the ability of probes to act as "boundary objects" (e.g. Bjögvinsson, Ehn, & Hillgren, 2012; Ehn, 2008). What is of particular interest for this book are the ways in which probes allow for collaboration and sharing of knowledge across social worlds and facilitate the ways in which expertise is being negotiated and made accessible across communities of practice.

Standardised Forms

While probes may serve as boundary objects for sharing expertise and knowledge, standardised forms are more structured boundary objects that facilitate other dimensions in co-creation processes. Standardised forms (along with methods and procedures which enforce normative practices across knowledge boundaries) provide a shared format for solving problems. They are one way to attend to the challenges posed by co-creating shared classifications and developing solutions. These objects can circulate easily and provide a standardised way of collecting information (Star & Griesemer, 1989). What is hence required are interventions that allow for the development and use of standardised forms in order to complement open methods such as probes. Standardised forms are for examples tables or templates in which data (and information) are collected. Within co-creation the structure of these tables or templates—the types of objects and their attributes—should be co-developed by citizens and reflect their life worlds.

Data Walks[4]

Walking is a human activity, engrained in urban and rural culture. It is also becoming a prominent method in projects related to co-design and critical data studies

[4] This section is part of an article published by myself in (Jarke, 2019).

(Wieringa & van Es, 2018) as well as participatory design (Kanstrup et al., 2014). What makes walks an interesting and appealing tool for engaging older citizens (critically) with data is their embeddedness in everyday urban life. Data walks have been proposed and conducted in a number of projects aiming to engage with data and putting an 'emphasis on the everyday experience of data' (Wieringa & van Es, 2018) as well as the relationality of design (Kanstrup et al., 2014).

Wieringa and van Es (2018) have mapped a number of different formats each comprising of different set-ups and goals. For example Greenfield and Kim (2011) set out to raise awareness/literacy on "networked urbanism" among citizens. Van Zoonen, Hirzalla, Engelbert, Zuijderwijk, and Schokker (2017) took city employees on walks through their own smart city. While Greenfield and Kim only delimited an area on a map, Van Zoonen et al. defined the routes beforehand. The focus of their walks was "identifying big data in the city and connecting it to political and ethical issues" (Wieringa & van Es, 2018). In so doing, Van Zoonen et al. not only raised awareness on data issues amongst civil servants, they also learned about the knowledge and beliefs of their participants with respect to the datafication of their city. Building on Greenfield and Kim, Powell (2018) experimented with different forms of data walks: initially to teach students about big data related to urban issues, later to create "bottom-up knowledge". In her walks, participants assumed different roles from note-taker to photographers. Yet another format of data walks was conducted by Hunter (2018), who did not only want to raise awareness amongst participants but also collect environmental data on specific areas and built multi-layered "dataspaces". Table 1 provides an overview on these different types of walks.

In sum, one question that civic open data approaches such as data walks allow to ask is what kind of (digital) information are relevant and useful to (a variety of) older adults and what kinds of data, data visualisations and data processing (e.g. filtering, searching) are required in order to provide information about neighbourhoods. These are questions that relate to the ways in which information about neighbourhoods are being classified and presented in e.g. pocket guides, catalogues or leaflets.

Summary

Probes, standardised forms and walks are methods that were developed in specific participation approaches: cultural probes are derived from design research, standardised forms from knowledge management research and different types of walks are deployed in various forms of civic open data use. The next three chapters describe in detail how we conducted our three co-creation projects and how these methods were amended to suit our co-creation needs. The chapters feature all the other methods we adopted such as interviews, focus groups, questionnaires, card games, co-design workshops, paper and digital prototyping, and user tests. In chapter "Learning from Co-Creation Practice", these methods are analysed and discussed with respect to enabling us to share control and knowledge with and amongst different groups of co-creators, and ultimately facilitating individual and social change.

Table 1 Inventory of different data walks (excerpt from Wieringa & van Es, 2018)

	Greenfield and Kim (2011)	Powell (2018)	Van Zoonen et al. (2017)	Hunter (2018)
Goals	Raising awareness/ literacy on 'networked urbanism'	Originally teaching tool against celebratory rhetoric. Now raising awareness and 'creating bottom-up knowledge'	Gaining insight into civil servants' ideas and beliefs about datafication and 'strengthening their critical interrogative attitude'	Examining tools and technology for data collection, and experimenting with data visualization
Number of participants per walk	15	5 per team (max. 15)	4–6	–
Role of participants	Photographer	Navigator	Participants	Data creator
	Map-maker	Photographer	Participant observers	
	Note-taker	Map-maker		
		Note-taker		
		Collector		
Duration of walk	90 min	60 min	60 min	Different lengths
Duration of event	Half a day	Half a day	60 min	Different lengths, from 3 days–45 min
Event makeup	Walk-discussion	Briefing—walk critical making	Walk-debriefing	Preparation—walk—visualisation
Outcome	Documentation of walkshop and online follow-up with other walks (e.g. through hashtag)	Direct participants attention to matters of concern such as surveillance, ethics, urban design	Discover visible and invisible urban data infrastructure	Visualisations of walks

Co-creation in Practice I: Co-creating a Digital Neighbourhood Guide (Bremen Osterholz)

Summary of Co-creation Project[1]

Problem Focus

The broad problem focus of this case study is on social inclusion of older adults as indicated in the previous chapter. For this, neighbourhoods play a very important role. Social connections, cultural participation, support, infrastructure (i.e. shopping opportunities, doctors) as well as opportunities for outdoor activities are crucial for the well-being not only of older adults but all citizens. However, even if these resources exist in a neighbourhood they need to be findable and accessible. In this co-creation project, we identified a gap between existing resources that can facilitate older adults' social inclusion in the neighbourhood on the one hand and the knowledge and awareness about these resources on the other hand.

Value Proposition

Enabling older adults to remain in their communities and neighbourhoods allows them the opportunity to connect and interact with other locals and to be part of a network of people looking after each other. The value proposed in this co-creation project is to better inform older adults about resources that facilitate their everyday lives and thereby help them to stay independent, socially included, active and healthy. An easy to find and usable digital district guide can support this because it is comprehensive and up-to-date. In addition, such a service can also support the work of intermediaries working with older adults in that their services are easier to find. Through the co-creation process, we identified that a comprehensive informa-

[1] This introduction is derived from the case study of our Interactive co-creation guide: https://co-creation.mobile-age.eu/guidebook/case-studies/bremenosterholz.

This chapter is based on the Mobile Age project deliverable D3.2 Senior Citizen Engagement Report Bremen: https://mobile-age.eu/images/pdf/deliverables/WP3/D3.2.pdf.

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_5

tion service of all institutions as well as nice outdoor places will facilitate outdoor activities and represent the district in a positive and welcoming way.

Limitations of Existing Services

There are several services that support community building and location-based neighbourhood information. In any district office, one can find dozens of flyers of a broad range of services for older adults provided by government units, welfare organisations and other NGOs. Departments of elderly care issue catalogues with information about relevant institutions and services, and there exist different kinds of district or neighbourhood guides, some with more commercial background (where to shop and spend money); others with a focus on social support. However, the advantages of e.g. searchability and findability at the same time proof disadvantageous as they require particular mental skills and digital literacy compared to using print media. And of course there is a need for technical devices and infrastructure which require additional technical skills and investment.

Field Site

The co-creation project was conducted in the city district Bremen Osterholz. The district is located in a suburban area and consists of six neighbourhoods, some of which were separate villages in the middle ages. The neighbourhoods differ very much with respect to the social status of their residents as well as infrastructure and architecture. Whereas some neighbourhoods are known as socially deprived and have high unemployment rates and a high share of people with migration background, others can be characterised as well-off middle-class neighbourhoods. The image of the district in the rest of the city however is characterised through its reputation as socially problematic. It is the wish of many residents that this bad image is improved.

Co-created Service

The result was a digital district guide for older adults that provides information on all points of interest in the district relevant for senior inhabitants. It includes 17 nice places and 75 organisations relevant for senior citizens. It is integrated in the official online portal of the city of Bremen[2] and is maintained there after the project terminated. The content of the digital district guide, has also been printed in a brochure featuring the textual and visual descriptions of the 17 nice places in the district. The booklet is distributed via the local government, local social care service providers and reaches out to older adults who do not use digital devices.

[2] www.bremen.de/osterholz/senioren.

Introduction to Field Site

We conducted our pilot co-creation project in Bremen's district Osterholz. Following our strategy to collaborate with relevant local stakeholders, we selected Osterholz as our field site because it was the only district with a voluntary but officially acknowledged online service provided through older residents and volunteers (BORIS).[3]

Osterholz is a district in the East of the Free Hanseatic City of Bremen with 37,554 inhabitants.[4] In 2015, 22% of the population (8590) were 65 years or older. This is similar to overall Bremen. By 2020, the number of older adults is expected to increase from 8389 to 9048. While a decline is projected amongst the 65 to 80 year olds, the number of persons over 80 is expected to increase. Of the current 8590 residents who are 65 years or older living in Osterholz, almost 3000 live alone, the biggest share being women (2124). Most older citizens (4330) live in two-person households. Almost 50% of the people living in Osterholz (18,702) have a migration background while Bremen overall has only 15%. Amongst the older citizens in Osterholz (65 and above), the share of people with migration background is 23%. The unemployment rate is 14.9%, which is slightly higher than the Bremen average. The district has its own local government (Ortsamt) and elected district council (Ortsbeirat) and consists of six neighbourhoods (Ortsteile), some of which were separate villages in the middle ages (Table 1).

Osterholz is characterised by six very diverse neighbourhoods that give the district its multifaceted character. Tenever is mainly known for its high percentage of inhabitants with migration background and was for a long time presented as socially troubled area with big apartment building complexes. While social problems are still concentrated in Tenever, social and constructional investments have changed its image to a showcase for social urban development and peaceful multicultural coexistence. Neighbourhoods such as Ellener Feld or Osterholz feature a very different scenery with detached houses and different socioeconomic structures. Due to its comprehensive provision of care residences, Ellener Feld is the neighbourhood with the highest proportion of pensioners. The neighbourhoods are important points of reference for the identity (Fig. 1).

Table 1 Overview Bremen Osterholz

The neighbourhoods	Size	Number of inhabitants
Ellener feld	161,4 ha	3.280
Ellenerbrok/Schevemoor	219,5 ha	11.927
Tenever	254,8 ha	10.247
Osterholz	537,8 ha	5.246
Blockdiek	116,0 ha	6.888
The total district of Osterholz	1.289,4 ha	37.588

[3] http://www.bremen.de/stadtteilredaktion-boris-osterholz-1896518 BORIS stands for Citizen Online Editorial Office in the District.

[4] Source: http://www.statistik-bremen.de.

Fig. 1 Impressions from the different neighbourhoods in Bremen Osterholz

Three of the district's neighbourhoods of are officially recognised as deprived areas with a neighbourhood manager employed by the office of social affairs and paid from federal funds.

Co-creation Process

Governing and Managing Co-creation

The initial and broad problem focus of our first co-creation project was on social inclusion of older adults for which neighbourhood play a very important role. Social connections, cultural participation, support, infrastructure (i.e. shopping opportunities, doctors) as well as opportunities for outdoor activities are crucial for the well-being of older citizens. However, even if these resources exist in a neighbourhood they need to be findable and accessible to a broad range of older adults. Through the co-creation process, we identified a gap between existing resources that can support older adults' social inclusion in the neighbourhood on the one hand and the knowledge and awareness about these resources on the other hand. A gap that is partly caused by the different ways of classifying information.

At the beginning of our process, it was not obvious which information about resources in a neighbourhood are most relevant to older adults, which information are available and how it should be depicted. For our planning, we referred to the eight dimensions of age-friendly cities and communities as proposed by the WHO. For each dimension, the report defines several action areas and objectives. With respect to social inclusion, a number may be relevant such as places to be and stay outdoors, infrastructures for active mobility and walkability.

As shown in Fig. 4 of chapter "Mobile Age: Co-creating Digital Public Services with and for Older Citizens" there exists already a variety of printed material about resources for Third Agers in this district. They each provide information in different formats and different degrees of detail. Most of them have been compiled and designed for senior adults but not with them. The way information is assembled usually represents a categorisation that makes most sense for those publishing the information (as part of their information infrastructure).

The benchmark in our view was a printed district guide for senior citizens, co-produced with service providers and senior citizens by a small design and media agency from Bremen. Since 2011, they develop map-based district guides in a pocket format. Until the start of our project, district guides for nine of the 16 districts of Bremen were produced.[5] The map design is optimised for older adults and the collection of points of interest conducted in a participatory process. The media company secured funds from district boards and neighbourhood development funds and established project groups of intermediaries that worked with different groups of older adults in each of the districts. The members of the project group conducted focus groups with a structured interview guide in order to identify relevant services and nice places, including comments on what was nice about them.

However, the small pocket guide for each service and place could present only minimal information. For Osterholz such a map did not exist. At the start of our project, we contacted the editor of the media company to explore whether she would be interested in collaborating: She supported the collection of information about points of interest in Osterholz and we used this information as input for a multimedia digital guide that would include additional information according to the needs of our own co-creator group.

To summarise: There were different district guides and readers covering different kinds of resources of the district in different formats and taking the particular needs of senior citizens into account to different degrees. The co-created pocket guides ranked high on comprehensiveness and relevance but low on information richness. The digital city portal bremen.online provided a high degree of information richness but was not particular well-organised for a district and not optimised for the target audiences of Third Agers and intermediaries.

Project Organisation/Governance

While in Zaragoza, a government unit initiated and coordinated a co-creation process for a government service, in the case of Bremen a team of researcher of the Institute for Information Management Bremen (ifib) at the University of Bremen acted as initiator, coordinator and facilitator. The governance model chosen was not a two layer model with a project group of intermediaries and groups of older adults as information suppliers. Rather we wanted to have older adults as the main contributors and decision makers of the process. Therefore, we decided to establish a permanent group of eight to twelve Third Agers who would contribute to the whole

[5] http://editionaxent.de/Stadtteilplaene/planefuraltere.html.

process, including idea generation and developing of the service concept to software and data design to the implementation and maintenance of the service.

In our co-creation project, the role of software developers was assumed by the Mobile Age project partner FTB, responsible for developing a demonstrator; the final service provider was bremen.online, the city's information provider.

Engaging Stakeholder: Establishing Older Adults as Expert Co-creators

The initial tasks for the activities relating to the engagement of stakeholders were the setting-up of a core project group, and to recruit *older citizens*. Recruiting people for a co-creation process, lasting about half a year, with open objectives and tasks unfamiliar to most was a great challenge. We had to provide a notion of the project's objective and what people would commit themselves to, what kind of input, in particular what kind of knowledge and lived experience, we would like them to contribute. As these issues are difficult to communicate clearly, for the information event and the kick-off meeting we were looking for a venue which was easy to reach for people in the district and a host that was trustworthy. We asked the head of the local district council and he agreed to open the assembly room and welcomed participants at both meetings.

All participants received a participant information sheet. Recruitment activities must consider the context in which they address older citizens as potential co-creators. "Cold recruiting", e.g. on fairs, markets etc. did not work well, as one intervention showed. Recruitment may be effective when starting from already existing groups and aligning with their interests (e.g. older citizens' computer clubs, local history clubs). Nevertheless, there is a tension between recruiting for well-targeted and well-framed activities, and simultaneously keeping the co-creation process open.

A number of *local/regional government* partners participated in the co-creation process. They were mainly involved in order to identify local stakeholders, support our recruitment and provide data about the district (Table 2).

In addition, we collaborated with social welfare organisations and other *social service providers* to older adults in order to gain support for the recruitment of older adults and to acquire information about the district. Some service providers supported our data collection process by conducting focus groups with older adults.

- Representatives from two different Christian congregations and one social service centre supported our recruitment process and also conducted focus groups with older adults in the district in order to collect data. We also conducted interviews with them on the role such a digital district guide may play for older adults.
- Further support for recruitment and insights into the district came from a representative from the centre for migrants and intercultural studies as well as representatives from two social welfare organisations.

Table 2 Key partners in co-creation project Bremen Osterholz

Local actors	Role and tasks during co-creation process	Type and frequency of interaction
Head of local district council	Supported our recruitment of older adults, provided us insights about the district and its people, allowed us to use his facilities as meeting venue	Initially and at the end of our co-creation activities we conducted interviews with him, he participated in a number of workshops and he also reviewed the collected data
Neighbourhood managers	Employed by the city who are responsible for the three most vulnerable parts of the district, served as a link to the district about which they are very knowledgeable, supported our recruitment and provided a set of data about institutions etc.	Initially and at the end of our co/creation activities, we conducted interviews with them. We collaborated on a printed version of their neighbourhood reader (which also served as a data source for us). The neighbourhood managers all performed quality checks on the co-created data. Furthermore, the neighbourhood managers support a printed version of the district guide financially
Department for Elderly Care in the State Ministry of Social Affairs	Provided data on public services (e.g. service centres, different forms of living) and further relevant data on the district	We held a number of coordination meetings and communicated via email
City information provider	Editorial staff helped us to identify local stakeholders. They also provided us with existing data about the district and committed to take-over the developed online district guide at the end of the project	We held regular meetings and were in continuous correspondence about the validation and creation of data (to be integrated into their system)

- A team of people running a senior citizen online web blog (BORIS) supported us in the recruitment and also with editorial work (data verification, text writing). We held regular meetings and some members also participated in our workshops.
- The editor of printed district maps for older citizens supported the data collection by providing us a template for collecting information on points of interest. We collaborated on data collection in 13 focus groups.
- The Council on Elderly People provided us the opportunity to present the project to all relevant stakeholders/intermediaries in the district and instigate cooperations.

Engaging stakeholders in the process and recruiting 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 a core group of older adults was mainly conducted via newspaper articles, were 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.

For the main part of the co-creation process (June 2016 until March 2017), a core-group of 11 older adults participated in Bremen Osterholz. The group consisted of seven females and five males aged 55–80.[6] They were comparably well educated, physically and psychologically healthy and all lived independently. Most of the Bremen participants (5) lived in partnerships. Two lived with a family (including teenage children) and four participants lived on their own. None lived in an institutional setting. 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. With regard to social inclusion they can be considered as quite well included. Most participants were quite mobile.

In addition, through our collaboration with the design team around the printed district map and their engagement with different existing senior citizen groups (e.g. men's breakfast, pottery groups) to collect information about relevant places and institutions, twelve groups with a total of more than 80 female and male participants were interviewed. The design team included two social workers working within two church congregations, one neighbourhood manager and one member of the Mobile Age research team.

Overall, the strong involvement of the local government has been fruitful for recruitment in the district because it is a small and intimate district, where people know and trust the local administration and certain local champions. One aspect to be considered though is who had *not* been attracted by this strategy, which might influence their positive attitude towards the (local) government authorities.

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. We choose to develop a card game in order to (1) learn about the district, (2) facilitate the communication between participants and (3) 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 other residents. For the *kick-off workshop* we prepared a proper card game (with pictures)

[6] One of the five male participants left the project early on (after the cultural probes) whereas one of the female participants joined later (in September). In between, we had another male and female participant that attended a few workshops. We have not considered them in our overview, as we did not interview them separately. Overall, we had a stable group number of about 11 participants throughout the process.

Fig. 2 Card game as developed at information event 23/05/16

Fig. 3 Card game as further refined and played at neigh-bourhood festival and kick-off workshop (blue and green dots signify relevance)

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. The two steps of this card game are depicted in Figs. 2 and 3.

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 was motivating as the focus was on the district, not on technology.

As stated in our co-creation framework, it was important to establish the participants as experts (of the process of ageing in the neighbourhood) and to appreciate

their local knowledge. It was important to establish this role as early on in the process as possible. The card game offered a first interaction to establish this relationship early on.

Co-creating a Service Concept: Probes as Tool for Sharing Tacit Knowing and Co-creating Scenarios[7]

The initial tasks for 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 the thematic space of the service was;
- What service domain we developed a service for;
- Who the target user group was and what other stakeholders were relevant.

The service to be developed in our co-creation process needs to be better than the existing ones in several respects:

Comprehensive and relevant information supporting the planning of activities (accessibility of buildings and routes, information about toilets and benches): The points of interests had been proposed by members of the target audience and included nice places, outdoor and indoor offers for recreation, where older adults can meet others in their district as well as information about local organisations, offering advice on different matters of everyday life. For different kinds of points of interest (objects) different sets of qualifying information (attributes) according to the information needs of older adults are provided.

Usable and accessible technical design for older adults; Relevant and up-to-date information facilitating social participation of older people in the district of Bremen Osterholz. Information may be searched via a map that is optimised for older people and via listings. All information is provided by a responsive application, which can be accessed from desktop PCs, tablets and Smartphones, with particular emphasis on accessibility.

In addition, the service *needs to be based on open data* (up to date, accessible via API, machine readable) and co-created data, relevant to the citizens' needs. If the service is linked to open data, the respective data providers are responsible for updates and the service provider is relieved from this job. Looking for and linking to available open data therefore is another part of the co-creation process. Where no open data is available to meet the information needs, data has to be collected and edited within the co-creation process.

[7] This section is part of a paper published by Jarke and Gerhard (2018) as part of a special issue on Probes as Participatory Design Practice (Jarke & Maaß, 2018).

Adopting Probes for Co-creation 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 the participants, there was a need to explore and jointly learn about their everyday lives in a more structured way. For this reason, we developed a set of 'cultural probes' (Boehner, Gaver, & Boucher, 2012; Gaver, Dunne, & Pacenti, 1999; Jarke & Maaß, 2018) which are self-documentation materials.

In contrast to more traditional approaches to probes which are used in user-centred design (Sanders & Stappers, 2008), 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 requirements 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 (1) to jointly reflect on the probes activity and experience, and (2) to identify some key characteristics that defined their everyday practices in the district.

For the participants the probes raised their awareness of everyday practices and practices related to ageing in the district. The probes 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.

In the following, I present the way in which we used probes in Bremen. I will demonstrate how they allowed us to explore and learn about the everyday lives of older adults in Osterholz in a structured and reflective way, but also to establish participants as experts of their district and ageing in this place. In particular, I analyse to what extent the probes served as "boundary objects" (e.g. Bjögvinsson, Ehn, & Hillgren, 2012; Ehn, 2008) among users and between users and researchers, and how they facilitated individual and communal perspective making and perspective taking.

The set of probes we developed for Bremen Osterholz included maps, a diary, postcards and a disposable camera (Fig. 4).[8] The participants kept the cultural 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 material.

In a subsequent workshop, the participants jointly reflected on the activity and their experience (Fig. 5). The aim was to define some key characteristics that would serve to develop personas. In the Appendix to this book, I provide an overview table of the probes that were developed for the field site in Bremen Osterholz.

[8] For a detailed description of the probes used in Bremen Osterholz, please see the appendix of this book.

Fig. 4 Overview of probes pack in Osterholz

Fig. 5 Participants discussing their maps and post cards

When participants compared the individual maps, they discussed what they believed to be differences that would eventually allow for the development of different personas. Some of the key differences where: biographical (on whether somebody just recently moved to Osterholz), related to retirement/employment, living circumstances (alone vs. partnership vs. caring for partner) related to mobility and health, related to the financial situation and how active people were in terms of charity work and hobbies. All these considerations were documented and informed the subsequent development of personas.

Mapping Socio-Spatial Networks: Explicating Perspectives and Demarcating Areas

One probe we gave to participants was a map of the district (Fig. 6). The main aim of this probe was to understand social inclusion with respect to primary networks and space. Participants were asked to mark where they live (red dot), where friends and family live (blue dots), where important places for their everyday are (yellow dots). In addition, participants were asked to highlight areas they particularly like in green, and areas they dislike in pink.

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, and clubs). We were also interested in learning which social networks the participants were part of and where they meet.

Fig. 6 Probe—district map

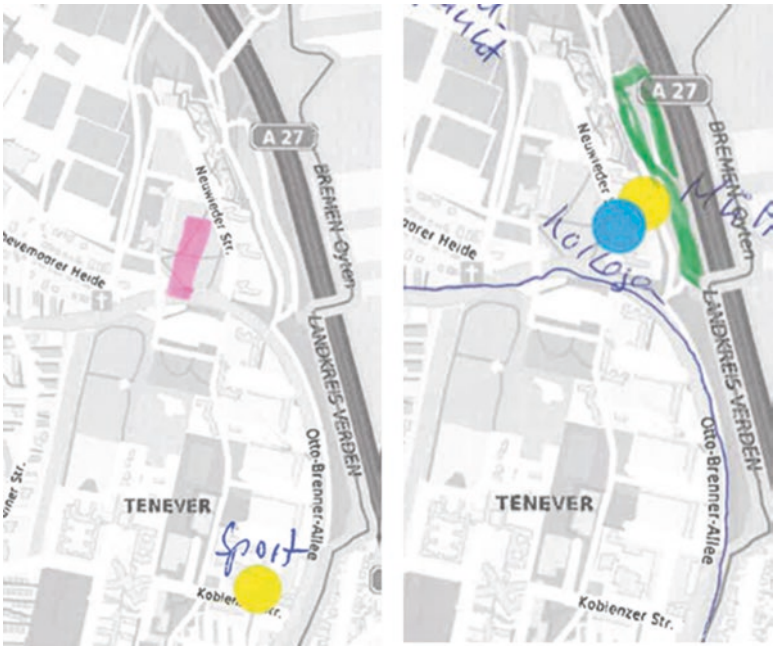


Fig. 7 Cutout of map s from participant 5 (left) and participant 10 right

The returned maps differed greatly with respect to the extent of their networks and the mobility patterns. The maps were supplemented with diaries and a set of seven maps in which participants documented their mobility patterns for a week. Not surprisingly, we found in the analysis of the district map that the participants' social networks were very much centred around their respective neighbourhoods. Since the participants lived in very different neighbourhoods their social interactions took place in different areas of the district. Preferences for certain areas as well as aversion regarding others also differed with regard to their primary networks.

Below are cut-outs from the maps of two participants (Fig. 7). They both comprise of the same area. Yet, whereas participant 5 has highlighted an area in pink (signaling that this is an area she does not like), participant 10 marked the area with a blue and yellow dot (important places) and highlighted an area close-by in green (areas participants like). In the interview, participant 10 explained that this is where she walks her dog. Again, the participants lived in different neighbourhoods and hence had very different mobility patterns and social relations in and to the area.

Later on, such conflicting perspectives became a rich resource for discussion, when determining which places would be included as "nice places" in our district guide.

Another difference in marking locations on the map was based on the different practices of people and what associations they had with particular places. For example, while a number of participants (e.g. participants 3 and 7) marked the big cemetery as an area in which they liked to spend time, participant 5 only marked it as place she routinely visits because of the graves she has to attend to (Fig. 8). The

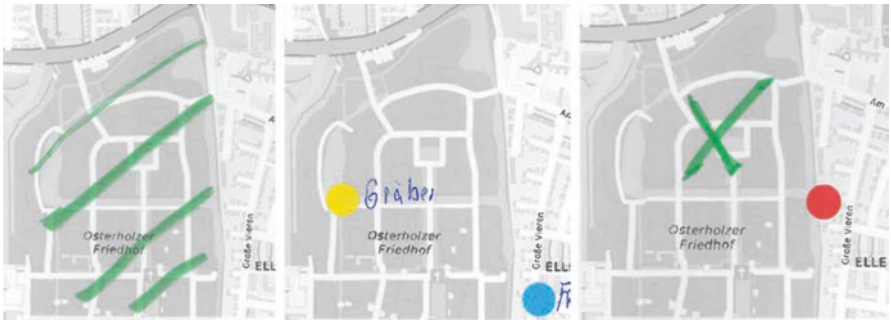


Fig. 8 Cutout of maps from participant 7 (left), participant 5 (middle) and participant 3 (right)

places were hence associated with the practices in which people engage and through these practices became part of the socio-spatial network.

Finally, many participants marked similar places in the district as reference to where they routinely go. Yet even here, we found differences with respect to whether these were also considered or known as recreational places (Fig. 9).

These initial findings were further explored in individual interviews with the participants. Talking about the maps and the mappings in the interviews encouraged almost all participants to reflect on the district as a whole, its multifaceted character and its image. Here we found that the spatial separation depicted in the maps corresponded with a stereotypical and often negative attitude towards other neighbourhoods. In particular two neighbourhoods, one characterised by tower blocks and widely known as socially diverse and troubled area (Tenever), the other one with a rural character and detached houses (Alt-Osterholz), were important points of identification and demarcation for the residents. As participant 1 who lives in Alt-Osterholz explains:

> My own neighbourhood, I like that one. […] I wouldn't like to live in Tenever for example. […] I'd rather be in the area where I live now or I prefer this. It's kind of like that, a little bit closed off and you know a lot of people and there's a lot of greenery and gardens. Whereas in this tower block neighbourhood, that doesn't suit me at all, I don't like that. I don't want to say that it is terrible, but for me personally, if I had an apartment there, I think I would be truly unhappy. Those tall houses, that overwhelms me. At least to live there. And I never actually go there. If we go on excursions, all right, then we go here to the dike [points to dike on the map] or, if we say "come let's go for a little walk in the evening", then we move around the clinic park, which is also very nice, because it's a lot of greenery and some nice old buildings and if you walk around there for an hour, then you have a little bit of time off your mind.

Participant 7 who also lives in Alt-Osterholz, had a more nuanced view on Tenever. He praised the success of social urban development actions and said that he had "learned to appreciate" the area since there had been renovations that "have made Tenever somehow attractive". However, he mentioned the neighbourhood only when asked why he had not marked any areas that he did not like in the map. Seemingly, his assumption was that we have had this specific neighbourhood in

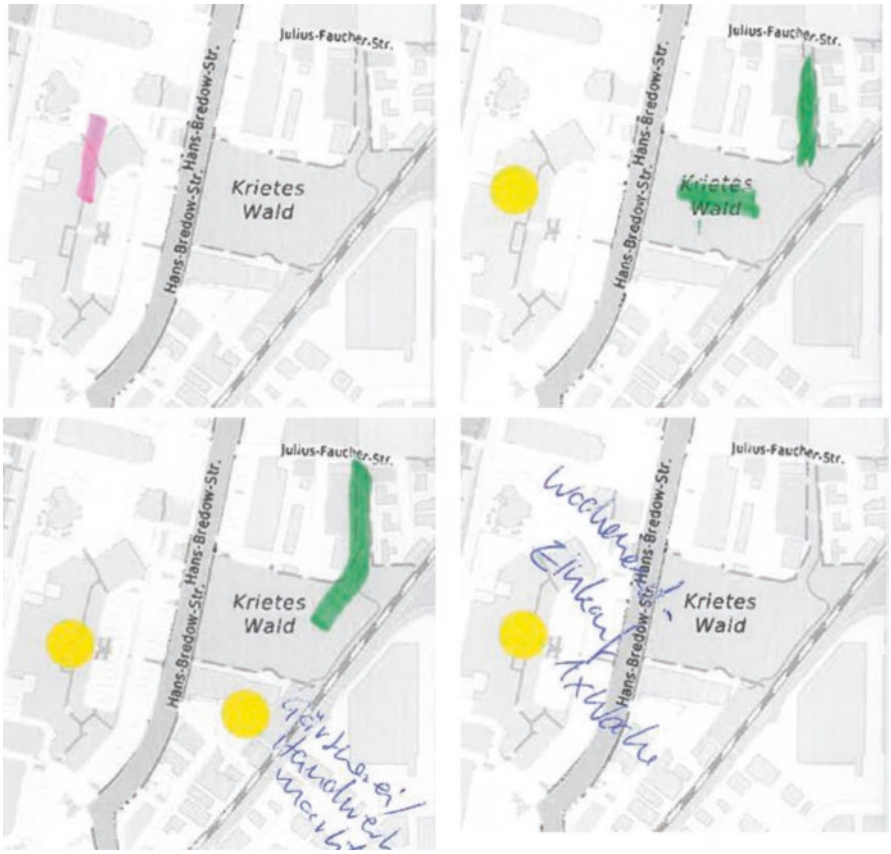


Fig. 9 Cutout of the same part of the map from different participants

mind when asking for disliked areas. Further, he confirmed that there are prejudices amongst his neighbours:

> Nevertheless, it is the case that as resident of Alt-Osterholz you actually avoid Tenever. Because there were also incidents that young gangs somehow attacked people in the early evening hours or something like that.

The *map was hence not a mere representation of the participants' place-making practices* and tacit knowing of the district *but also a performance of what they considered to be socially acceptable*, e.g. to mark Tenever negatively or not.

In contrast, participant 9 who lived in Tenever produced a very different image of her neighbourhood. She had lived there for a very long time and had "always found it exciting, always interesting". She told us that

> … acquaintances of ours had said that you can't move to Tenever […] but I was still unbiased, I thought I'd take a look and now I'm living there and the apartments are really nice and we have a great view from the seventh floor.

She explained that in her opinion the bad image of the neighbourhood was no longer justified today. She had a strong attachment with the neighbourhood and the residents that was rooted in the togetherness of the people living there. She appreciated the ways the residents interact and treat each other, and recounted her negative experiences with neighbours when living in a different neighbourhood for a short while:

> The others who owned the condominiums, they were upset that some families had a barbecue. So that was ONE situation, no, that's how it went. And then you really don't feel well. And then other things like that, like bullying and harassment. [...] Something I don't know from here [Tenever] at all. Because here its really such a peaceful togetherness and doesn't matter whether one is running around in pyjamas or not. Maybe we smile about it (laughing), but there is no one to blame for such things. That was a little bit there, as I said, it was a little bit different.

Despite these divergent perspectives on the different parts of the district, the participants realised some commonalities regarding preferred and avoided spaces: They differed with respect to the specific areas that they like or dislike, but the reasons for these preferences are the same. All participants like to visit calm, green recreational places and they avoid places where young people often meet. Participant 9 explains:

> […] and that's the big parking lot and there are a lot of young people meeting with the car and so on and sometimes it's a bit uncomfortable. I don't really know any really unpleasant places like this. But these are such meeting places for young people, where you just feel insecure and you think they're talking to accost me and stuff like that, yeah.

Participant 5 who differs quite a lot from participant 9 with regard to her socio-spatial networks perceived the same sense of discomfort at places with many young people:

> I don't like to go to the lake anymore, because of things that you don't like as an old person anymore, yelling youths and barbecue sessions, where the rubbish is just left and so on and so on. […] I don't want to get upset about it. When I was younger, I was able to ignore these things but with increasing age it is strangely more difficult and since I don't want to become a militant old one I choose the avoidance tactic.

Hence, what could be derived from the individual probes and interviews was an appreciation of the participants for green and recreational spaces. Despite differences on where these areas could be found in the district, all participants emphasised the importance of green areas. Similarly, we noticed an agreement to avoid places where young people hang out and may intimidate older citizens. These were all individual perspectives that participants made through their engagement with the probes and while reflecting on this exercise during the interviews.

However, it was only during a workshop in which the *participants jointly interpreted the differences in the maps* (which were displayed on a pin board as depicted in Fig. 10) that we started to understand some of the reasons for these differences. These interpretations were based on taking their respective perspectives and through interpretation of the assembled maps the participants created a joint, communal perspective.

One of the biggest differences—according to the participants—was whether somebody grew up in the district and still had friends, acquaintances and family from that time or if most members of the social network live somewhere else.

Fig. 10 Participants discussing their maps during a workshop

Participants pointed out that this could be seen in particular in the number of blue marks on the map (representing family and friends). A second difference was considered whether somebody still works and also where somebody has worked (as these could have included long commutes with little chance of colleagues living in the district). The financial situation was considered another defining difference (e.g. with respect to buying organic food or owning a house and garden). Participants argued that this made a difference in terms of shopping behaviour or whether somebody goes to public parks more often for recreational purposes. Furthermore, the functional health was considered to be important with respect to people's mobility in the neighbourhood and beyond. Lastly, it made a difference whether people are engaged in charity work and if so, where (some people work within in the district, others across the city).

Relating these accounts of our field work back to theoretical framework (see Chapter 3: Co-creating Digital Public Services), we can see that working with the neighbourhood map facilitated the perspective making and perspective taking of participants in three ways: The neighbourhood maps served (1) as a standardised form and method, (2) as a coincident boundary and (3) as an ideal type.

Standardised forms, methods and procedures enable a shared view by enforcing particular work practices across participants and provide a shared format for providing input. The neighbourhood map acted as a standardised form by asking people to identify where they live, where family and friends live and where important places are. By asking participants to follow this particular procedure when working with the map, it became a standardised form (or method). In so doing, it allowed for the translation of different contexts into the same pattern (colour-coded dots).

The map served also as a *coincident boundary* in that it outlined the demarcation of the district. Through this framing only those activities became visible (and relevant) that took place inside this boundary. Many of our participants reflected on this. For example, participant 5 reflected about how she perceived of the district differently when she was still working and commuting to another district in comparison to her reduced mobility patterns within the district since retirement. Participant 7 reflected in the final focus group about how many of his activities took place outside

of the district and how much he used the car to get to places. This coincident boundary later became inscribed into the app we co-created with the participants.

Finally, the neighbourhood map facilitated the creation of *ideal types* such as "nice places and walks" as we asked the participants to mark places/areas they like and dislike in the map. These were later turned into key categories of our information service. There was an initial broad understanding of what a nice area would qualify as. This "ideal type" became more and more refined as the design process progressed. Initially our participants had different ideas and understandings of what qualified as a nice place and also where they might be found in the district. These differences were important for negotiating the future design and categories of the information system. For example, the conversation about the nice places informed the definition of attributes to describe nice places later on (e.g. how to get there, whether there are benches and toilets, whether there are possibilities to get refreshments). This was hence, an important activity for negotiating classifications for the information service to be developed.

The probes pack consisted of other materials as well. They are all summarised in the appendix of this book and include a disposable camera to capture how participants "see" their district; postcards to imagine an emblem of the district and identify its unique characteristic as well as envisage the future of the district.

The postcard relating to future-making facilitated participants' joint perspective taking and making on how they envisioned the future of the district. The taking of the individual perspectives allowed to develop a joint perspective with respect to thinking about how to tackle challenges rather than being trapped in a diffuse fear. Figure 11 depicts some of the participants during the workshop while reading each others responses. In addition, participants reflected upon what they were missing in the district (e.g. young people). Some said that this was also reflected in the fact that there are only few places for going out (e.g. for a coffee in the afternoon or a drink in the evening). Some believed this was also an infrastructural problem (e.g. with respect to the tramline).

A further part of the conversation circled around charity work in the district and how this may support the development of the district. One idea was an app to support this, e.g. a platform for people that need help in their neighbourhood. Some participants reported on how they were already helping older neighbours with their weekly shopping. Another discussion was around the idea to build student houses and make the district more attractive for younger people and in this way "raise" people who are willing to take over charity work.

Hence, when displaying the postcards in our workshop they served again as a *repository* that allowed to be queried as various ideas, concepts, objects were collected and allowed for a creative process. It also served to envision an ideal future.

Proceeding to Develop Personas and Scenarios

Based on the insights gained through the probes, we co-created personas with our participants. Usually, personas are defined as "hypothetical archetypes" of real users (Cooper, 1999). Very often personas are created by the research and design team from insights gained through other research methods (e.g. interviews, ethnographic observations/participations in activities with older adults, focus groups, demographic data on older adults). Hence, personas are a representation of

Fig. 11 Participants discussing the postcards at a workshop

a fictitious user that include a concise summary of characteristics of the user, their experience, goals and tasks, pain points, and environmental conditions. Personas allow the developers to consider the needs, wants, expectations etc. of wider user groups, without involving them directly in the design process. Very rarely are persons developed in collaboration with users (Neate, Bourazeri, Roper, Stumpf, & Wilson, 2019 is an exception). By drawing attention to potential users, the creation of a common understanding of the users is supported and developers are engaged to implement this understanding in their decisions.

In Bremen Osterholz, personas were jointly developed with older adults. We developed three personas based on the probes and individual interviews with our participants as well as statistical data on older adults. We used personas to examine communication- and information needs as well as resources of older citizens in Osterholz. The personas played an important role throughout the co-creation activities as they allowed to investigate and discuss the information needs of older citizens further. 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 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.

The personas still differed according to a number of important dimensions (Table 3).

The participants worked in three groups, each on one persona in order to identify their information needs and interests.

- What needs and resources do they have?
- What functions and objects should the map/application contain regarding this needs and resources?
- And how should these objects be structured/filtered?

The results were noted on cards (colour-coded according the points above) and pinned on a wall (Fig. 12).

Table 3 Considering social participation through personas

Factors influencing access and social inclusion	How factors were considered in our personas
Demographic/personal	Age, gender, living arrangements, household type, mobility, relationship, health & well-being
Socio-economic	Income, employment/retirement, urban
Social and political	Social networks, social capital, charity work and political participation
Use	Needs for access/motivations, relevance, existing practices
Device and content	Media repertoire (type of devices owned)
Infrastructure	–
Attitudes/feelings	Trust in technology, confidence, self-attitude
Skills and support	Family members, time used, knowledge of options

Fig. 12 Collecting results from group work

Based on the personas we developed two use case scenarios. Overall, the result was a set of relevant classifications in terms of 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 develop different viewpoints on the types of classifications that are sensible and generate ideas for the service definition. The main point here was that the participants felt that it was important to focus on the resources of older adults: 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 services 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 Mobile Age 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 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 were not yet systematically captured elsewhere (e.g. nice places, informal meeting places). This would constitute a benefit, particularly with regard to the content (as making available informal local knowledge). Finally, we defined the value proposition and target audience of the service:

> The target audience consists firstly of older adults living in the district, in their Third Age, and with an interest in digital technologies, and secondly, of intermediaries that are providing information about the resources in the neighbourhood. Beyond these two groups, the service may be interesting for other audiences such as local politicians or relatives of members of the first group. However, their needs were not of primary concern during the development process itself.

The desired impact was to improve social inclusion of Third Agers in the district by providing such a service and measured by an increase in social participation as defined by the British ELSA report. However, as shown in Fig. 4 of chapter "Mobile Age: Co-creating Digital Public Services with and for Older Citizens" this depends on the availability of resources in the neighbourhood and the resources of the older adults themselves:

> The service shall provide all relevant information about resources in the district in order to support mobility and social connectedness of older adults in the district and improve access to different types of services. Compared to existing guides and services, it shall be more relevant and comprehensive, exploit the full potential of digital media technology, optimise usability for older adults and be easily accessible.

Working with Data Through Data Tables

One of the first steps in our co-creation project 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. In a number of workshops dedicated to the development of ideas and defining a service, we had selected categories of objects to be displayed on a map as well as relevant attributes for each of these categories. According to the selection of categories and attributes, we decided to differentiate between two main kinds of objects, with differing attributes:

- *Nice places and walks,* with descriptions about what was considered to be particularly nice, and information about the availability of benches and toilets nearby as well as supplementary information on possibilities for e.g. exercising or BBQs.
- *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.

We created a matrix table with a line for each object and several columns for the different attributes. These two data tables (one for nice places, one for services) became the central working tool for the data collection and co-creation process with two objectives: (1) *Completeness*: identify all the relevant objects in Bremen Osterholz for each category; (2) *Richness of relevant details*: 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).

Through a number of iterations we gradually completed the tables. In addition, a main task for the researchers was to standardise the data, e.g. to find the right format to describe different kinds of objects. This format also had to comply with the data structure of the city information provider (Bremen.Online) as they were envisaged to sustainably maintain the final product.

Below are three Figs. 13, 14, and 15 that illustrate the progress of completing the data tables throughout the co-creation process. There is a line for each object (place or facility) and the columns contain relevant attributes, e.g. name, address, description, offerings, transport, contact, and website etc. Altogether, 19 nice places and walks and more than 70 institutions and services were identified, but there was little precision on attributes. All in all, the project team conducted 12 focus groups (e.g. men's

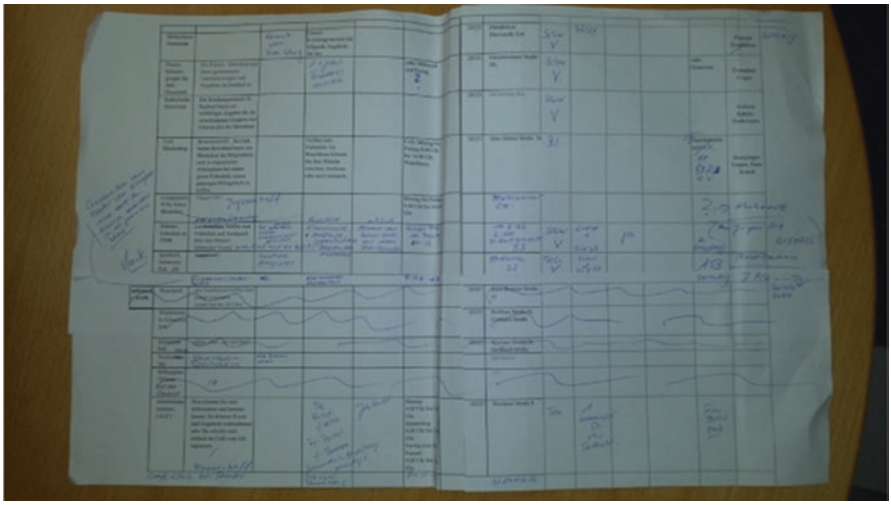


Fig. 13 First data table with "our" attributes

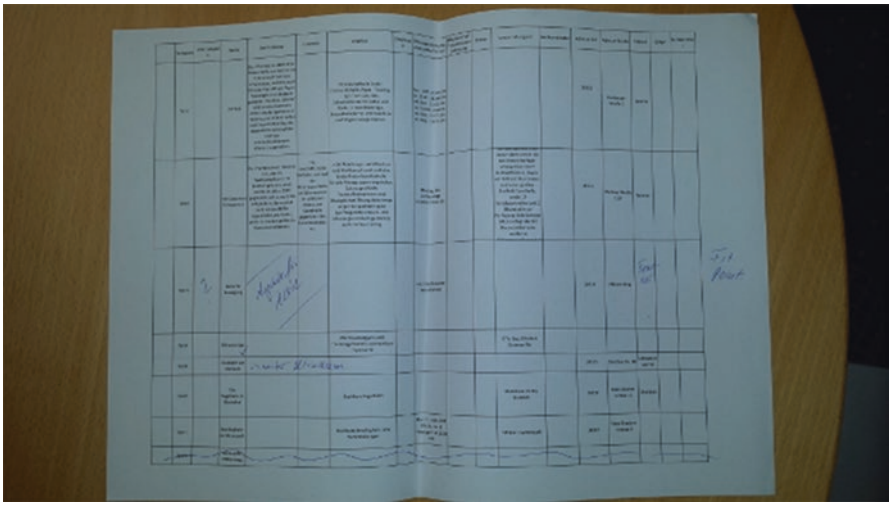


Fig. 14 Slowly completing the data tables

breakfast club, pottery groups) with more than 80 older residents, where the participants named places they considered to be nice and places where they meet other people as well as institutions offering different kinds of services relevant to them.

Most of the focus groups were conducted with people that had lived in Osterholz for a long time. People were deeply rooted in the district and had a vast knowledge about the history of the district, interesting places and events. Some participants were very active themselves in organising meetings, gatherings and other informal

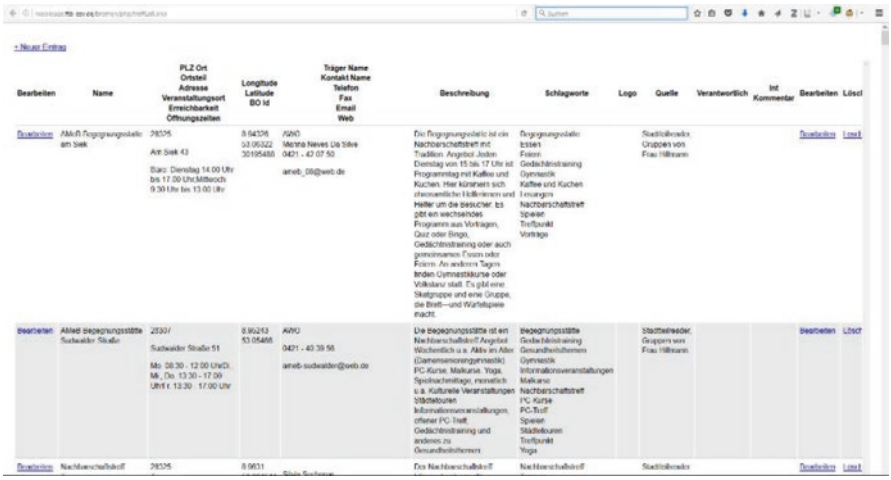


Fig. 15 Data table online in Mobile Age app

social events. The discussions were usually very fruitful as groups were very engaged and had many stories to tell about the district as well as lots of practical information on places and events.

Information on attributes largely came from a printed neighbourhood guide. But this guide did not cover all the objects proposed by our core group of participants and not all desired attributes. Therefore, the first tables contained several blank fields due to participants contributing limited information, in some instances (Figs. 13 and 14).

Because of these gaps, it was also important to recruit knowledgeable people (beyond our core group) for data collection and for supporting the drafting and editing of the data collected on nice places and walks. In our "collaboration meetings" with local stakeholders we presented our "data tables" and discussed either possible collaborations or received input on specific categories/objects. We met with three members of the "men's breakfast club" (a group of mostly older men meeting for breakfast and discussing issues in the district on a monthly basis); a member of the BORIS editorial team, a member of a group concerned with the district's history, one representative of a church congregation and the neighbourhood manager of "Schweizer Viertel". They provided useful information on differing aspects on nice places and walks which were noted by researchers.

This complementary task was important as it was relatively easy to get people to name nice places and give a few keywords to describe it. It was however, harder to get information on a pre-defined set of attributes, and even more difficult to complete this for all the points of interest. A major challenge was to identify people who could take over editorial tasks and write clear and relevant texts based on the initial sets of keywords collected through the focus group (as described above). Yet this was important for future users of our Mobile Age neighbourhood guide.

Figure 14 shows the progress as we proceeded with the data validation. Throughout it was important to provide informants and co-creators with printed tables as they were not always prepared to work in a digital file.

While information on attributes such as address, contact, and 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 residents. For the description our participants had contributed keywords. The ifib team wrote complete sentences and a coherent structure of the description. For a few nice places, a member of the BORIS team, prepared texts based on the keywords from our participants. Another member of the BORIS team, also engaged in a history workshop for the district, checked and amended the texts edited by the ifib team.

Finally, the largely completed tables were transformed into digital data tables by FTB and used as input for the data base, which was made accessible to our participants who added further information, e.g. keywords, and uploaded photos. 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) (Fig. 15).

Some basic information was provided with permission of different data providers. The data sets were supplemented by our core group. Information about public toilets and benches/seats were uploaded by the German OpenStreetMap community[9] for which one of the co-creation participants checked all public toilets and added information (e.g. opening hours). The integration of data regarding public transport was realised by linking to the public transport association.

> 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 extensively 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[10]

The visual design and functionality of the app were co-created through a number of paper-prototyping exercises and subsequently transformed into digital prototypes. A first step for the co-creation of software was to identify concepts and app ideas, then gather requirements from each stakeholder group. These ideas became more

[9] https://www.openstreetmap.de/.

[10] The software development and design work in this co-creation stream was led by our Mobile Age partner FTB.

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 app's functionality.

Map Design Workshop

In order to discuss the design of the digital map to be used for the Mobile Age neighbourhood guide, we conducted a workshop dedicated to map design. This included a presentation of different kinds of maps as well as an individual task for participants to navigate three different map applications (Google, Bing, OSM) and search for a point of interest. This was an ideal way for participants to experience a variety of existing services. Below is a screenshot of the three different maps (Fig. 16).

After the hands-on exercise, we discussed the different aspects of the maps like contrasts, content density and content presentation. The participants were told not to argue just from their perspective but also from the co-created personas' perspective.

It was important to draw the participants' attention to aspects of usability, accessibility and user experience. The personas helped the participants to focus on practical decisions. The participants found the following aspects positive, in particular with respect to orientation:

- Outlines of all buildings like on OpenStreetMap (Google maps does not show all buildings and uses a very low contrast (1.1,1); Bing maps does not show any buildings).
- House numbers of the buildings like on OpenStreetMap (Google maps and Bing maps do not show house numbers.)
- Landmarks such as bus stops, pharmacies or other well-known locations that support orientation.

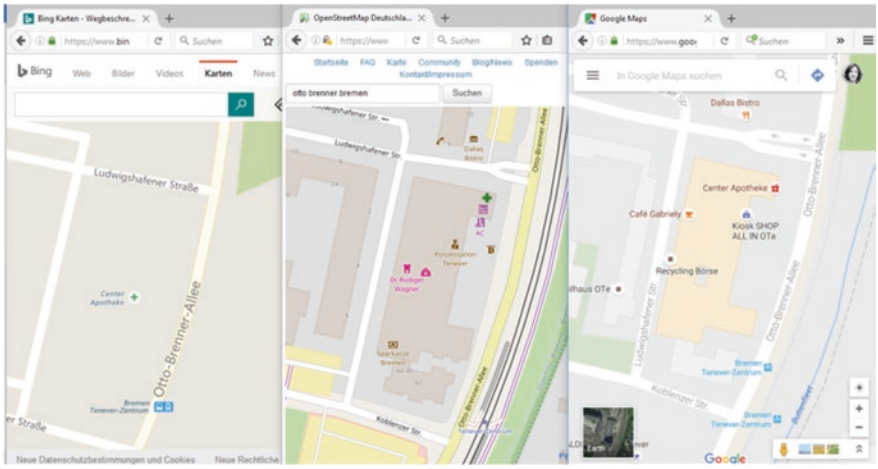


Fig. 16 Visualisations/maps of the same part of Osterholz with different map designs and different objects visible (Bing, OpenStreetMap and Google Maps)

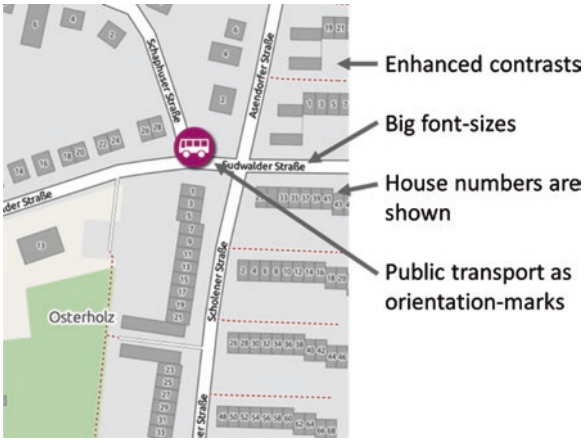


Fig. 17 Mobile-Age map for older citizens with improved features as developed by Mobile Age partner FTB

Subsequently Mobile Age developers presented a demonstration of the map they had developed and which was based on the experiences of their former work with older citizens and visually impaired people. The map uses high contrast for textual information such as street names, names of districts as well as street- and building outlines. Figure 17 below provides an overview of some of the features that are improved in the Mobile Age map.

One of the ifib researchers suggested the option of filters: In order to provide more information, that could be shown or hidden depending on specific filters. The participants considered this aspect very helpful. In the following, FTB researchers demonstrated how objects could be visualised in the map using benches and toilets as examples. Below we show the final result (Figs. 18 and 19).

Subsequently, we conducted **four digital design workshops** along with activities related to **editorial data work**. In the workshops we aimed to (1) demonstrate and discuss the welcome page, (2) discuss the experiences with tables and prototype, and (3) validate information. This was accomplished through a mix of presentations, group work and group discussions.

Welcome Page

As for example, for the welcome page, participants favoured tiles. FTB developers demonstrated a number of visualisation options and all came to an agreement (Figs. 20 and 21).

The agreement was reached on basis of the following criteria:

- The design was based on the official Bremen.Online page for the district
- Single tiles for each category of attributes in the map (nice places, meeting places, cultural offers, sport offers, counselling)
- Further tiles for project description, telephone numbers and links to other district related websites (“Voices from Osterholz”)
- Because of accessibility and usability no additional text for the different tiles, only headline

Fig. 18 Final map design featuring bus stops as orientation points

In the discussion on how much information each tile should contain the participants agreed, that they did not want too much text. One group worked on a welcome text/note. One important point of discussion was the question which term they wanted to use to describe the target audience (older citizens) of the web page. Some participants did not want to name the target group at all, but then agreed with the researchers that it should be clear who is addressed. One participant proposed the German term "Menschen im fortgeschrittenen Alter" (people in advanced age), but another participant preferred the term "seniors" and another one said, that he does not care at all, what term we choose. It was a very lively discussion and at the end we decided to use the term "older adults".

List or/and Map?

We had a long conversation over several workshops as to whether the app's content should be visualised on a map or in a list as a first output. Below are the two examples from the paper prototype session. Finally, we agreed to list all five object categories on the start page and provide the users with the possibility to select either a list or map representation (picture on the right hand side).

The list view was implemented according to the ideas of the senior participants (Figs. 22 and 23).

Fig. 19 Final map visualisation featuring toilets and benches

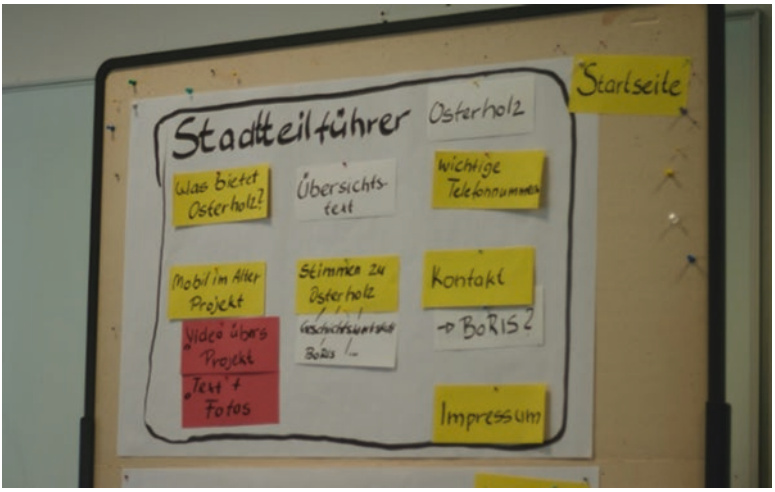


Fig. 20 Collection of ideas about start page of Mobile Age app

Fig. 21 Digital translation of start page discussion

Fig. 22 Paper prototype list

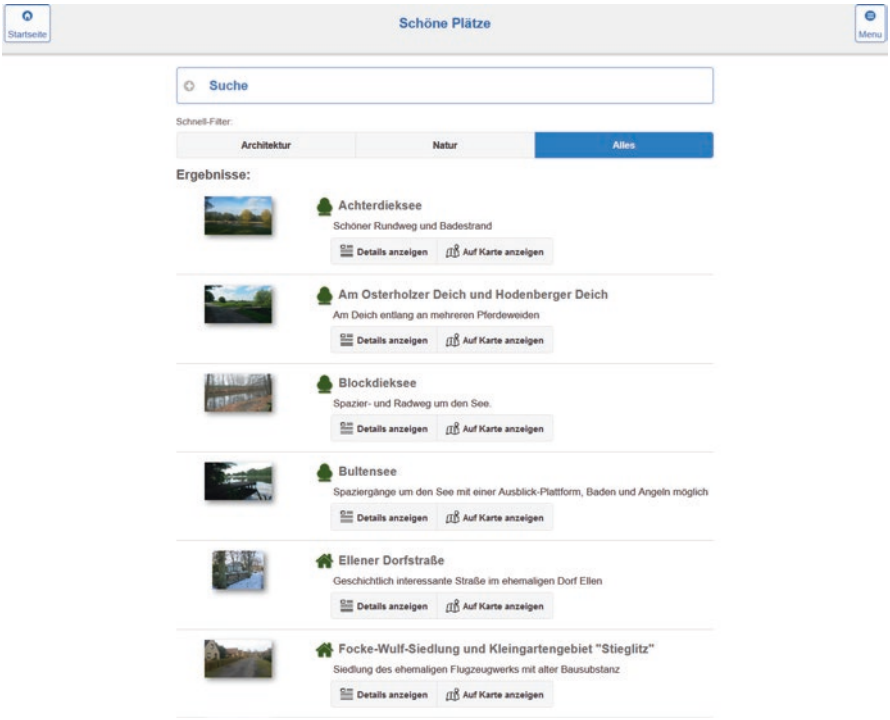


Fig. 23 List first digital demo

In contrast to the paper prototype, participants decided on the necessity to visualise the boundaries of "places to go" or walks. This has been implemented in the digital prototype map view as shown below (Fig. 24).

Toilets and Benches

Toilets and benches were not only considered as attributes of places but also as standalone categories. All of them should be visible on the map in relation to the location of the user, in order for the user to find the nearest one (Fig. 25).

Test Tablets

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. 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 use of these tablet, we developed a better understanding of the participants' motivations to use 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

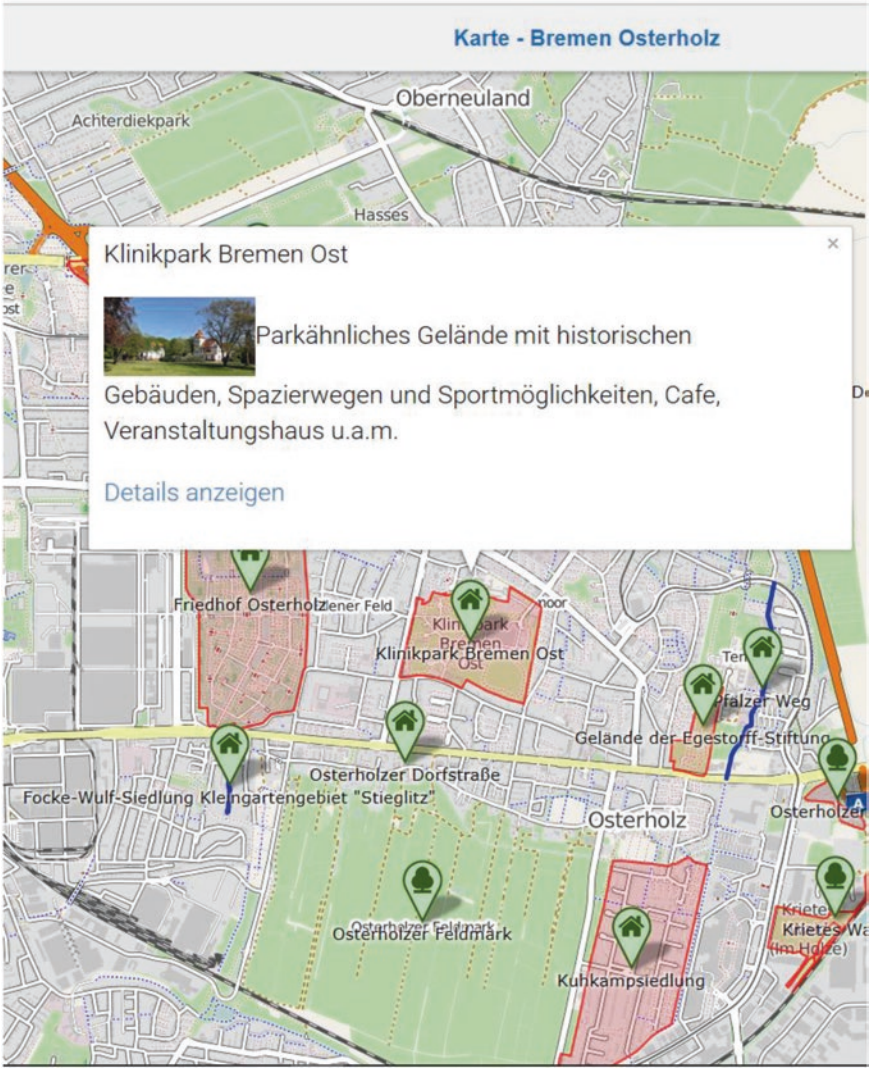


Fig. 24 Preview on map—prototype

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).

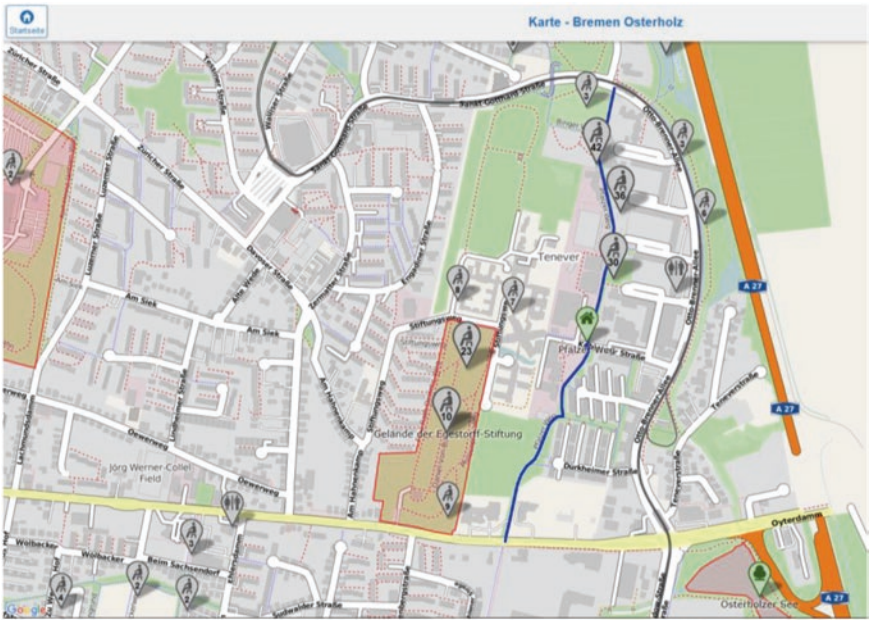


Fig. 25 Display of benches and toilets (clustered)

In particular, those participants who only had a desktop computer and no mobile device appreciated the opportunity to test a tablet. The introduction of tablets and the opportunity to test the co-created service was an important step in the process. In addition to experience the use of a tablet, participants 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 district. 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 infrastructure and access for the Bremen Osterholz.

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 (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. 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.

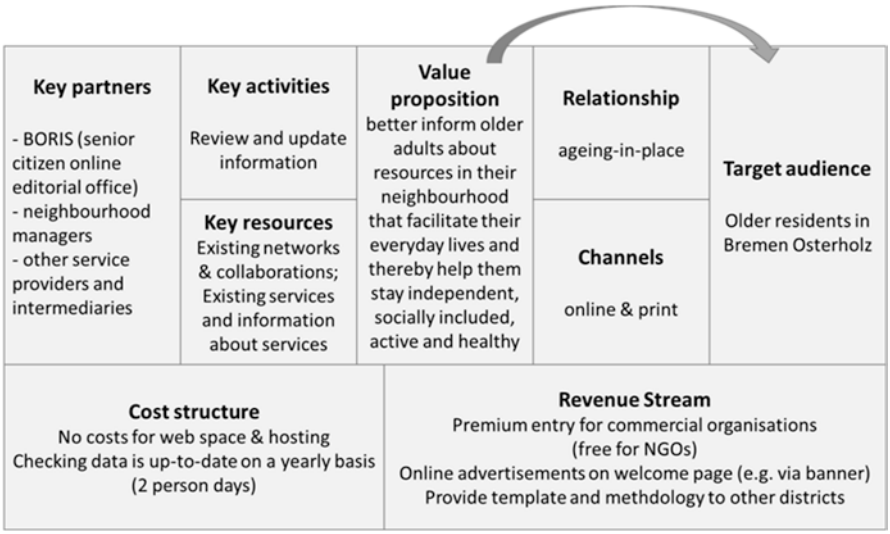


Fig. 26 Final canvas for co-created service in Bremen Osterholz

Exploiting the Service

For the initial planning of co-creation activities, a first definition of targets, outputs and value propositions was defined and throughout the project continuously refined. This also included initial considerations about the sustainable deployment of the service and its required data and technical infrastructure as well as *key neighbourhood resources*. 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 (*cost structure* & *revenue stream*), whereas a group of local actors (*key partners*) would be responsible in maintaining the content (*key activities*). To communicate the service, it was provided through a *multi-channel approach*: in digital form and in a printed version. The following figure summarises the canvas for Bremen Osterholz (Fig. 26).

Summary of Co-creation Process and Output

Overall, there was an emphasis of activities in the engagement with stakeholders, the working with data and the co-creation of software which allowed participants to share control and knowledge throughout the co-creation process. The table below provides a summary about the types of activities/methods we used during our co-creation process and the stakeholders involved (Table 4).

Table 4 Overview of activities/methods deployed in Bremen Osterholz from May 2016 to January 2017

Activities	Number	Attendees
Expert interviews with intermediaries	8	Ifib, neighbourhood manager, head of local district government, representatives from two different Christian congregations and one social service centre, representative from centre for migrants and intercultural studies (ZIS), representatives from social welfare organizations (Mütterzentrum, AWO)
Meetings with local stakeholders	10	Ifib, neighbourhood manager, head of local district government, BORIS senior citizen group, local older citizens groups
Recruitment and information workshops	2	Ifib, older citizens, head of local district government, editor senior online web portal, editor printed neighbourhood map
Cultural probes and interviews	11	Ifib, our workshop participants
Co-Design workshops and observations (idea forming, service and data definition, co-design, tablet use and testing)	14	Ifib, FTB, our workshop participants, head of local administration, journalist, intermediaries, stakeholder
Questionnaires regarding technology use	9	Ifib, our workshop participants
Focus groups for content/ data creation	12	Ifib, project group for printed neighbourhood map, 12 existing groups of 3 to 20 older citizens
Evaluation focus group (1 about tablet use and 1 about process)	2	Ifib, our workshop participants

There are three kinds of output of the co-creation process of an interactive digital district guide for Bremen-Osterholz:

- data collected and presented in the guide,
- an app providing access to these data,
- an online service in which data and app are embedded and that is offered by a service provider that maintains it.

As it has been described above the guide contains all points of interest in the district relevant for senior residents. The list has been checked with several experts and nobody mentioned something missing. It includes 17 nice places and 75 organisations relevant for senior citizens.

In order to assess to which extent the service provides relevant information to older adults and other stakeholders, we collected feedback in interviews with participants, service providers, intermediaries and government.

Value for Older Adults

Through a formative evaluation, participants confirmed that they were satisfied with the content of the service. They considered the 17 nice places and 75 service providing organisations as complete and the information as correct, comprehensive and appealing. However, the target group of older adults is larger than our group of co-creators. In a focus group with three neighbourhood managers, working in less privileged neighbourhoods in the district, they confirmed that *information provision* in general is a relevant factor for social inclusion. However, they saw limitations with regard to the general issue of accessibility of digital technologies (technical equipment, skills, interests, fear). That is why they produced the printed neighbourhood guide.

They recommended public access terminals and a *printed short version* of the most important content. As their printed district guide included the service providers but not nice places and walks, we decided to print a booklet with the 17 nice places. This was published on the day of the launch of the online service at bremen.online and was distributed via their offices as well as via the district office.

In addition, the intermediaries were critical about the accessibility of the service in terms of its sustainability and up-to-dateness. One of the neighbourhood managers stated:

> Well, I'm not so sure if it's really going to reach the seniors. …If you are looking for something, when you search purposefully, for example, I want to go to the swimming pool in the OTE hall in Osterholz for example and when are the opening hours, then I would google it. Then I wouldn't find it. And then whether I bump into this site, I don't know. […] Well, I think that as supplementary information such a thing is good, but as I said before, it has to be kept up to date and if I am looking for it, I have to find it.

With the migration of the content to the city portal and its feature of self-administered updating by data owners on the one side and the commitment of the providers of the city portal to maintain the data of the 17 nice places for a duration of 2 years, sustainability is ensured.

An open question is the relevance of the information provided for different groups of older adults, in particular with regard to issues around social inclusion, connectivity and participation. The relevance of the objects and attributes selected reflects the needs of a particular subgroup, which is mobile, comparatively well-educated, and engaged. One of the neighbourhood managers suggested that for older people with health issues or financial constraints this kind of information provision might not be as relevant: "Well, I think that's going to do well for those who are better off." The other neighbourhood manager explains:

> And very few have a large iPad or a PC with a large screen. I saw that also in this PC course for older people. Some people said: "Oh, that's interesting, now I dare to buy one of those things, now I know how to do it. That's what the residents are like, but I'll tell you, those from the blocks that don't live in condominiums or in single-family houses, they're really into it, they like it. However, most of these residents are poorer people who don't have these financial possibilities, they miss it.

Value for Intermediaries and Service Providers

The interviews with the neighbourhood managers also demonstrated, that the service is not only relevant to older adults but also to intermediaries and local service providers as it may support them in fulfilling their tasks:

> It would be more important to have all these multipliers. And I think that's good for them, because for many of those who work in Blockdiek [area with low socio-economic status], they don't know what the neighbouring facility does and can do. It is so… The managers might know about it, but the normal employees, if they work part-time even, they don't know what the institution around the corner is doing, what they have to offer, or that there is one at all. In this regard, the service is totally valuable, because they could say I have a web page here, take a look at it. That would be important.

In this regard, the digital district guide can support the *networking of local service providers* and consequently facilitate better service provision. The intermediaries also assessed the content as being oriented towards older adults as target audience (addressing their needs and interests). Categories that were defined in the process were confirmed by the neighbourhood managers as being relevant to older adults when moving outside.

Value for Government

At the launch event of the service in February 2018, a director of the State Ministry of Social Affairs, Women and Senior Citizens confirmed that the content of the services is highly relevant and compliant with the objectives of the recent political priorities and four central issues with regard to seniors (Table 5):

The service supports all four policy objectives and hence the ministry can support similar processes in other districts of Bremen. The director outlined some of these correspondences and explained why such as service could be a "good practice case" for other districts. He welcomed the offer by bremen.online to provide the templates of the Osterholz-Guide to other districts.

Table 5 Value for government

Political objectives	Corresponding part of the guide
The district as home:Districts are central for integration and social participation and politics should support people to stay in the district as long as possible (ageing in place)	The guide provides information, where people can get advice
"Stadt in Bewegung" [City/Citizens in motion]: Physical exercises (indoor and outdoor, e.g. in sporting clubs) shall be supported	The guide lists all sporting clubs in the district and information on nice places to walk to
Living together in a growing city: Opportunities for social participation will be improved in order to develop the city and improve tolerance for differences	The guide includes all the indoor meeting places of the district, inviting people to get together there
Good services for the city and its people	The guide itself is a good service for the district

Lessons Learned

The following section summarises our lessons learned. These have been taken-up and evaluated in the second co-creation project, which is presented in the next chapter.[11]

Governing and Managing Co-creation

To select a district where already a group existed that provide a information for senior adults and to start recruiting co-creators from and with this group turned out to be a good choice and should be repeated with regard to subsequent co-creation processes.

> Lesson O-1.1: Start with an existing group of stakeholders that provides information of the desired kind for the target audience.

Given the broad range of contributions that are necessary for developing an interactive district guide that is relevant, up-to-date and accessible, we found that each of our participants had only some of the necessary skill set. Therefore, we challenged our initial view whether the recruitment of one single core group over the whole co-creation process is indeed the best model. Our partner in the data collection phase that had developed several printed district guides for older adults in other districts of Bremen followed a two stage model. She established a project team of intermediaries working with older adults to plan and coordinate the process and asked them to recruit focus groups to identify relevant objects and provide information. This model may be extended to other tasks such as specifying requirements for software design or editing of texts as well in order to engage older adults as representatives or advisors.

> Lesson O-1.2: Establish a project group that helps coordinating different co-creation contributions by different co-creation partners.

In an action research project there is a time conflict between research-related activities and the practical co-creation activities required from the participating older adults: In order to get a better understanding of the members of our core co-creation groups, their personal background, relation to the district, digital literacy, we spent some time to develop cultural probes that demanded a lot of time from the

[11] Please note that the lessons learned were also used for the interim good practice guidebook.

participants as well. On the other hand, more support in introducing the tablet PCs was desired.

Lesson O-1.3: Consider *activities that are feasible* for other co-creation processes, in particular if the co-creation facilitators are not researchers but public authorities or service providers.

Lesson O-1.4: Consider *activities that are supporting the use of technology* in order to ensure a higher motivation and satisfaction and more effective contribution by older adults.

There is a need to be transparent about the decisions to be made during the co-creation process and to reach agreement on the appropriate decision-making method, i.e. open idea generation and discussion, choice between a few alternative options or discussion of and consent on a preferred solution by the co-creation team. It is also important that such decisions are documented in a transparent and accessible way in order to keep participants up-to-date.

Lesson O-1.5: Establish transparent decision-making procedures.

Engaging Stakeholders

In general, it can be said that engaging stakeholders worked best through the collaboration with local stakeholders and existing groups. Promoting the project on two district fairs did not work well.

Role of Intermediaries Intermediaries were equally important and helpful as the co-creating older adults with regard to field exploration, recruitment of participants, idea forming up to the service development and sustainability considerations. Depending on the topic area their role in the co-creation process differs (from information providers and/or supervisors, topic experts to future users).

Lesson O-2.1: Identify the different roles which intermediaries may assume throughout the co-creation process (data providers, maintenance, recruitment support, future users) and establish corresponding collaboration relationships.

"Cold recruiting", e.g. on fairs, markets etc. did not work well, as one intervention showed. Recruitment may be effective when starting from already existing groups and aligning with their interests (e.g. older citizens' computer group). Nevertheless, there is a dilemma of recruiting for well-targeted and well-framed activities, and simultaneously keeping the co-creation process open. Recruiting people for a co-creation process, lasting about half a year, with only vague objectives and tasks unfamiliar to most older people is a great challenge. We had to provide a notion of the project's objective and what people would commit themselves to for about half a year, what kind of input, in particular what local knowledge, we would like them to contribute. As these issues are difficult to communicate clearly, for the information event and the kick-off meeting we were looking for a venue which is easy to reach for people in the district and a host that is trustworthy. We asked the head of the local district government of Osterholz and he agreed to open the assembly room of the district council and welcomed participants at both meetings. All participants received a participant information sheet.

Lesson O-2.2: Recruitment activities must consider the context in which they address older citizens as potential co-creators.

Lesson O-2.3: Engage intermediaries who are ready to support recruiting older adults.

For our process, it was important to establish the co-creators as experts 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. Establishing the participants as experts was facilitated through methods such as the card game or the probes. In particular the probes and related individual interviews were one of the interventions that resonated with participants most. They further helped to establish a trusting relationship with the participants. They also manifested the expert status of the participants with respect to knowledge about the district and their experience of becoming older. What was particularly helpful with probes throughout the process (idea forming as well as evaluation), was their ability to prompt participants to reflect about their everyday life. In subsequent interviews and focus groups, participants were much better prepared to give an account about for example their mobility and socio-spatial inclusion within the district. Cultural probes sensitised participants about certain aspects of their everyday practices and were hence tremendously helpful in identifying needs and resources.

Lesson O-2.4: Establish older adults as experts.

During a co-creation process, participants need to "find" their role from a customer/user of a service to service designer. The co-creation facilitators hence need to think about ways to facilitate role shifts and consider the following questions:

- What is the role/contribution from administrations, software developers, facilitators?
- What does this role entail and what are necessary skills and knowledge?
- How are older citizens enabled to assume such a role?
- What may be barriers for role-shifting?

In the different phases of a co-creation process different capabilities are required. In a permanent core group there will always be some participants with limited ability to contribute to particular aspects and activities. Therefore, it is worth investigating to assemble different participants for each of the phases rather than one core co-creator group. This allows for defining expectations more clearly and may be more satisfactory for the participant. Overall, there are several areas in which co-creators may engage:

- Identify information needs
- Identify gaps between information needs and existing services/data
- Perform editorial work
- Collect, create, and validate data
- Define technical specification/systems requirements
- Plan and perform usability testing and system evaluation

Lesson O-2.5: Establish procedures to facilitate role shift of participating older adults.

Co-creating a Service Concept

Personas and scenario-based design were an important co-creation method for our project in Osterholz. On the one hand they *helped to anticipate future users*, on the other they *helped to tease out the relevant characteristics* (socio-economic, social relations, general health & mobility, attitude towards technology) of older adults. Personas were developed based on the participants and complemented with statistical information. They enabled participants to discuss matters of concern not only from their perspectives but also by taking other people's perspective into account. In particular, with respect to sensitive aspects such as financial constraints or limited mobility, personas helped participants to articulate needs without feeling intimidated to speak about themselves. The personas were subsequently used to develop use case scenarios and facilitated communication for the concept developing, co-design and evaluation stages. Personas and scenarios also served as a thread

throughout the co-creation process, connecting different activities (such as identifying information needs to map design).

> Lesson O-3.1: Make use of methods that help to tease out defining characteristics and that allow establishing a thread throughout the process.

Given the low internet use among older adults they may not become the main users of a digital service such as a local district guide. If the topic is nice places and walks, intermediaries that organise and advertise walks for older adults in their district may be the direct users and the guide should be designed in a way that supports their work.

> Lesson O-3.2: Intermediaries should be considered and integrated as main users of a service.

We learned that there is a dilemma that most people who are socially excluded or at least not well included (e.g. because of poor social status, being unemployed or having language problems) will not volunteer for co-creating a district guide on nice places. Therefore, the value proposition and the announced impact of our co-created service needed to be more modest and restrictive. Addressing intermediaries could be effective in this respect as well. The focus should not only be on future users, but also on (complementary) existing services these intermediaries provide. They can facilitate contact with different experts for e.g. identifying needs, services, or relevant content.

> Lesson O-3.3: Information is a necessary but not sufficient condition for social inclusion. Consider more activating services.

Working with (Open) Data

Overall, we had to realise that very little data is 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 ready to name objects of interest but not to collect or validate detailed data on attributes. During the process, we decided to focus on fewer categories and less content than foreseen, and instead to focus on those objects that currently are not found online and that are rather difficult to describe. It is hence not advisable to keep the process open for too long but rather to focus on fewer aspects and work on them more intensively.

As the content creation on nice places was seen as most valuable by the participants and also local stakeholders, we decided to focus on nice places in our next phase and investigate further the specific, additional information needs of older adults and intermediaries (e.g. also with respect to features that are not based in data but for example on videos of walks).

Lesson O-4.1: Open data should not be considered to be easily available for the information needs of the co-creating older adults and other stakeholders as there is a gap between the data available and the data required for a service that improves social inclusion by activating people.

To develop a comprehensive district guide that contains detailed and relevant information on many different kinds of relevant resources, turned out to be too much work for such a group of older volunteers. Even though we reduced the categories of objects to be represented in the digital neighbourhood guide, we concluded to reduce objects and instead focus on nice places and walks for the next district.

In our first co-creation process, a team of local service providers supported our

Lesson O-4.2: Less is more. Concentrate on a few categories of objects and dedicate more time on their presentation, making use of a range of media formats.

process by conducting structured focus groups with different groups of seniors in order to identify places and institutions of interest to them and the most interesting aspects in each case. As described above, overall 12 focus groups were conducted which led to almost 20 nice places and about 80 institutions of interest. The *snowball data collection* process about nice places and walks, informal meeting points and points of interests was a *necessary supplement to the small core-co-creation group,* putting the content generation on a much broader and more representative set of sources, needs and views. However, among the first eight groups four were in a church environment, leading to a bias, which needed to be compensated by finding other groups e.g. the men's breakfast club.

Lesson O-4.3: Consider methods that allow the inclusion of a broader range of older adults for the data collection (e.g. focus groups).

Co-creating Software

For involving end users into co-design activities, open questions regarding the design and functionality were at times misleading, because the participants often answer intuitive and spontaneous. It is more effective to propose a selection of dif-

ferent existing examples and discuss the advantages and disadvantages. Personas helped participants to reflect on other users and anticipate their requirements (e.g. non-native speakers, new residents).

Lesson O-5.1: Consider the reduction of open prototyping tasks.

Overall, *the design of an application is more than the design of a user interface* and also includes the design of the data base and other back-office functions, e.g. user administration. For example, the data tables that were used for data collection were also the blue print for the database model of our service. The decision to develop two different tables for nice places and facilities was taken by the ifib team and discussed with the technology partners FTB. It was based on considerations of different data models (objects and attributes). The result was communicated to the participants but not discussed. They did not feel competent nor interested in how we would translate their needs into technical requirements.

Lesson O-5.2: Consider the co-creation of an application beyond the design of the user interface.

Exploiting and Disseminating the Service

Even when intermediaries participate in the co-creation process and conceive themselves as users they may not automatically take responsibility to maintain the resulting service. In the case of Osterholz, we could start with an already existing online editing group. However, they were the only one of this kind in Bremen. In a second district, we are challenged to find someone else who would take responsibility for taking care of the content.

Lesson O-6.1: Sustainability remains a big challenge.

The next chapter describes our co-creation activities in Bremen Hemelingen, how the lessons learned in Osterholz have been taken into account and what we learned in the process of doing so.

Co-Creation in Practice II: Co-creating a Digital Walking Guide (Bremen Hemelingen)

Summary of Co-creation Project[1]

Problem Focus

One dimension of the World Health Organization's age-friendly cities and communities guidelines is the provision of age-friendly outdoor spaces to allow older adults spending more time outdoors. From a public health perspective this is particularly relevant, as spending more time outdoors improves people's functional health and ensures Vitamine D take-up. Hence, one of the tasks of social care service providers is to organise joint outdoor activities in order to activate older adults to exercise and to meet other people.

Value Proposition

A digital information service around local walking tours allows, compared to printed guides, for more detailed and up-to-date information as well as greater information richness. Walks and related locations can be presented by adding video clips of people conducting those walks and voice recordings of recommendations by members of the target audience, which gives the information a lively and personal touch. We developed a digital service that provides relevant and appealing information to older adults which activates and motivates joint walks in the different parts of the district and supports service providers in organising and announcing these kinds of walks by exploiting the potential of multimedia technologies.

[1] This introduction is derived from the case study of our interactive co-creation guide: https://co-creation.mobile-age.eu/guidebook/case-studies/bremen.

This chapter is based on the Mobile Age project deliverable D3.2 Senior Citizen Engagement Report Bremen: https://mobile-age.eu/images/pdf/deliverables/WP3/D3.2.pdf.

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_6

Limitations of Existing Services
Existing services (such as a printed pocket guide, a district website, flyers and posters in meeting places) are not comprehensive, and limited in their appeal to motivate outdoor and social activities of older adults. An existing printed pocket guide for the district informs about nice places and walks but it lacks appealing information that has the potential to attract people to visit places they did not know before. Furthermore, certain features important for older adults such as up-to-date information on benches and toilets are missing.

Field Site
This co-creation project was conducted in the district of Hemelingen in Bremen, Germany. Hemelingen is located in the east of Bremen, connected directly with the inner-city district in its Western part. Hemelingen is the second largest city district in Bremen. It is divided into five neighbourhoods each of which is an important point of identification and reference for its residents. Some of the neighbourhoods have a rural character as they are situated on the outskirts of Bremen, whereas others go seamlessly into one of the most popular city districts and have an urban flair. The share of each of the neighbourhood's foreign population differs between 6.3% and 23.6%. This segregation manifests in people's attitudes towards each other and "their" neighbourhoods. One important aim of urban development processes in this district is therefore to overcome such divides and establish of a sense of shared identity.

Co-created Service
The result of this co-creation project was a digital walking guide for older adults that provides appealing multi-media information on several walks in the different parts of the district. It is integrated in the official online portal of the city of Bremen[2] and is maintained there since our project finished. On top of the information about walks, the guide provides also general information about the district (e.g. meeting places, consulting). The content of the digital district guide, has also been printed in a booklet featuring six walks. This was co-financed by the Mobile Age project and the district council. The booklet is distributed via local social care service providers and reaches out to older adults who do not use digital devices. In addition, two of the senior citizen meeting places instigated tablet groups for older adults after the project finished. Part of the reason was that a demand for such a service became apparent through our project.

Rationale for Selection of Field Site

There are a number of reasons for why we selected Bremen Hemelingen, most of them derived from our lessons learned in Bremen Osterholz. Table 1 provides an overview on the lessons learned from Bremen Osterholz and the actions that were to be implemented in the next co-creation phase. It further explains why Bremen Hemelingen was chosen for the second co-creation project.

[2] www.bremen.de/hemelingen/senioren.

Table 1 Rationale for selection of district based on lessons learned from first co-creation process

	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Hemelingen
Planning	O-1.1: Start with an existing group of relevant data providers	Identify a district in which a printed neighbourhood guide already exists as a basis for data and identify the group of people that produced it	In Hemelingen there is an existing network of local service and care providers ("Alte Vielfalt")
	O-1.2: Establish project group of local stakeholders	Identify a district in which a network of service providers already collaborates and which may be interested in extending their collaboration to the development of a digital district guide	Six members of the network "Alte Vielfalt" signaled interest in joining the project group and supporting our co-creation activities
Engaging stakeholders	O-2.3: Engage intermediaries to support recruitment	Identify a network/group of service and care providers, which facilitate recruitment within the context of their work	
Co-creating a service concept	O-3.2: Consider intermediaries as main users of a service	Identify intermediaries, such as service and care providers and investigate how a digital service could support their work	Through the network "Alte Vielfalt" we had access to a variety of service providers to explore how the service could support their work
Co-creating (open) data	O-4.1: Take into account that information identified as relevant may not be available as open data	Plan ahead to collaborate with various data owners (e.g. service providers) and allow sufficient time for data creation during the co-creation process. Offer a user-friendly backend for inputting data to participants	In Hemelingen a printed neighbourhood guide which provides basic data about the district already exists
Exploiting	O-6.1: Sustainability remains a big challenge	Identify local stakeholders that can sustain the maintenance of the service early in the process (e.g. identify ways in which the service serves their interests/ supports their work)	With a stable and active network of local service providers, the likelihood of identifying actors willing to sustain the service increases

Introduction to Field Site

As field site for the second co-creation project, we chose the city district Hemelingen. Hemelingen has in total 42,415 inhabitants of which 19, 8% (8,394) were 65 years or older in 2015, which is similar compared to overall Bremen with 21, 2%. By

2020, the number of retired adults is expected to increase to 8.683.

Hemelingen is located in in the east of Bremen, connected directly with the inner-urban area in its western part. Hemelingen is the second largest city district in Bremen. It is divided into five neighbourhoods (Hemelingen, Sebaldsbrück, Hastedt, Arbergen and Mahndorf) of which each is an important point of identification and reference for the residents (Table 2).

The orientation towards the neighbourhoods is partly due to the relatively late incorporation of former autonomous villages into the city structure and to the different socio-demographics. It is facilitated by "natural barriers" like big roads that divide the neighbourhoods and hinder physical crossing. The size and diversity of the district foster the division further. For instance, the neighbourhoods of Arbergen and Mahndorf on the outskirts of Bremen have a rural character, whereas Hastedt in the east goes seamlessly into one of the most popular city districts and like Hemelingen and Sebaldsbrück has a more urban flair. Arbergen also has the lowest share of foreign population with 7, 4% compared to Hemelingen with the highest share of 23, 6%. The unemployment rate is highest in Hemelingen (16, 3%) and lowest in Arbergen (6, 3%). Arbergen has with 25% of people above 65 years the largest share of older adults (compared to the average of 19, 8% for the whole district of Hemelingen). This segregation manifests in people's attitudes towards each other. One important aim of urban development processes therefore is the overcoming of these divides and the establishment of a sense of shared identity (Fig. 1).

Figure 2 shows how big the district is in comparison to Osterholz. It also visualises how the different neighbourhoods are divided by major roads and railways.

Co-creation Process

Governing and Managing Co-creation

In our first co-creation project in Bremen Osterholz, we collected a number of lessons learned for each of the streams of activity. These lessons learned informed the planning of our second co-creation project in Bremen Hemelingen (Table 3).

Table 2 Overview Bremen Hemelingen

The neighbourhoods	Size	Number of inhabitants	Of which aged 65 and above
Sebaldsbrück	509 ha	10,010	2,144
Hastedt	286 ha	10,674	1,813
Hemelingen	934 ha	10,649	1,786
Arbergen	602 ha	5,950	1,504
Mahndorf	644 ha	5,627	1,244
Total district		42,910	8,491

Fig. 1 Impressions from the different neighbourhoods in Bremen Hemelingen

Fig. 2 Map Bremen Hemelingen (neighbouring to Osterholz to its North)

Table 3 Lessons learned for planning the second co-creation project

	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
Planning	O-1.1: Start with an existing group of relevant data providers	Identify a district in which a printed neighbourhood guide already exists as a basis for data and identify the group of people that produced it
	O-1.2: Establish project group of local stakeholders	Identify a district in which a network of service providers already collaborates and which may be interested in extending their collaboration to the development of a digital district guide
	O-1.3.: Consider activities that are feasible	Cut down on the cultural probes pack, to make it less time consuming for participants and facilitators
	O-1.4.: Consider activities that support use of technology	Allow more time in the co-creation process for participants to get acquainted with technology. Offer tablet support groups outside of the core co-creation activities
	O-1.5: Establish transparent decision-making procedures	Establish a procedure to document the process and decision-making to all participating stakeholders
	O-3.2: Consider intermediaries as main users of a service	Identify intermediaries, such as service and care providers and investigate how a digital service could support their work

Target Audience

Based on our learnings from Osterholz, we wanted to target two different stakeholder groups in this project (O-3.2): Older adults in their Third Age and service providers, i.e. intermediaries that provide services for older adults in the district. The rationale for targeting not only older adults but also service providers was twofold: firstly, we wanted to foster existing support structures in accordance with our aim to embed the co-created service in already existing service structures. Secondly, regarding the persistent exclusion of a large part of older adults from the use of the internet and related devices and programmes, we aimed to expand the impact of the co-created service to a broader audience by targeting service providers.

Problem Focus

The problem focus in the second co-creation project was again on social inclusion. In the first project (Osterholz), we aimed to develop a comprehensive information service. The following two recommendations were important for the refinement of the problem focus in Hemelingen (Table 4).

In our initial meeting with the network of service providers in the district called “Alte Vielfalt” (Old Variety) care takers affirmed that nice places and walks, as included in the Osterholz app were of great interest, but the description of these places alone was not activating (older adults to actually go there). One main task of their work with older adults is the organisation of joint outdoor activities in order to activate older adults to exercise and to meet other people. Furthermore, like in

Table 4 Lessons learned for problem focus in second co-creation process

Recommendations derived from Osterholz	Actions to be implemented in second co-creation process
O-3.3: Consider a service that is more activating/beyond information provision	Identify and implement potential services that could complement the information provided in a digital district guide
O-4.2: Less is more. Concentrate on a few categories of objects	Identify and concentrate on a manageable number of categories of objects (in line with the human resources available and involved in the co-creation process)

Osterholz, in Hemelingen the issue of segregation in the district, a lack of shared identity and mutual prejudices particularly amongst older residents was considered a problem. We learned that the limitation of the mobility patterns and interests of the majority of (older) people in the district is also a social issue: socially disadvantaged people are more likely to have a narrower radius. Therefore the service providers (and later on also the participating older adults) considered it important to provide information on the district as a whole and not separate neighbourhoods.

Limitations of Existing Information Services

In addition to the limitations of existing information services for Bremen overall, that were detected in our first co-creation project, we identified the following existing information services for Hemelingen:

- a printed neighbourhood pocket guide had been put together by local stakeholders in 2016. The guide contains information on recreational spaces, meeting places, creative and cultural offers, events, institutions and facilities, possibilities for lunch, sport, infrastructure, living and consulting as well as nice routes for walking. The data in the Mobile Age app are based on this printed guide.
- The district marketing conducted a survey about places to meet and eat which were published on the districts' Website.
- The network "Alte Vielfalt" publishes guides for older adults in Hemelingen (biannually) that contain comprehensive information on services and facilities for older adults in the district
- The district marketing runs a website where anyone who organises events or activities can announce these.
- A great variety of flyers announcing events and activities.

Only the pocket guide designed for and with older adults includes a few walks in different neighbourhoods of the district (Fig. 3). However, information provided is minimal. Besides the highlighted way on a small map the description on the left hand side only mentions the starting point and the lengths of the walk as well as references to two points of interest. For example benches and toilets, deemed relevant by the co-creators in Osterholz, are not featured nor are most of the attributes that were defined as important and relevant during our first co-creation project.

With regard to the problem focus, the limitation of these services is that they do not inform about activities and/or events for older adults in an activating way, which means in a way that motivates older adults who are not already active anyway.

Value Proposition and Expected Impact

A digital service not only allows for more space and richer information as already demonstrated with the Osterholz service. In addition, walks can be presented with even greater information richness by adding video clips of people moving and voice recordings of recommendations by participant. Our value proposition for the second co-creation process was therefore:

> Provide relevant and appealing information to older adults which activates and motivates joint walks in the district and supports service providers in organising and announcing these kinds of walks by exploiting the full potential of multimedia technologies.

Fig. 3 Example of walk in printed neighbourhood guide

The expected impact was that due to the more activating way of presenting walks more older adults in the district would participate in walking tours. This would encourage walks not only in their own neighbourhood but also in others. In addition, we expected that the information provided also improves the advertisement of walking tours by the service providers and intermediaries.

Engaging Stakeholders

Before describing our engagement activities in more detail, the following table provides an overview about the key lessons learned for these activities and how we planned to implement them in the second co-creation project (Table 5).

Engaged Co-creators
Our learning from the first phase had shown that we had focussed too much on the engagement of older adults. Therefore, in Hemelingen we aimed to engage different groups of people to support the co-creation projects in different ways from the beginning (O-2.1). In order to build the service on existing data, we therefore initially identified the group of people that had produced the printed district guide (O-1.1). This was a network of *elderly care service providers* called "Alte Vielfalt". Another main insight from Bremen Osterholz was that the recruitment of older adults is most successful when processed through local intermediaries (O-2.3). The network "Alte Vielfalt" turned out to be the appropriate stakeholder group also in this regard. Another advantage of including this group was that they could host the co-creation meetings, that they had an interest as target group (and potential users) in supporting the co-creation process and that they could potentially maintain the co-created service (O-3.2). We attended one of the regular meetings of this group and presented the project and our request. The response was predominantly positive—the members of the network expressed their appreciation for our commitment to the district and their willingness to engage in the project. From the whole network 7 members committed themselves to be part of a "project board" that would recruit different groups of older adults for the co-creation process and that would accompany and support the whole process (O-1.2).

As result from our experiences from the first co-creation project, we decided not to engage with individual *older adults* in the form of *one* core project group and additional co-creators, but to involve different existing groups in different phases of the process (O-2.5). Through this approach, we wanted to make sure that people from different neighbourhoods and with different skills and knowledge get involved. By using certain resources for specific purposes in the different phases we wanted to lower the barriers for participation, firstly because it becomes possible to participate selectively in certain tasks and secondly because it is not required to commit to the whole process of 6 months. The members of our project board "Alte Vielfalt" recruited three existing groups in three different neighbourhoods for initial focus groups:

Table 5 Lessons learned for engaging stakeholders in the second co-creation project

	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
Planning	O-1.1: Start with an existing group of relevant data providers	Identify a district in which a printed neighbourhood guide already exists as a basis for data and identify the group of people that produced it
	O-1.2: Establish project group of local stakeholders	Identify a district in which a network of service providers already collaborates and which may be interested in extending their collaboration to the development of a digital district guide
	O-1.5: Establish transparent decision-making procedures	Establish a procedure to document the process and decision-making to all participating stakeholders
Engaging stakeholders	O-2.1: Identify the role of intermediaries in co-creation process	Consider the different roles of intermediaries and explain expectations well in advance (e.g. role of local government, role of service providers in process)
	O-2.2: Consider context in which older adults are invited to participate	Identify a network/group of service and care providers which can host the co-creation process and facilitate recruitment within the context of their work
	O-2.3: Engage intermediaries to support recruitment	Identify a network/group of service and care providers, which facilitate recruitment within the context of their work
	O-2.4: Establish older adults as experts	If activities such as cultural probes are reduced (O-1.1), find new ways of establishing older adults' expertise early on in the process and allow them to reflect on their practices for identifying needs and resources
	O-2.5: Facilitate role shift of older adults	Define the co-creation process in a transparent and clear way. Communicate tasks early on. Identify interests and abilities of participating older adults
Co-creating a service concept	O-3.2: Consider intermediaries as main users of a service	Identify intermediaries, such as service and care providers and investigate how a digital service could support their work

- A tablet group in a senior residence home;
- A group of older adults that regularly participate in events and activities organised by the protestant church in the district;
- A group of people with mental health problems.

The engagement of the first and the third group was not successful. In the senior residence home, the older residents stated that there was no need for a district guide like we had planned to develop since the residents struggled with problems of physical as well as infrastructural mobility and hence did not see any relevance for a district guide that informs them about places they could not reach.

The intermediary that had arranged the focus groups with people with mental health problems alerted us early on, that they would probably not be able to commit to a longer process. The idea with this focus group was to gain feedback on the Osterholz service and assess its relevance.

Later on different older adults from the different neighbourhoods were engaged in (parts of) the process. Most of them were recruited through the social activities manager of the protestant church in the neighbourhood Hemelingen and through the walking workshops that were announced as neighbourhood walks in different parts of the district. Some participants only showed up at a single intervention, others participated regularly. From the initial focus groups and the following activities, a group of 7 older adults formed that engaged in the data and design activities.

The *local government* was not involved as key partner. However, we presented the project to the local advisory council and kept a close communication with the head of the local district council.

Finally, FTB participated in the co-creation activities and implemented the app in continuous interaction and feedback loops.

Other organisations that were involved in specific parts of the project were

- *ButenAktiv*: a research team from the public health department of the University of Bremen that conducted a project on physical activities and ageing in the district. After an initial meeting, the collaboration was limited to the inclusion of one of their walks to our digital district guide.
- *Accessible City Guide projec*t: a bureau for urban planning that conducts a government-funded project on the accessibility of facilities and routes in the city and that collaborated with us on the measurement of barriers on walking routes.

Overall the following number of people per stakeholder group were involved (Table 6).

The co-creation streams in which they were engaged differed. For example, the biggest number of older adults was involved in the co-creation of the service concept (24) and the working with (open) data (36). Only few were involved in the co-creation of software (9) (Fig. 4).

Table 6 Number of people involved per stakeholder group

Involved stakeholders	Number of people involved
Older adults	46
Local government	5
Software developers	2
Local service providers	6
Co-creation facilitators	5
Other organisations	8
Intermediaries	2

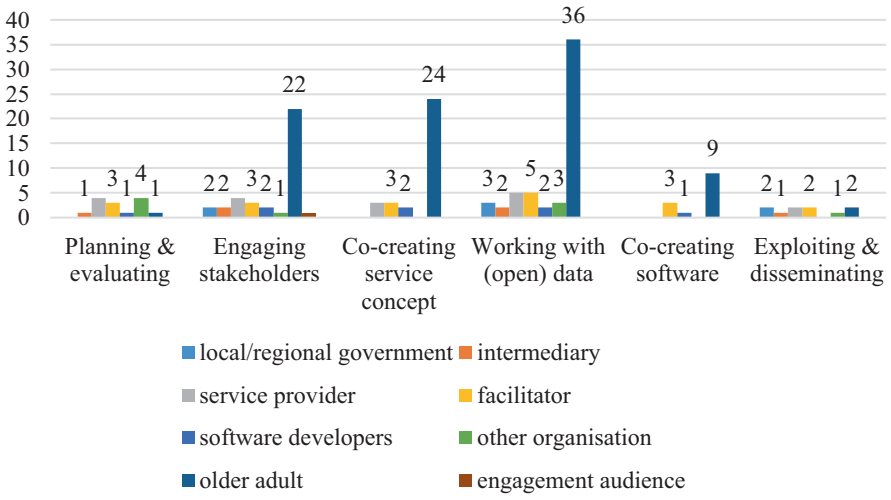


Fig. 4 Stakeholder engagement per co-creation stream

Project Organisation/Governance

In contrast to our project organisation in Bremen Osterholz where the core group was constituted by a group of older adults, in Bremen Hemelingen we followed a different governance structure by setting up a project board consisting of seven service providers, one older adult and three facilitators (researchers from ifib). In order to get a better understanding of the types of stakeholders involved, a brief overview is provided about the seven service providers in the following.

Förderverein Familienzentrum MOBILE e.V.

The Family Centre Mobile is a meeting place for all generations. It was planned with the participation of residents and experts from social institutions in the Hemelingen district and was built by the Bremen Society for Urban Renewal, Urban Development and Housing Construction. The planning and construction were funded by the European Union, the Federal Government, the City of Bremen as part of the "Living in Neighbourhoods" programme, the "Wohnliche Stadt" foundation in Bremen and the Hemelingen district advisory board. The association provides extensive groups and counselling for children, families and older adults. They also provide professional guidance on further assistance in family matters of any kind. The services for older adults comprise a senior citizens' café, a breakfast and lunch, special offers, trips for senior people and various small projects can also be taken up or supported in the family centre. After our project an IT-support group for older adults was planned, where older adults can learn about PC's, Smartphones, tablets and Internet applications.

Aufsuchende Altenarbeit

The project "Outreach Work with Older Adults" is a model project of the Bremen Senator for Social Affairs, Children, Youth and Women's Issues. It is now being carried out as a standard service of open care for the older people in four districts

(amongst them Hemelingen). It helps and supports older adults who want to stay at home in their familiar surroundings as long as possible. Through visits and joint activities the aim is to counteract the threat of loneliness and thus noticeably improve the quality of life. Voluntary visitors regularly offer social activities and provide information on the district. Upon request, support is arranged or participation in events is organised.

Bürgerhaus Hemelingen
The community centres in Bremen are the cultural and social meeting points in the districts supported by the Bremen city administration. They are run by non-profit associations. They offer groups and courses for children, adolescents, adults, seniors, on a range of activities, covering hobbies, sports, health, entertainment, culture or languages. The community centres are run by full-time and volunteer staff. The community centre Hemelingen is the central cultural and social institution in the district. For seniors the community centre offers a yoga course for seniors 50+, as well as a PC and Internet workshops and courses and painting courses. It houses a café, where people can meet even without consuming something.

Begegnungszentrum der evangelischen Kirche Bremen Hemelingen
The meeting centre is the community centre of the Protestant parish in the district. It is a meeting place for senior citizens' as well as children and includes a nursery. In addition to facilitating social encounters, it also organises concerts and festivities, counselling services and a broad range of activities for older adults.

ASB
The Arbeiter-Samariter-Bund Deutschland e. V. is a politically and religiously independent relief and welfare organisation. The section "mental health" is promoting mental health—through support for mentally ill people. The services are not specifically focussed on older adults. However, the representative from the organisation is actively involved in work with older adults in the district.

Quartiersmanagement
Due to special challenges in some parts of Bremen, various neighbourhood development programmes have been installed in the past, including Hemelingen. The neighbourhood management supports the implementation of ideas, the networking of actors and the application of additional funding. It coordinates the various activities, processes and funding programmes. Prerequisite for this is the cooperation in and initiation of networks as well as the support and activation of project sponsors and residents on site. The neighbourhood management is available to all actors and residents and operates both in the neighbourhood and in the political-administrative domain, in order to involve as many local actors as possible in the neighbourhood development and to act as an intermediary on different levels. The neighbourhood manager in Hemelingen targets isolation and segregation of disadvantaged people. She initiated projects to create opportunities for participation. With respect to older residents, she is involved in different projects in the district in cooperation with

other organisations. She also offers consulting services for older people who suffer from poverty.

Stadtteilmarketing
The district marketing is an association that works as an interface between trade and commerce, business, administration, politics and citizens in Hemelingen. It plays an information and moderation role and mediates between voluntary and full-time organised claim and interest groups. Their aim is to promote Hemelingen as a "district worth living in". One main part of this task is to organise events and activities. Furthermore, the district marketing runs a website with comprehensive information on activities, events and services in the district. One focus is on older adults.

Bremer Heimstiftung
The Bremer Heimstiftung is a non-profit organisation offering residences to older citizens. The foundation is part of a civic network in Bremen. The organisation is represented in the network by the head of the residence "Arberger Mühle" in the neighbourhood Arbergen in Bremen Hemelingen.

The project board met regularly on a monthly basis. In total, there were six project board meetings (with an average of five members participating). Initially the main task of the project board was to explore issues that concerned older citizens and service providers in the district and to recruit groups of older adults for focus groups. The members of the project board also worked as important intermediaries for the involvement of further co-creators. During the process, we jointly reflected on the conducted activities and arranged the next steps. In the meetings, the facilitators presented the activities that had been conducted and got feedback from the group. Jointly we reflected on progress and problems that arose from the process. Additionally, the members of the project board were involved in the data creation and validation. One member of the project board, the social activities manager of the protestant community centre, took a special role in the process: She hosted all the project board meetings and most of the co-creation activities. She also organised and attended some of the co-creation activities.

In order to keep all involved stakeholders up-to-date with the process (O-1.5), we set up a blog with a project diary where we documented every single activity and its outcomes. In addition to a description of the project, the blog contained an entry for each activity as well as an announcement of the next activity (Fig. 5).

Each activity was described featuring

- the type of activity;
- its location, duration and date;
- a summary of the activities and outcomes (e.g. decisions),
- pictures

Below each entry, there is a comment box (Fig. 6).

Fig. 5 The project blog

Co-creating a Service Concept

There were three key recommendations derived from our co-creation process in Osterholz that were relevant for the co-creation of a service concept. The table below outlines what actions we planned to implement in the second co-creation process (Table 7).

Initially, we conducted a preliminary survey and analysis of existing services. Subsequently, we ran *two rounds of initial focus groups with three different groups of older adults* in order to validate the service concept developed in Osterholz and receive some first ideas on a rough service concept. The three groups covered three

Fig. 6 The project blog

Table 7 Lessons learned for co-creation a service concept in the second co-creation project

	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
Co-creating a service concept	O-3.1: Consider methods that connect different activities and relate to defining characteristics of the target group	Use methods that connect different activities and allow for the refinement of the target user groups
	O-3.2: Consider intermediaries as main users of a service	Identify intermediaries, such as service and care providers and investigate how a digital service could support their work
	O-3.3: Consider a service that is more activating/beyond information provision	Identify and implement potential services that could complement the information provided in a digital district guide

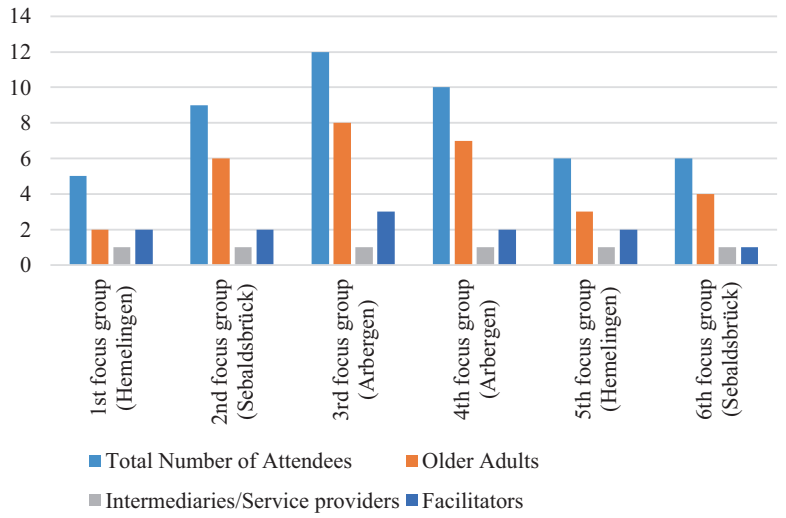


Fig. 7 Number of stakeholders in focus groups

different neighbourhoods in the district. One group consisted of older adults that regularly participate in activities from the community centre of the Protestant church. The second focus group was conducted with a group of people with mental health problems. The third group was a group of people from a resident home for older adults. However, the last two groups could not be engaged in the further process (Fig. 7).

We had learned from the first co-creation project, that one needed to have an idea of the thematic space of the service, the target user group(s) and the kind of technical solution that is going to be developed (mobile app, website). Since we had planned to co-create a digital district guide similar to one from our first co-creation project, we took this service as a starting point for the development of a refined service concept. Hence, in the first round of focus groups our intended goal was to get feedback on the Osterholz service and to detail a rough service concept for Hemelingen. We presented the project and completed the consent forms. We talked about where participants get information about the district and showed the digital district guide from Osterholz and discussed it. We worked with printed screenshots of the district guide in order not to alienate people that may feel intimidated by using a tablet. The focus was on the content, and we worked on the following tasks

- Are the categories on the front page the important topics? What is missing?
- Is the content under each topic what you expected it to be? What is missing?
- Are the attributes appropriate to describe the places in the respective category?
- Are the information relevant at all? Can you find them somewhere else?

We further discussed relevant topics in the district for older adults and handed out a reduced set of cultural probes. In two of the focus groups, we got positive

feedback on the Osterholz district guide. In the elderly care home however, it became apparent that a district guide was not of relevance for the residents. Most of them suffered from health-related mobility restrictions and had much more basic needs than the kind of service we planned to develop could respond to (e.g. better access to public transport).

In the second round of focus groups, we worked with the printed district guide and discussed in what ways a digital district guide could enhance/complement the service in an activating way. In parallel, we had discussed the question with project board. Both stakeholder groups, service providers and older adults, emphasized the issue of segregation and the lack of a mutual identity inside the district. In addition, the social activities manager of the community centre of the Protestant church reported on a strong interest amongst older residents for joint district walks.

We determined with our participants in the focus groups as well as in agreement with the project board to focus on district walks. The concept we developed was a digital walking guide for the district. It had to contain activating elements that motivate older adults to go outside, to meet others and to explore other neighbourhoods. Furthermore, it should support the service providers to organise and conduct these kind of activities.

Probes In order to make the probes more feasible (O-1.3), we cut down on the probes pack. We did this by adapting the initial set of probes from the first phase. Instead of a daily diary, we included a more standardised questionnaire. The aim was not so much to understand the everyday life of participant but rather to gather data on them, their relation to the district and their experiences and skills with digital technologies. We kept the map of the district.

In the following I report on our negative experiences with using these reduced probes with a group of six residents of a care home, all aged above 79 years.

In an initial workshop, we introduced the project and discussed about the information needs and interests of the group. All, but one of the participants were active users of mobile devices, such as tablets and members of a "tablet group" which meets regularly. During this initial workshop we handed out the probes bags to each of the participants. In a workshop scheduled two weeks later, we agreed to collect them again.

In contrast to the experiences we made in Bremen Osterholz, this group did not appreciate the probes at all. One participant spoke of a "shock bag". We had the opportunity to discuss with the participants about their experience in the workshop (after which they jointly decided not to participate in the project anymore) as well as separately with the director of the residence home.

The reasons for the rejection of the probes may be manifold, but I would like to concentrate on two here: (1) the tasks were not appropriate for the participants and (2) by trying to complete the tasks, participants were not established as experts but rather were identifying their own limitations and perceived deficits. The first point relates to the map, which was not well to read. This experience was reported as being frustrating for the participants who subsequently questioned either their own

ability to fulfil the task as well as our good intentions in posing such a difficult task in the first place. The second point relates to our focus on movement patterns, socio-spatial networks and knowledge about the district which did not fit well with the participants' abilities and interests: since many of them had mobility impairments, questions relating to their movement patterns made them even more aware of their limitations. Moreover, since most of them had only recently moved to the district (into a residence home) they neither had many social relations nor comprehensive knowledge about the district. Participants justifiably questioned how well we had anticipated and understood their particular situation.

In our striving to develop sets of probes that may be used in other co-creation contexts also focussing on space-related issues concerning ageing (e.g. ageing in place), we only slightly adapted the probes from our first process. However, we had to realise that in order to develop meaningful and engaging probes, a much more substantial engagement with the specific circumstances of participants needs to take place. Sadly here, the probes did not establish participants as experts of their everyday life and ageing in a neighbourhood, but rather highlighted their increased immobility and age-related deficits.

In sum: In contrast to Osterholz, we agreed to co-create a digital district map with a specific focus on neighbourhood walks (O-4.2). In addition to simply providing information about possible walks/routes, we planned to include (1) *activating functionalities* (e.g., to organise and/or participate in social activities via online tools – O-3.3) and (2) to *support elderly care and support providers* to organise inclusive activities for older adults (O-3.2)

Working with (Open) Data: Data Walks and Content Creation

There were three lessons learned derived from our co-creation project in Osterholz that were relevant to the working with (open) data in Hemelingen. The actions to be taken in Hemelingen are outlined below (Table 8).

Data Walks

Step 1: Detailing the service idea for digital walks

In order to detail the concept for a digital service and define the data (categories), a first walking workshop was conducted in June 2017 together with a social activity manager of a senior citizen centre. The participants were recruited through the staff of the senior citizen centre but also via newspaper announcements. Most participants could walk without support, few had walking aides. The intended goal was to identify relevant attributes for walking routes (what information older adults need or are interested in on walking routes). In addition, the aim was to raise interest in the project so that participants would become engaged throughout the process.

Table 8 Lessons learned for working with (open) data in the second co-creation project

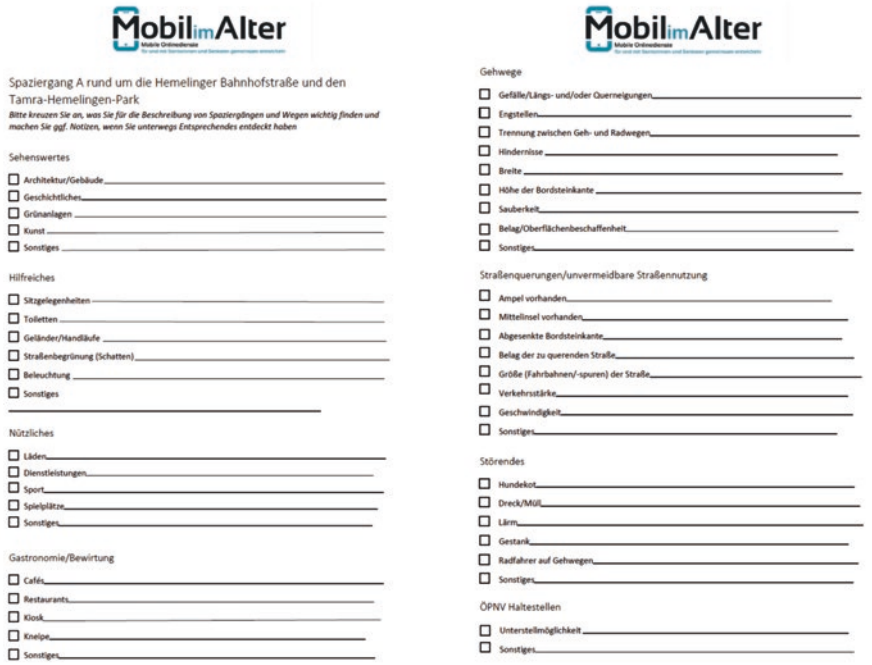
	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
Co-creating (open) data	O-4.1: Take into account that information identified as relevant may not be available as open data	Plan ahead to collaborate with various data owners (e.g. service providers) and allow sufficient time for data creation during the co-creation process. Offer a user-friendly backend for inputting data to participants
	O-4.2: Less is more. Concentrate on a few categories of objects	Identify and concentrate on a manageable number of categories of objects (in line with the human resources available and involved in the co-creation process)
	O-4.3: Consider methods for "snowball" data collection	Use methods that allow a variety of older adults to contribute to the data collection

The route had been defined in a preceding meeting with the project board. The announcements in the newspapers foregrounded the joint walk through the neighbourhood rather than the technology focus of the project itself, in order to keep the barriers for participation low. It was planned to walk together along the route and complete a questionnaire on what attributes may be considered relevant (Fig. 8).

The questionnaire had been developed based on literature on accessible and age-friendly neighbourhoods and cities by the team facilitating the project. It asked the participants 'to mark what you think is important for the description of walks and paths and make notes if you have discovered something accordingly on the way' and offer response items in the following areas:

- Points of interest (Architecture/buildings, historical, green areas, art, other)
- Helpful things (benches, restrooms, railing/handrails, street greening (shade), illumination, other)
- Useful things (shops, services, sport, playgrounds, other)
- Rest points/provision of food and drinks (cafés, restaurants, kiosk, bars, other)
- Sidewalks (Inclination/longitudinal and/or transverse inclinations, narrow places, separation of footpaths and cycle paths, obstacles, breadth, height of the curb, cleanness, surface condition, other)
- Road crossing/unavoidable road use (traffic light available, traffic island available, lowered curb, surface of the road to be crossed
- Size (lanes/tracks) of the road, traffic intensity, pace, other)
- Annoying things (dog excrement, dirt/waste, noise, smell, cyclists on footpaths, other)
- Public transport stops (shelter, other)

Nine older residents from the district participated in the first walk. Most of them had lived there for a long time and were very knowledgeable about it. For example, they talked about the historical developments in the district, which turned out to be a main point of interest for walks.



MobilimAlter

Spaziergang A rund um die Hemelinger Bahnhofstraße und den Tamra-Hemelingen-Park

Bitte kreuzen Sie an, was Sie für die Beschreibung von Spaziergängen und Wegen wichtig finden und machen Sie ggf. Notizen, wenn Sie unterwegs Entsprechendes entdeckt haben

Sehenswertes

- ☐ Architektur/Gebäude
- ☐ Geschichtliches
- ☐ Grünanlagen
- ☐ Kunst
- ☐ Sonstiges

Hilfreiches

- ☐ Sitzgelegenheiten
- ☐ Toiletten
- ☐ Geländer/Handläufe
- ☐ Straßenbegrünung (Schatten)
- ☐ Beleuchtung
- ☐ Sonstiges

Nützliches

- ☐ Läden
- ☐ Dienstleistungen
- ☐ Sport
- ☐ Spielplätze
- ☐ Sonstiges

Gastronomie/Bewirtung

- ☐ Cafés
- ☐ Restaurants
- ☐ Kiosk
- ☐ Kneipe
- ☐ Sonstiges

MobilimAlter

Gehwege

- ☐ Gefälle/Längs- und/oder Querneigungen
- ☐ Engstellen
- ☐ Trennung zwischen Geh- und Radwegen
- ☐ Hindernisse
- ☐ Breite
- ☐ Höhe der Bordsteinkante
- ☐ Sauberkeit
- ☐ Belag/Oberflächenbeschaffenheit
- ☐ Sonstiges

Straßenquerungen/unvermeidbare Straßennutzung

- ☐ Ampel vorhanden
- ☐ Mittelinsel vorhanden
- ☐ Abgesenkte Bordsteinkante
- ☐ Belag der zu querenden Straße
- ☐ Größe (Fahrbahnen/-spuren) der Straße
- ☐ Verkehrsstärke
- ☐ Geschwindigkeit
- ☐ Sonstiges

Störendes

- ☐ Hundekot
- ☐ Dreck/Müll
- ☐ Lärm
- ☐ Gestank
- ☐ Radfahrer auf Gehwegen
- ☐ Sonstiges

ÖPNV Haltestellen

- ☐ Unterstellmöglichkeit
- ☐ Sonstiges

Fig. 8 The questionnaire on attributes for describing walking routes

The analysis of the questionnaire confirmed the impression that the participants were more interested in historical and recreational attributes than in information on accessibility. Five participants were interested in architecture and buildings; four were interested in historical information. Six were interested in recreational spaces. While seven stated to appreciate information on benches and toilets, only three were interested in information about traffic lights and almost none listed any of the attributes concerning the pavement and the road crossing. In a subsequent focus group, which was meant as a debrief of the results, it became apparent that, in addition to the accessibility of walks, a thematic focus of the digital walking guide on historical and recreational walks was commended.

The results of this first walk confronted us with the recognition that the data required to realise this service idea were not available. We had expected that the target group would be particularly interested in the accessibility of routes and buildings, public transport, benches, toilets, restaurants and other practical aspects, on which open data sets are (easily) available. However, we quickly realised that the required information on the history of and stories about the district as well as tips about recreational places (e.g. for walking) was not available: All of the participants had their personal stories to tell which revealed surprising and interesting facts

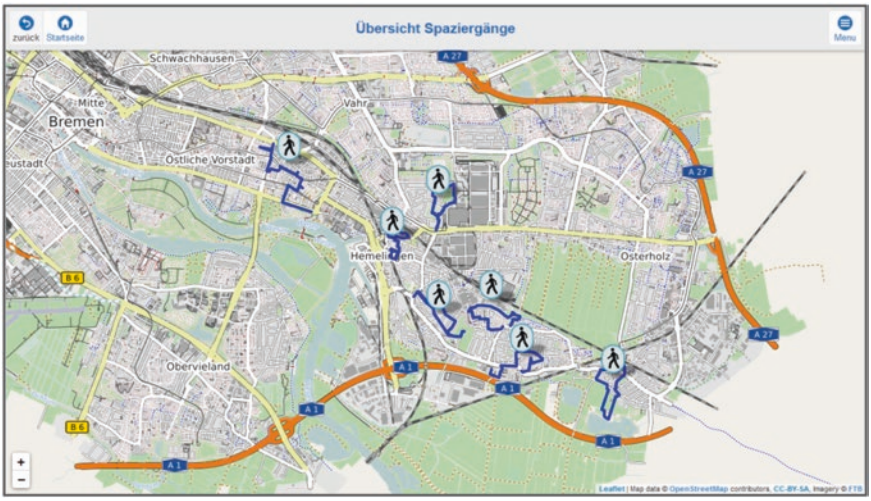


Fig. 9 Map with the routes of the neighbourhood walks

about the historical development of the neighbourhood. Some of them knew places unknown to the others they wanted to share. In order to collect this local knowledge and make it available via a digital service to a broad range of older adults in the district, we started conducting data co-creation walks.

Step 2: Conducting data co-creation walks

In a second step, we conducted walks to engage further residents and co-create data on these walks. They differed in their scope and framing:

- Walks in parks and recreational areas (walks 1–4)
  The walks were conducted in collaboration with the senior citizen meeting place in one of the neighbourhoods.
- Guided historical walks (walks 5–6)
  We conducted two walks that were each organised by an older resident that talked about the neighbourhoods' history.

The figure below provides an overview on the walks, that we co-created (Fig. 9).

Each walk was announced via the local newspapers, the district's website as well as the network of service providers. They were between 2 and 3 km and lasted between 90 min and 2 h. This time was proposed by the network of service providers (project board) as most suitable (also for people with mobility issues) and included time for breaks. The starting points were well-known places in the district and reachable by public transport. Each of the walks included at least one stop for either lunch or cake and coffee. The descriptions of the walks featured places with lunch offers for older adults or coffee and cake as well as public toilets and benches. Figure 10 presents an overview of the different participant groups participating in the walks. Figure 11 shows how participants took notes during the walks.

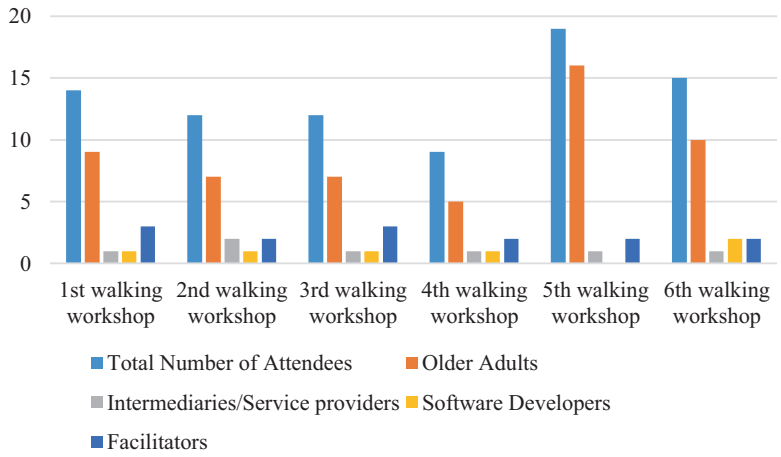


Fig. 10 Number of participants per stakeholder group in walking workshops

Fig. 11 Note-taking during our walks

The older participants and service providers assumed different roles in the walks which are summarised in the following table (Table 9).

During the walks, a central topic that the participants discussed was the age-friendliness of the urban infrastructure. Part of the discussion on the walks was voice recorded, valuable data on problems about and with the physical infrastructure were collected. Subsequently, the data was presented during one of the district council meetings in order to suggest improvements (e.g. installing new benches). The data collected on the walks was then used to co-create a walking guide that visualises the routes and provides relevant information as well as appealing multi-media content that is meant to motivate older adults to explore their district jointly. In order to do so, a number of design workshops were conducted in which participant produced multi-media content.

Table 9 Roles assumed by co-creators during walks

Role	Description
Organiser	One of the local social care service provider acted as organiser of the walks. They published the announcement in their networks and newspapers and also organised with other service providers for visits during lunch time or for coffee and cake
Guide	The tours were either guided by knowledgeable residents on historical points of interest or planned as walks through parks and recreational areas
Data collector	Most participants on the walks used a clipboard to note down points of interest, issues with the infrastructure (e.g. missing benches) and other noteworthy things
Data validator	One of our participants checked the location of benches on the walks as provided by OpenStreetMap. If benches were missing on OSM, he added them; if benches were listed on OSM but not existent, they were deleted
Photographer	Overall, three older adults participated supported our data collection by taking pictures. Not all pictures could be taken during one of the walk, so all of them volunteered to visit points of interest again

Step 3: User Testing

In order to review the functionality of the app, which was developed in subsequent workshops and the quality of the data, a last walk was conducted where participants tested the application on tablets. They were asked to review and discuss the functionalities, the relevance of the content and the quality of the data. This led to a number of usability and functional issues that had to be resolved. In a subsequent focus group, we asked for further feedback. The participants emphasised that they were happy to see the progress of the app, the contents and their own contribution to it.

Summary: Phases 1–3

Overall, the walkshops conducted helped us define and refine a service concept, co-create data and test the digital service developed. Participants in those walking workshops assumed a number of different roles, from explorer (what kind of walks are of interest to other older adults), to idea former (what kind of information may be of interest to others), to data creators and validators, users and testers of digital apps.

Content Creation Workshops

In addition to the individual walks in *Bremen Hemelingen* that we ran a series of eight content creation workshops in order to (1) recruit older adults, (2) demonstrate the interest of older residents in such walks and (3) collect data (and produce digital content for the digital district guide). These content creation workshops were supported by accompanying tablet support groups for those older adults which were not familiar with digital technologies.

Overall we conducted 11 workshops dedicated to either content co-creation (8) or software co-creation (3). We called them all "tablet workshops" as we were working with tablets and it did not matter to the participants to distinguish between the two types of activities. There was generally a good attendance with an average of four to five participants.

Using a Content Management System[3]

Our core group consisted of five male and two female participants with varying technology skills and knowledge about the district. In those workshops (and the times between meetings), participants described the walks according to the attributes/templates defined under the service concept. Participants had access to a tailor-made back-end in order to provide these descriptions and information to the system (Fig. 12).

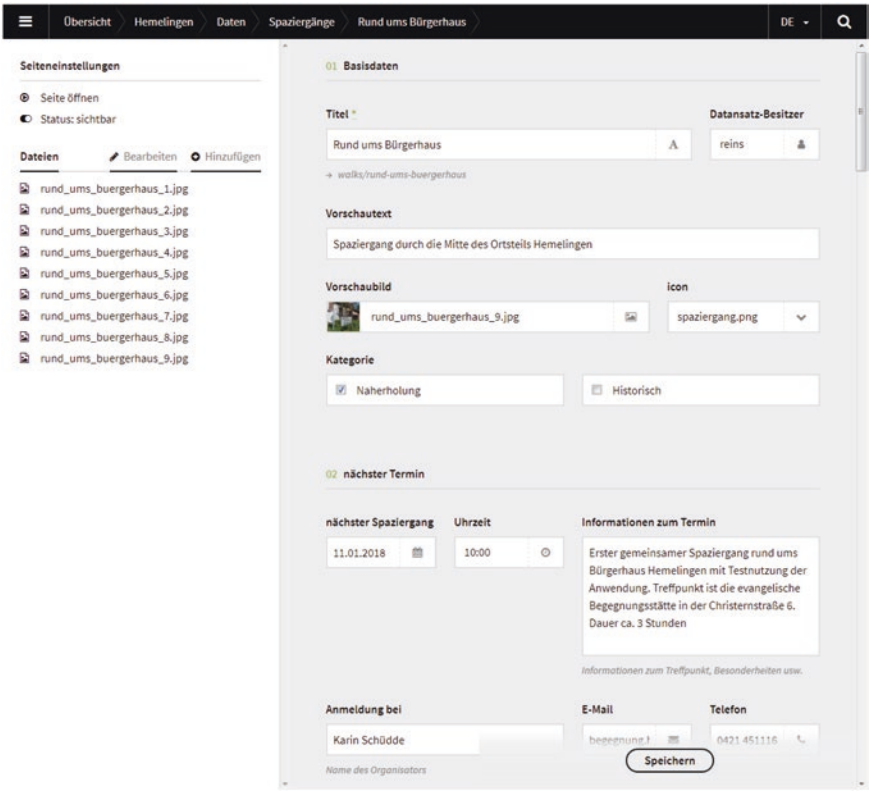


Fig. 12 Screenshot of the data backend for a walk

[3] This system was set-up by our Mobile Age partner FTB.

After the very rudimentary and pragmatic data creation support in the first co-creation project in Osterholz, a more user-friendly backend for the second co-creation project was desired. For Hemelingen, a content management system (CMS) handled the data co-creation of the participants. A location database was manually initialised with the data provided by the printed "Stadtteilplan für ältere Menschen – Hemelingen" and then maintained and improved by the participants of the co-creation workshops.

Creating Screenplays and Producing Multimedia Slideshows

In addition, participants produced short videos about the walks in order to raise interest in the walks. Originally, we had thought that the information gathered on the walks and from participants could easily be used for video and audio clips attached to each walk. However, participants had difficulties to do so from a user-perspective. In order to enable participants to shift their perspective from reporting their own experience to creating motivating videos that make other people feel like wanting to experience the walks, we recognised the need to develop scripts for multimedia screenplays, storylines of what the highlights of the walks are, and a corresponding video sequence and corresponding comments on the voice track. This did not only require a new conceptual perspective but also different software tools for slide show creation. We used a video editing app on the tablets.

Most of the produced videos are slideshows of photographs and include a spoken text by participants. The reasons for producing videos were (1) to create content for the digital neighbourhood guide, (2) to expose participants to (new) software, and (3) to allow older adults who do not feel comfortable in writing long texts to contribute orally. As we had experienced in Osterholz that not all participants felt comfortable and competent to write. Others did not feel competent to create slide shows on the tablets. In Hemelingen, the different participants with their respective preferences and abilities could take over different roles and complete different tasks according to their competencies and interests. This was considered a more inclusive practice. For parts of the descriptions, where we did not have written text, we used transcripts of the videos.

The picture below shows a participant checking the route on a printed map while working on the slide show, confirming where the picture on his tablet was taken (Fig. 13).

Detailed Information About a Walk

The detailed information page about a walk displays all relevant information stored for the walk. The information about walks contains:

- The title of the walk.
- A short description.
- The length of the walk.
- The estimated duration.
- A small image for decoration.
- A long description of the walk.
- A video clip if available.

Fig. 13 Producing a slideshow while checking the route

- An image gallery with a list of previews of all available photos.
- Information on availability of toilets, benches, street lightning and hospitality services along the route.

Detailed Information About a Location
In addition to information about the walks, participants also produced information about points of interest. The information about a location contains:

- The title of the location.
- A short description.
- The relevant categories of the location.
- A long description of the location.
- The address of the location if available or a description of where to find the place, if the place is a bigger area.
- A video clip, if available.
- An image gallery with a list of previews of all available photos.
- Keywords that Give a Brief Description of the Available Offers and Services.
- Information on how to get to the location by public transport
- Information about the accessibility of the location.
- Further important information.
- A block of contact information, like contact person, telephone number, email, homepage, sponsorship/owner and opening hours.

The data and information provided by the application was mainly produced by older adults who participated in the co-creation project. Some of the co-creation participants were able to use the app's database backend to feed in the collected data. The user-friendly backend was used for input and maintenance of structured data about the walks and the locations at the walks.

Table 10 Lessons learned for co-creating software in the second co-creation project

	Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
Co-creating software	O-5.1: Consider the reduction of prototyping tasks	Devote specific sessions to prototyping and only involve those older adults interested. Establish procedures to feed the continuous development back to participants
	O-5.2: Consider design of application beyond design of user interface	Consider design of data structures and back-end functionality for data maintenance

Some basic information was provided with permission of the media agency producing district guides for older adults. Further information was provided with permission of different providers (e.g. data on street lightening). The data sets were substantially supplemented by the participants of the co-creation workshops, with very detailed information, new walking routes, new locations, photos and video clips. Information about public toilets and benches/seats were retrieved from the German OpenStreetMap community,[4] for which one of the co-creation participants checked all public toilets and added the address information and opening hours.

Co-creating Software[5]

There were two lessons learned concerning the co-creation of software which we considered for our second co-creation project. The actions to be implemented are outlined in the table below (Table 10).

Based on lesson learned O-5.1, we decided to cut-down on the (paper) prototyping tasks and use digital prototyping sessions (and feedback sessions) to further advance our demonstrator. In total, we ran three prototyping workshops.

At the beginning of the content creation phase, we conducted one workshop in which we broadly defined the visualisation and functionality of walks. Rather than working in smaller groups, we had an open discussion with an oversized display on a pin board (Fig. 14). The Osterholz demonstrator served as a point of reference. The definition of attributes as developed during the walking workshops served to structure the information screens (Fig. 15).

In order to review (1) the functionality of the app and (2) the quality of the data we walked along one of the walks in the neighbourhood Hemelingen while using

[4] https://www.openstreetmap.de/.

[5] The software development and design work in this co-creation stream was led by our Mobile Age partner FTB.

Fig. 14 Discussing the design of the digital neighbourhood guide

Fig. 15 Paper prototype and zoomed in map with the route of a single walk. Pins are displayed for every location along the walk

the application on tablets. We asked participants to review the functionalities, the relevance of the content and the quality of the data. At a coffee break in between and a closing lunch, we discussed the feedback in the group. We observed the participants while using the app, took notes and audio-recorded the discussions.

Exploiting and Disseminating the Service

The main challenge and lesson learned from Osterholz in this stream of activity was that the sustainability of the service remains a big challenge (Table 11).

Dissemination and Communication of the Co-creation Process and Service
As we had learned from Osterholz that local newspapers are the most effective medium to reach our target group, we aimed at disseminating our activities in Hemelingen as best as possible via this channel. Since the district of Hemelingen is covered by the same newspaper supplement as Osterholz, we could use our contacts to journalists from two local newspapers. Before we started the co-creation activities in Hemelingen our aim was to raise awareness for the project in this district. According to our strategy not only to involve older adults, we wanted to make the project visible amongst older adults as well as intermediaries, service providers and members of the local government. In order to gain support from the local administration we organised a kick-off event in May 2017, were we invited the press.

During the kick-off event, we informed about the activities in Bremen Hemelingen and stated that we were looking for more collaborators in the core group. We also presented the results from our activities in Bremen Osterholz on a multi-touch table (see Fig. 16). The event was well attended with the head of local district government, the district marketing, representatives of the district council, two service providers from the network "Alte Vielfalt" and a neighbourhood manager.

At the local summer fair in Osterholz in May 2017, we presented the Osterholz app on a multi-touch table. Since the fair was also visited by many Hemelingen residents, we used this dissemination event of the results from Osterholz simultaneously for the recruitment of co-creators for Hemelingen. Several important actors from Hemelingen were there and we could raise interest and commitment amongst them through showing the results from Osterholz.

Through these two events we gained some public attention and the two local newspapers reported about the project and it's continuation in Bremen Hemelingen several times. Since our recruitment strategy to engage existing groups of older people through the service providers and intermediaries of our project board, did not work as well as expected, we used the press coverage to announce our activities. In particular, we wanted to attract a broad range of older residents in Hemelingen for the walking workshops.

Table 11 Lessons learned for exploiting and disseminating in the second co-creation process

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation project
O-6.1: Sustainability remains a big challenge	Identify local stakeholders that can sustain the maintenance of the service early in the process (e.g. identify ways in which the service serves their interests/supports their work)

Fig. 16 Meeting with local stakeholders in Hemelingen to present results from Osterholz on a multi-touch table

During the process, the newspapers reported on some of the conducted walks and simultaneously announced the next ones. We thereby reached a broad range of people that participated in the walks. In addition, the collaborating service providers announced our walks and tablet groups in their communication material. This led to quite a high number of participants in some of the walks. However, often a large number of the participants only showed up for one walk. Furthermore, our engagement with the project board opened up some other dissemination channels for us. The director of the district marketing invited us also to announce the walks on the event calendar on the website of the district marketing and she published an article in the annual magazine of the district.

Sustainability

As in the case of Bremen Osterholz, sustainability of the co-created demonstrator was achieved by the migration to the official city information provider bremen.online. Most crucial for the sustainability of a digital service is to keep the information offered up to date. As most of the data from Hemelingen had been generated by the participants there was no possibility for automatic updates and linked open data (as in Osterholz). On the other hand the attributes of the point of interest do not change very frequently. Therefore, the members of our project board and the "Alte Vielfalt" committed themselves to maintain the information on one walk each.

Similar to Bremen Osterholz, I provide below a canvas of the final co-created service (Fig. 17).

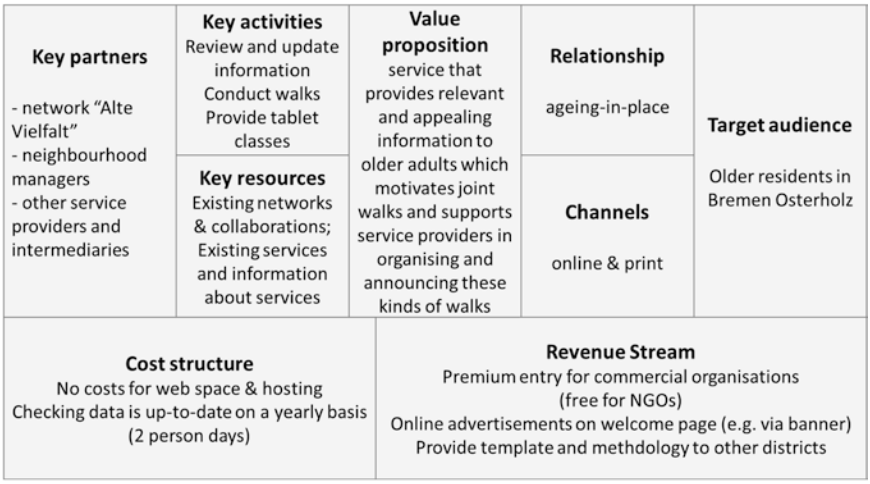


Fig. 17 Final canvas for co-created service in Bremen Hemelingen

Table 12 Overview of activities/methods deployed in Bremen Hemelingen from May 2017 to February 2018

Activity type	Number of activities
Cooperation meeting	2
Dissemination event	2
Tablet workshop	11
Stakeholder meeting (meetings with project board)	8
Data collection	2
Walking workshop	7
Focus group	8

Summary of Co-creation Process and Output

As in Osterholz, there was an emphasis on activities in the engagement with stakeholders, the co-creation of a service concept and the working with data. In contrast to Osterholz the co-creation of software took less time and space. Below, I provide an overview of the activities we used during our co-creation process (Table 12).

There are three kinds of output of the co-creation process of the interactive digital district guide for Bremen-Hemelingen:

- data collected and presented in the guide,
- an app providing access to these data,
- an online service in which data and app are embedded.

As it has been described above, the guide contains seven neighbourhood walks. A social activities manager emphasised the special appeal of the multimedia information in an interview:

> I also find it simply well turned out optically, with these word contributions or with the small videos, which are inserted and where then you can see the walks and the people, who were there, that I find already beautiful.

Value for Older Adults

All stakeholders assess the service as being relevant to older users. The overall relevance for this particular target group is seen in the relevance of walking for older adults. As the social activities manager says, that "going for a walk is much more part of the reality of older adults than of younger generations". And the director of the association for social work (MoBiLe) adds the dimension of retirement:

> I believe that […] for other people who already live here, but maybe have always worked, always had a family around them and maybe are now in a situation that they now also have time to do a bike tour or something.

In addition to the overall relevance of walks for older adults, the service providers, intermediaries and participants define the value of the service for particular groups of older adults. Most of the stakeholders emphasised the value of the walking guide for *older people who are not well oriented in the district***.** This applies for example to many of the new residents in elderly care homes and residents. The director of association for social work (MoBiLe) stated

> With such a portal you reach the people who are still fit, who can still walk, but they are also important to reach, right? Because these are often those who can still walk, but have no more ideas.

Also the social activities manager confirmed the motivational effect of the app and added that the service can help older people to find their way when walking:

> Well I think that the people who want to know, they will certainly orient themselves to it. […] And I think in this regard it is an excellent thing to get people moving again, because then maybe they know again, where can I can go? Something they may not have known before or haven't had any idea at all […]. Or if my neighbour tells me, you know, if you want to go out, then just walk into the Schleng-Park then the person also thinks, yes nice, but if I don't know where the Schleng-Park is and I'm new here then it can be very very helpful, if the route is drawn in correctly and the you have about an idea where to go.

The director of the community centre also saw a value for (*older*) *people with mobility issues*. On the one hand because the service provides routes with "various difficulty levels":

> And they [the walks] are all regarding the length I find them wonderful to walk, that's also my opinion, even with people with walkers you can walk 2.4 kilometers or 1.8 or what ever […] and I find that quite good that you simply have different possibilities.

On the other hand, she also considered the service relevant for people who cannot move outside and with the help of the service can "follow the route virtually". Furthermore, she saw a value for *older people with dementia*:

> Our dementia patients, for whom this is also is a great event, even if they may not be able to cope with it in the same way, but perhaps to evoke memories, right, of the past.

The director of the community centre further considered the service particularly relevant for *older people with little money*, who cannot afford to spend a lot of money for travelling:

> And especially in Hemelingen and especially with not only the age structure, but also with the financial structure in this neighbourhood and in this district […] Mahndorf is bourgeois, but in particular here in Hemelingen or also in Sebaldsbrück we have of course also many fellow citizens who simply have no money at all or little and certainly not at all to arrange leisure time.

In addition, to not having the chance to travel abroad, she saw a general value in „creating experiences that lay right on the door step" also in order to create a better image of the district. This is supported by the statement of a participant that also affirms the increasing relevance of the local environment in older age:

> Why wander far away, good things are so close.

The social activities manager mentioned the issue of *loneliness and fear* that in her opinion is addressed by the service. Because as she says for older people "walking alone is associated with fears". And one of the participants added the social dimension and said

> The tendency is always 'I don't have anyone to go with me' or so, […] then you can make an appointment if you want to do this or if you want to do that. And then it always goes 'If the others would, then I could' or so. This inertia […] it's basically like this that many people say 'I shall go to the park alone?!' or something. I mean, the best example is Mr G, an Arbergen resident who says 'I've never been to this park', that fascinates me.

Value for Intermediaries and Service Providers

While all stakeholders see a substantial value in the service for older adults, the service providers are not all convinced of the relevance it will have for their work. When asked if they could imagine if and how the walking guide could support them in their work, some are less enthusiastic than others. However, two service providers announced to conduct further walks, using our digital district guide. The neighbourhood manager sees a supporting function in the service for her work, since she often acts as a contact person for all kinds of questions of especially older adults:

> So perhaps it is another support, if you have eight walks or ten walks on such a page or in such a brochure and if somehow one is attacked with such questions like 'where can I go for a walk here at all? There is nothing here' […] and then one can say, 'yes you can go to the Schlengpark or where else can you go' and then you are considering and then you would have the guide and can open it and say, 'look, there you can, there you can, there'. So you would have something compiled on which you can fall back, which did not yet exist. […] or 'just have a look at the website, there are ten, twelve suggestions, where you can walk nice routes and, uh, get to know other things without using the car or just by train and bus or maybe actually by bike'.

This relative lack of seeing an immediate benefit for the own work may be due to the fact that the intermediaries have been involved—foremostly—as supporters of the process. If we had considered the user role more strongly, we would have set-up a second small co-creation group that looks at the ways they organise and announce walks, the problems they encounter and how a digital service might be helpful. In a final discussion, there was the idea that a separate editing function might support designing and printing the announcement of walks which are pinned on news boards. Another option might be a calendar function with the walks that are offered by different service providers with an online registration, so everybody can see how many people are expected to participate. In a kind of community building even volunteers might suggest or announce walks by themselves on such a platform.

A separate subject is the value with regard to e-inclusion. The director of the association for social work, who was planning to organise ICT courses for older adults, wants to use the walking guide:

> Then we will also open a group here for people who have never been engaged with these media before. […] and then we want to show them that it's not that bad, that you can really do something […] And then I wanted to take your page just as an example, right? So one shows them 'look' so they can see, that the Internet can also be used very quickly for one's own gain, right?

Further ICT courses are planned by two service providers.

Value for Government

The following table shows how the service relates to the objectives of the recent political priorities and central issues with regard to seniors defined by the State Ministry of Social Affairs, Women and Seniors (Table 13).

The service supports all four policy objectives and thereby the ministry can support similar processes in other districts of Bremen.

Table 13 Evaluating the value for government

Political objectives	Corresponding part of the guide
The district as home Districts are central for integration and social participation and politics should support people to stay in the district as long as possible (ageing in place)	The guide informs older adults of nice places and walks and thereby helps creating an image of the district as worth living
"Stadt in Bewegung" [City/Citizens in motion] Physical exercises (indoor and outdoor, e.g. in sporting clubs) shall be supported	The guide informs about walking routes and shall motivate older people to exercise outside
Living together in a growing city Opportunities for social participation will be improved in order to develop the city and improve tolerance for differences	The guide offers the possibility to organize joint walks and thereby supports the social participation of older adults
Good services for the city and its people	The guide itself is a good service for the district and its image as well as for the people

Outcome and Impact

In order to evaluate the outcome of our co-creation projects in Bremen Osterholz and Bremen Hemelingen, we conducted a survey amongst intermediaries and service providers working in these districts from December 2018 to January 2019.

Sustainability: Commitment for the Maintenance of the Service
The commitment of the intermediaries to the project and the outcome was in general quite high. The majority felt responsible for the content, even if only for parts of it (those parts where they have expertise mostly). Only 3 out of 10 did not feel responsible at all (Fig. 18).

Most of the service providers reviewed the content in order to detect errors or missing information. Of those who did, most reported those errors (Fig. 19).

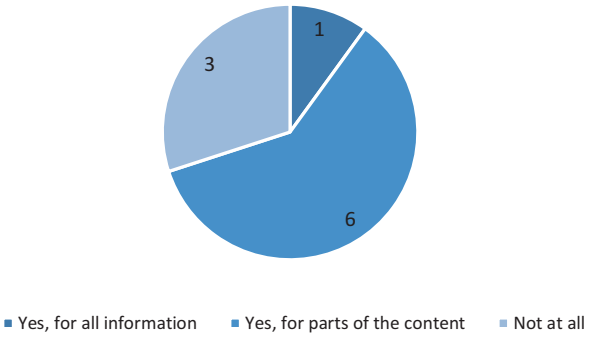


Fig. 18 Perceived responsibility for maintenance of information

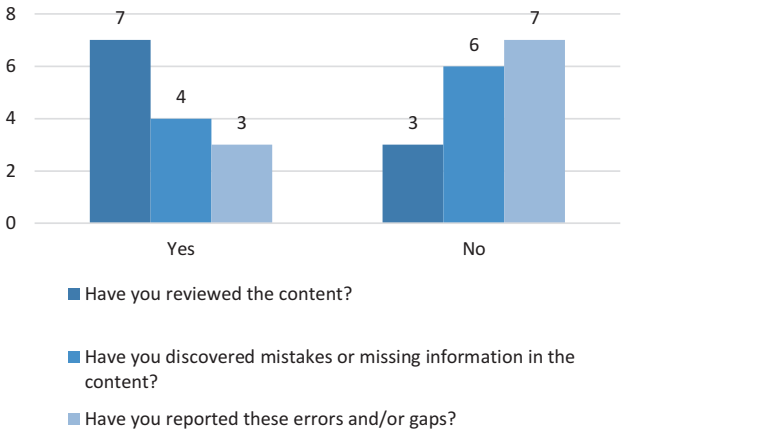


Fig. 19 Maintenance

Relevance

The printed versions of the guidebook are used by most of the intermediaries in their work with older adults. The two heads of the district councils use the brochures in their contact to older citizens, e.g. at neighbourhood meetings. They are also available at the city office in the district and are given to people e.g. at change of registration and passport extensions. The social service providers and social workers distribute the brochures in their own offices and are well received. The digital services are used by intermediaries in their regular tablet/ICT courses. Furthermore, they are used by the social service providers and social workers when their older customers ask about offers for seniors in the district (Fig. 20).

The intermediaries mainly estimate the service (web pages and printed) as being relevant for the support of older adults social connectedness, with 80% stating that the digital service is very relevant or relevant.

Dissemination

Half of the interviewed intermediaries have referred the service to colleagues, in particular the web pages. The members of the district administration state to have pointed out the service in meetings to colleagues from other districts of the city. One of the local district council heads was so enthusiastic, he set-up a number of meetings between the researchers from ifib and other district councils. This led to another co-creation project in one of Bremen's districts which was financed by the district itself. Others disseminated the services by linking to the web pages on their own website. The social service providers and social workers that were interviewed recommended it to their employees or to colleagues in senior citizens centres.

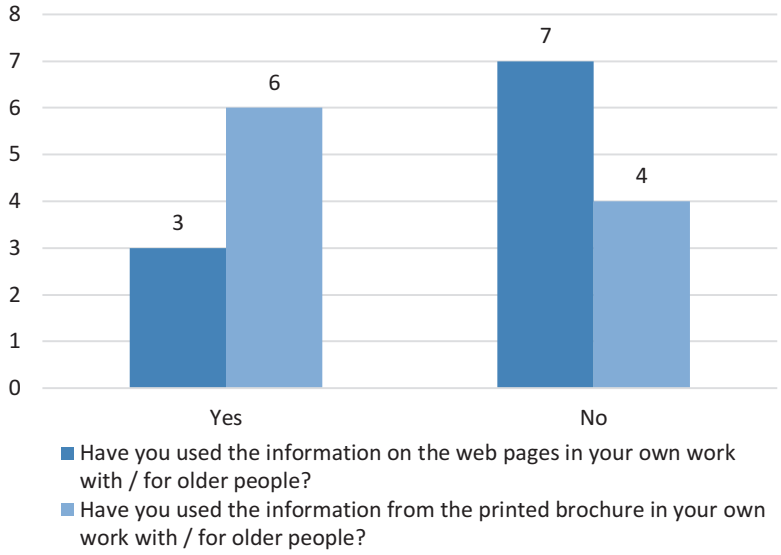


Fig. 20 Relevance of the service for the work with older adults

Impact of the Co-creation Projects

Finally, we asked the intermediaries in an open question for their assessment of the outcome and impact of the project as a whole *for older adults* in the district. Five main aspects were mentioned:

- The projects have contributed to more comprehensive information for older adults about the district.
- They have stimulated older residents to engage with digital media.
- They have facilitated the emergence of new services and courses such as tablet, PC and internet groups for older adults.
- They have facilitated social encounters amongst older inhabitants and thereby supported their social connectedness.
- They have given older residents the feeling of being valued and heard, and have encouraged them to play an active role and help shape the future of their neighbourhoods and districts.

Asked for the impact of the project on *their work* interviewees mentioned the following:

- Getting to know the district better;
- Extending their own service portfolio (pc/internet/tablet group);
- Being supported in the advocacy for older people's interests and rights;
- Expanding contacts to senior networks & to the older residents themselves;
- Being supported in advisory activities for older adults by the information/materials created in the project.

Lessons Learned

In the first co-creation project in Bremen Osterholz, we learned a lot with regard to all streams of our co-creation model and developed a set of lessons learnd for the second co-creation project in Bremen Hemelingen. In the following, I recall these lessons learned, show what actions had been taken and what lessons learned can be drawn.

Governing and Managing Co-creation

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-1.1: Start with an existing group of relevant data providers	Identify a district in which a printed neighbourhood guide already exists as a basis for data and identify the group of people that produced it	The media agency from the first co-creation process had edited a printed district guide for Hemelingen in 2016 in collaboration with the network "Alte Vielfalt". They provided these data for our intended digital guide

In the early phase of idea formation, the focus shifted from a comprehensive guide on services to more in depth information of nice places and walks. Therefore, the relevance of available open data decreased. However, the existence of printed guides was still a good starting point as they provide the benchmark for an improved digital multimedia service.

Lesson H-1.1: Get an overview on existing printed information in the domain of your problem focus and take them as a starting point and benchmark for an improved service that exploits the full potential of digital multimedia technologies. One of the main assumptions of Mobile Age was that co-created services for older adults would run on open government data. This has not been the case for Bremen. Governmental institutions did not provide the most relevant data. Rather, local service providers have proven to be the most important data sources relevant to older adults.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-1.2: Establish project group of local stakeholders	Identify a district in which a network of service providers already collaborates and which may be interested in extending their collaboration to the development of a digital district guide	Members of "Alte Vielfalt" became part of project board

The printed district guide had been developed with several intermediaries that cooperated in the network "Alte Vielfalt". They were editing a second edition of a district reader. They agreed to engage in a project board in order to support a complementary service to these printed guides. The collaboration with the Network "Alte Vielfalt" was helpful and beneficial to the process in several respects:

- It served as a means to legitimise the project in front of the local district council as something regarded beneficial by local stakeholders.
- It enabled us to have a positive press-coverage featuring relevant local stakeholders.
- It supported the recruitment of older adults.
- It ensured that we would develop a service relevant to local services providers.
- It ensured the sustainability of the service, because local stakeholders volunteered to maintain it.

We realised that only those members of the network participated who benefited most directly from the new service.

Lesson H-1.2: Start a co-creation process in collaboration with an existing network of intermediaries and service providers, who ideally have experience in collecting, editing and providing information for older adults and an interest in improving their role as information brokers.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-1.3.: Consider activities that are feasible	Cut down on the cultural probes pack, to make it less time consuming for participants and facilitators	The cultural probes were reduced to a questionnaire booklet, that allowed us to gain an overview about our participants' technology use practices and relationship with the district

In the second process, the probes pack had been reduced to a questionnaire instead of several tools for self-documentation. This was not welcomed by all participants. We had to realise that there is no "one-size-fits-many" option for probes. We found that amongst our target audience, a particular mistrust is prevalent when it comes to the disclosure of any kind of personal information. There needs to be an established and trusted relationship between facilitators and participants before introducing probes (or similar methods).

Lesson H-1.3: Written personal information of participants may only be collected during the co-creation process if necessary (e.g. for idea formation), and must be discussed and explained to participants in advance. The material needs to be tailored to the capabilities and realities of the persons involved.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-1.4.: Consider activities that support use of technology	Allow more time in the co-creation process for participants to get acquainted with technology. Offer support clinics outside of the core co-creation activities	We introduced the tablets earlier on in the process. We offered some additional training to non-tech savvy participants

We addressed this recommendation through a number of action points. Learning from Osterholz, we introduced the tablets earlier on in the process and offered some additional training to non-tech savvy participants. The training sessions were welcomed by our collaborating service providers as well as participants. For the co-creation process itself however, we had to realise that our training sessions were not sufficient to enable digitally illiterate participants to fully engage in technology-related activities and overcome, the imbalance in technological know-how amongst our core group of older adults.

H-1.4: Offer additional training to non-tech savvy participants, should they be interested in learning more about technology.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-1.5: Establish transparent decision-making procedures	Establish a procedure to document the process and decision-making to all participating stakeholders	We documented all our activities in a blog and circulated meeting minutes

As pointed out above, the decision making process was meant to be more transparent (e.g. through our activity blog). However, only few participating older adults consulted the blog, partly because they did not look for information in the internet; partly because they felt no need to follow the decision making process. In contrast, the blog was used and found useful by our project board of service providers and intermediaries.

H-1.5: Making the documentation and communication of activities and its results available to all involved stakeholders via suitable channels is indispensable for co-creation processes in order to ensure equal opportunities to exert influence among all involved stakeholders.

Engaging Stakeholders

Recommendations derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-2.1: Identify the role of intermediaries in co-creation process	Consider the different roles of intermediaries and explain expectations well in advance (e.g. role of local government, role of service providers in process)	Network “Alte Vielfalt” became our gate-keeper; local government endorsed the process

The close collaboration with intermediaries was beneficial to the co-creation process in several ways:

- They acted as *gate-keeper* to local government and supported the recruitment of older adults (see also O-2.3)
- They acted as *champions* of our project and endorsed the process during council meetings.
- They acted as *communicators* by promoting the project in the local newspapers, their own publications and the district fair.
- They served as *data providers* with data about their own services and resources.
- They will ensure the sustainability of the service.

Lesson H-1.2: Intermediaries can take different supporting roles in co-creation processes. However, the prerequisite for their commitment is that the outcome will benefit their work.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-2.2: Consider context in which older adults are invited to participate	Identify a network/group of service and care providers which can host the co-creation process within the context of their work	We conducted the neighbourhood walks in cooperation with a senior citizen meeting centre as part of their service offers

In Hemelingen, we aligned our co-creation process closer to the services and resources of local social care service providers and intermediaries. Older adults were invited to participate as part of the service offerings of these service providers. We hence, circumvented "cold recruiting" as in Osterholz but embedded our project as part of the existing service infrastructures. For example, the meeting places offer a variety of courses and meetings. They were ideally positioned to adopt our tablet courses as part of their offers. Likewise did the neighbourhood walks fit well to the services provided by some of our collaborating service providers. Recruitment is hence more effective, as these service providers are already actively involving a broad range of older adults from the district. The drawback might be that some people might not feel addressed by certain places/organisers (e.g. the church, a certain neighbourhood).

Lesson H-2.2: When embedding the process in existing services and activities be aware that only a certain part of the target group might be addressed (e.g through the church or in particular neighbourhoods). Consider to organise activities at different hosts and places.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-2.3: Engage intermediaries to support recruitment	Identify a network/group of service and care providers, which facilitate recruitment within the context of their work	For our first round of focus groups, network members ("Alte Vielfalt") recruited some of their customers

Intermediaries facilitated the recruitment of older adults mainly in two ways:

- *Explorative focus groups* with groups of older adults with very different skills and needs. These included:
  - A group of older adults with mental health issues
  - A group of older adults who regularly participate in activities from the protestant church congregation in the neighbourhood of Hemelingen
  - A group of older adults from a seniors residence home

- *Recruitment of older adults* for walks and walking workshops through the intermediaries' communication channels.

As we were aiming to collaborate with service providers whose service portfolio could potentially be complemented with the digital district guide, we expected that they would also provide the most effective access to older adults interested in and in need of such a service. This was only partially true. In particular, the group of older adults with mental health issues and the group of older adults from the senior residence home did not participate in the co-creation activities beyond the two scheduled focus groups. This way of recruitment however, allows validating the service idea with groups of older adults that cannot participate throughout the whole life cycle of such as project.

Lesson H-2.3: Engaging intermediaries for the recruitment requires a deep understanding and commitment of these intermediaries to the co-creation process.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-2.4: Establish older adults as experts	If activities such as cultural probes are reduced (O-1.1), find new ways of establishing older adults' expertise early on in the process and allow them to reflect on their practices for identifying needs and resources	While conducting the walks, many of the participants had a lot of knowledge to share about the district. The walks became a lived experience of demonstrating expertise (e.g. about the district)

As argued earlier, it is important to establish older adults as experts in a co-creation process in order to level out some of the power imbalances that are present in any collaboration project. The walks and walking workshops were an ideal format in which participants could demonstrate their local knowledge and expertise. They were particularly helpful for prompting participants to speak about certain places, streets, etc; something that was at times more difficult for our participants in Osterholz, when they had to report on nice places in a closed workshop environment. In addition, some participants had above average technical expertise, e.g. on Open Street Map or video editing.

Lesson H-2.4: In order to establish older adults as experts, the different kinds of experience and expertise that people have, need to be articulated and appreciated equally.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-2.5: Facilitate role shift of older adults	Define the co-creation process in a transparent and clear way. Communicate tasks early on. Identify interests and abilities of participating older adults	We recruited the older adults first for the walks and later on for the design and data collection of the digital neighbourhood guide. This was communicated early on and a good mix of local knowledge and technical expertise was assembled

In Osterholz, we experienced that participants found it difficult to shift between different roles and tasks throughout the co-creation process. For Hemelingen, we proposed to identify interests and abilities of the participating older adults, and include them accordingly. For example, we included some older adults only in a few focus groups because they would not commit to a long process. However, some participants experienced this fragmentary user participation as dissatisfactory as the vision and idea for the service had to be continuously negotiated throughout the process while new participants joined and left the process. A core group of older adults as co-creators seems the most suitable form.

Lesson H-2.5. Consider a core group of older adults as co-creators that engage over the entire process and where each participant contributes to different tasks that fit her/his interests and abilities and are defined jointly in the beginning. From the start, facilitators should announce that they will engage additional co-creators when there is consent that certain additional input or expertise are required.

Co-creating a Service Concept

Recommendations derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-3.1: Consider methods that connect different activities and relate to defining characteristics of the target group	Use methods that connect different activities and allow for the refinement of the target user groups	The walks served as a thread, that served for the definition of attributes, the collection of data and also the design of the front-end

Personas and scenarios were helpful methods for providing a thread through our co-creation process in Osterholz. This works however only with a somewhat stable group of participants. As we planned to conduct a more open process in Hemelingen,

we needed to design the process in a way that we could use other methods to connect different activities and keep the project somewhat framed. In Hemelingen, the walks served as a thread through which we defined attributes, collected data and also design the front-end. The walks themselves hence became a reference point. And even though not all participants participated in all walks, they were similar enough to serve as a joint reference. This was for example also facilitated through the template questionnaire that we had developed for the walks and which participants completed while walking.

Lesson H-3.1: Depending on the problem focus and the service to be developed, personas & scenarios or walks may be suitable methods to define a thread throughout the co-creation process and connect different activities.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-3.2: Consider intermediaries as main users of a service	Identify intermediaries, such as service and care providers and investigate how a digital service could support their work.	We considered the intermediaries and services providers as organisers of joint walks for older adults in a disseminating role. Since some of the members of the project board, provide activities, such as walks for older adults, the service is meant to support their work by facilitating the planning and organisation of joint activities for older adults

In Hemelingen, we collaborated closely with intermediaries by involving them substantially throughout the whole process. They contributed in many respects (see O-2.1 above). Besides their support of our work a main reason was that we considered them as target group of the service and thus considered them as future users. The guide is valuable since it serves as source of information to which they can refer when asked by their customers. In addition, we worked out a supporting functionality for those service providers offering walks to senior citizens.

Lesson H-3.2: Intermediaries need to be substantially involved in the co-creation of services for older adults from the beginning. Ideally, the service concept is developed in close cooperation with intermediaries in order to ensure its relevance.

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-3.3: Consider a service that is more activating/ beyond information provision	Identify and implement potential services that could complement the information provided in a digital district guide	Beyond the mere provision of information about nice places, the digital district guide now provides information about walks. In addition, local service providers offer walks to older residents as part of the digital district guide service

As outlined in the introduction to this book, there is a difference between providing information about services and providing services as such. We have moved beyond mere information provision with the Hemelingen demonstrator and potentially a step further towards (online) interaction and activation.

Lesson H-3.3: With regard to social inclusion, a service should focus more on specific forms of participation in the neighbourhood and provide information that is activating, and hence actively supporting social inclusion.

Working with (Open) Data

Lesson learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-4.1: Take into account that information identified as relevant may not be available as open data	Plan ahead to collaborate with various data owners (e.g. service providers) and allow sufficient time for data creation during the co-creation process. Offer a user-friendly backend for inputting data to participants	We obtained the data from the printed district map. We offered a user-friendly back-end solution for data input

We initiated early on in the field work in Hemelingen a survey on existing data (also in printed versions) and collaborated with data providers. We also offered user-friendly back-end solutions for data input. This is the only viable way we saw for the use of data in co-creation processes.

Lesson H-4.1: There is a tension between data-driven app development and citizen-driven service co-creation as much of the information identified as relevant in co-creation processes is not available as open data. We are convinced that effective and relevant services for older adults should not be driven by what data is available, but rather have to be based on the needs and requirements of the target audience.

Lesson learned derived from Osterholz	Actions to be implemented in second co-creation process
O-4.2: Less is more. Concentrate on a few categories of objects	Agree on specific objects to be explored in more detail

The work with data on so many different kinds of services in Osterholz was highly time consuming. Many of the participants engaged in the validation of information about meeting places, service providers etc. Such tasks can also be performed by others. The resources and expertise of older adults seem to be better used for tasks relating to objects that are not dealt with in the available guides and directories, i.e. nice places and walks. In Hemelingen, we concentrated on walks only and had the advantage of exploring a service around walks, much further than the nice places in Osterholz. This focus also allowed to include different multi-media features in our service (e.g. spoken comments and video clips were produced by some of our participants.)

Lesson H-4.2: Many older adults are very busy. Hence, their resources and commitment should be used in the most effective way (e.g. concentrating on the in-depth development of service concepts or data co-creation) and potentially allow for richer descriptions (e.g. through video and audio clips).

Lessons learned derived from Osterholz	Actions to be implemented in second co-creation process	Actions taken in Hemelingen
O-4.3: Consider methods for "snowball" data collection	Use methods that allow a variety of older adults to contribute to the data collection	Neighbourhood walks included around 46 older adults from the district that contributed comments on relevant aspects

We had about 46 older adults participating in six neighbourhood walks. Such activities had a low-threshold. Participants contributed to the further refinement of attributes and data. Towards the end of the project, several teams of older adults worked on individual walks. It was hence useful that the data collection tasks could be easily separated.

Lesson H-4.3: "Snowball" data collection allows for the contribution of the collective knowledge of a large group of people. It thereby enables older adults to contribute their expertise.

Co-creating Software

Lesson learned derived from Osterholz	Actions to be implemented in second co-creation process
O-5.1: Consider the reduction of prototyping tasks	Devote specific sessions to prototyping and only involve those older adults interested. Establish procedures to feed the continuous development back to participants

Early on in the process, we conducted a number of focus groups to evaluate the design and functionality of the Osterholz demonstrator. We then conducted one paper prototyping session that was announced in advanced as being more technical. We started with a comprehensive overview over the objectives and tasks of the design session. We then left the decision to participants if they preferred to do the paper works themselves or not. They decided to jointly discuss the design in the group and leave the paper work to the facilitators.

Subsequently, the technical team presented their progress on digital versions and received feedback. Overall participants found this reduced prototyping tasks adequate. In order to increase the use of technologies, we encouraged participants to use the back-end of data creation and a software for creating slide shows.

> Lesson H-5.1: Prototyping tasks need to be announced and explained well in advance so participants are given the opportunity to decide if and in what form they want to contribute.

Lesson learned derived from Osterholz	Actions to be implemented in second co-creation process
O-5.2: Consider design of application beyond design of user interface	Consider design of data structures and back-end functionality for data maintenance

The first walks and workshops were used to defined the data structures and attributes of the walks and the stops. The content management systems had been adapted and the description of the walks got beyond a set of attributes with texts.

> Lesson H-5.2: Full co-creation in software development should not only deal with the user interface of the app but also provide a back-end that is easy to use for co-creators in providing and maintaining the input.

Sustainability

Lesson learned derived from Osterholz	Actions to be implemented in second co-creation process
O-6.1: Sustainability remains a big challenge	Identify local stakeholders that can sustain the maintenance of the service early in the process (e.g. identify ways in which the service serves their interests/supports their work)

Members of "Alte Vielfalt" became part of a project board and subsequently took over responsibility for the service maintenance (tablet courses, walks).

> Lesson H-6.1: The willingness to commit to the maintenance of the service increases with the degree of involvement in the process and the degree of benefitting from its outcomes. Responsibilities for the maintenance should therefore be defined early in the process together with local stakeholders.

Co-Creation in Practice III: Co-Creating Age-Friendly Routes (Zaragoza)

Summary of Co-Creation Project[1]

Problem Focus

Physical accessibility, as well as sensory access, are important elements to configure the improvement of the friendliness of urban environments, for all citizens, but especially for older adults. The possibility of moving and enjoying the city in a safe and accessible way represents another way to promote equality, ultimately avoiding the inequalities that the environment can generate for older citizens. In Zaragoza, different participatory processes aiming at the improvement of older citizens lives have been conducted by the city administration. In these processes, older people have expressed their demand for safe and well-equipped spaces for strolling and moving around and that encourage physical activity.

Value Proposition

The service provides all relevant information on the facilities that need to be improved or added to support the mobility and social connection of older adults in a district and improve access to all types of services. This is a new service that did not exist before as it combines the possibility of creating age-friendly routes to walk calmly and safely through the city with the possibility of making demands to improve those routes according to the needs of older adults. As an online service, it is more relevant and comprehensive, optimises usability for older adults and is easily accessible and continuously updated.

[1] This introduction is derived from the case study of our Interactive co-creation guide: https://co-creation.mobile-age.eu/guidebook/case-studies/zaragoza1

This chapter is based on the Mobile Age project deliverable D3.4 Senior Citizen Engagement Report Zaragoza: https://mobile-age.eu/images/pdf/deliverables/WP3/D3.4.pdf

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_7

Limitations of Existing Services

There exist already quite a number of printed information about resources for older citizens in all districts of the city. They deal with different kinds of objects and provide information in different degrees of details. Most of them have been compiled and designed for senior adults but not with them. Many older adults complained about the shortcomings of some areas with regard to the equipment they felt they needed to have. The ICT unit of Zaragoza's public administration was informed by service providers such as Senior Citizen Meeting Centers that it was a very arduous job for older people to report incidents as there was no clear way to identify where the problem was, how to report it to the municipality and, finally, how to get it resolved.

Co-Created Service

The result is a service better than the existing ones in several respects. First, it provides *comprehensive and relevant information supporting the planning of activities* (accessibility of buildings and routes, information about toilets and benches). Second, it is a *user-friendly and accessible technical design for older adults* which provides relevant and up-to-date information facilitating social participation of older people in the city of Zaragoza. Information may be searched via a map that is optimised for older people and via listings. All information is provided by a responsive application, which can be accessed from desktop PCs, tablets and Smartphones, with particular emphasis on accessibility. In addition, the service is based on open data (up to date, accessible via API, machine readable) and co-created data, relevant to the citizens' needs. As the service is linked to open data the respective data providers are responsible for updates and the service provider is relieved from this job.

Reason for Inclusion in this Book

The third co-creation project described in this book was managed by the city council of Zaragoza[2], one of the project partners of the Mobile Age project. In the project, two departments were involved: the Department of Elderly Care and the Technical Office of participation, transparency and open government. The work presented here was conducted between May and December 2017. What is interesting in the case of the co-creation project in Zaragoza in comparison to the ones presented from Bremen is that the governance structure and stakeholders were different. Whereas in Bremen, the co-creation projects were coordinated and managed by a research institute in cooperation with the local district councils and service providers, in Zaragoza it was the public administration itself that coordinated and managed the co-creation project. At the same time, all projects focused on age-friendly cities and communities; the services developed were in all cases map-based digital services. Hence, for the purpose of this book, this is an interesting case for comparison, as it illustrates how differences in governance structures impact on a co-creation project, for example with respect to its scope, engagement of stakeholders and sustainability of the outcome.

[2] www.zaragoza.es

Although, I have not personally conducted the co-creation activities in Zaragoza, I was involved their planning, revision and evaluation. I have been to Zaragoza three times between July 2016 and November 2017. In November 2017, I was able to participate in one of the co-creation events—a walking session with older adults. In addition, I met with the Spanish colleagues for workshops during our project meetings three times (in Bremen, Thessaloniki and Brussels). Furthermore, we had bi-weekly video calls between all partners where we discussed our progress, shared insights and also materials and resources. The chapter is based on the report that colleagues from Zaragoza city council prepared for reporting to the European Commission.

Introduction to Field Site

The co-creation activities in Zaragoza took place at the same time as the ones in Bremen Hemelingen and after the first co-creation project in Bremen Osterholz. This means that the project was informed by the lessons learned from Bremen Osterholz. The co-creation project was carried out in three districts of Zaragoza in three phases. The districts were chosen upon recommendation of the Department of Elderly Care based on previous good working relations. In addition, in all districts there existed groups of older people engaged in walking clubs and familiar with using GPS. The three districts have a different socio-economic structure.

District 1: Zaragoza Centro (May ‘17–June ‘17)
Central district has 53.411 inhabitants of which 27.27% are over 65 years old. It corresponds to a municipal district of high economic level (average net income 17,846.86€). Its geographic location corresponds to the downtown area of the city, with numerous urban commercial spaces. There is one Senior Citizen Centre in the district.

District 2: Zaragoza Delicias (October ‘17–November ‘17)
District of Delicias is the district with the highest population density, with several old housing areas and a total population of 106,371 inhabitants, of which 23.05% are over 65 years old. It has a low to average level of income (average net income 10,282.8€) and has three Senior Citizens Centres.

District 3: Zaragoza Almozara (November ‘17–December ‘17)
District of Almozara is located near the Historic Quarter of the City. It is a small neighbourhood with a population of 29,229 inhabitants and 18.65% of people are above 65 years. The district has an average income level (average net income 11,717.25€), and it is one of the neighbourhoods which experienced most social and urban transformation in the last decades.

Co-Creation Process

The co-creation projects in all three districts were similar and comprised of eight sessions. The following Fig. 1 provides an overview of the process.

Fig. 1 Overview process for co-creation projects on age-friendly routes

Governing and Managing Co-Creation

There exist already quite a number of printed information about resources for Third Agers in the districts. They include different kinds of objects and provide information in different degrees of details. Most of them have been compiled and designed for senior adults but not with them.

- When the co-creation process in Zaragoza began, the directors of the Senior Citizen Centres informed the co-creation team in Zaragoza that in some centres, older residents organise themselves to take walks in different neighbourhoods in the city and on the outskirts. Many of them complained about the shortcomings of some areas with regard to the equipment they felt they needed to have. They argued that it was a very arduous job for older people to report incidents as there was no clear way to identify where the problem was, how to report it to the municipality and, finally, how to get it resolved.
- The official website www.zaragoza.es contains information on many services that can help citizens to communicate complaints and suggestions to the city council and to create shared routes with all citizens through a map. These are two independent services that were not directly featured on the city council's senior citizens' website.

The co-creation project as conducted in Zaragoza made the following value proposition: The service to be developed provides all relevant information on the facilities that need to be improved or added to support the mobility and social connection of older adults in the district and improve access to all types of services. This was a new service that did not exist before as it combines the possibility of creating age-friendly routes to walk with the possibility of filing requests to improve them according to the requirements of the people who use them. As an online service, it is more relevant and comprehensive, exploits the potential of digital media technology, optimises usability for older adults, is easily accessible and continuously updated.

Engaging Stakeholders

In Zaragoza, the co-creation process was managed by the city council. In each district, a core-group of six to eight older adults participated. For example, the co-creators in Zaragoza Central District consisted of four males and two females aged 65-80. They were comparably well educated, physically (one had a leg mobility impairment) and psychologically healthy; all lived independently. None lived in an institutional setting. Overall, the participants were familiar with digital technologies. Only one participant had never used a computer. Almost half of the participants engaged actively in political and volunteering work in the district.

The co-creators in each of the three co-creation projects included older adults living in the respective district and with some bond to the district. They needed to be still mobile, although at least one had to have some kind of limitation in his/her movements (wheelchair or any kind of problem walking). For the project team, it was important to include a similar number of women and men. In each group there had to be somebody experienced in digital photography and another person familiar with digital technologies.

Co-Creating a Service Concept

In order to familiarise participants with the ideas and objectives of the co-creation projects in each of the three districts, staff from both participating city council departments introduced the project's ideas and objectives.

To start the co-creation project participants needed to familiarise themselves with the project, so the first session was dedicated to understanding the main contents. To do so, the experts from each of the City Council Departments explained both, the Mobile Age project and the idea of age-friendly routes. Participants then had the opportunity to ask questions about the process, methods and expected results.

Frequent Destinations (Data Collection)

Once the project's objectives, procedures and timeline were explained, the way of collecting information about the most frequently visited destinations was discussed. It was agreed that the participating Senior Citizens Centre in each of the three districts, should be the starting point for each of the age-friendly routes as they are centrally located and an important point of reference for older residents in any of the three districts.

In order to determine the route and destination, each of the groups completed a data sheet about their district. For this exercise, a card was designed: "FREQUENT DESTINATIONS". Each participant was asked to consult with six further people about frequent/important destinations in the district. In the subsequent session, each participant returned with a completed form (Fig. 2).

Iniatially, it appeared as if participants had no problem in understanding the task. However, at the next session the project team discovered that some (two out of six), had misunderstood the objectives of the task in that they were specifically looking for problematic routes (e.g. sidewalks in bad conditions) rather than frequently used ones. A further round of data collection was initiated and a set of destinations collected. In a subsequent workshop, two destinations had to be selected as there was not enough time to work on more than two routes per district.

Affinity Diagrams

In order to select two destinations out of the set of different destinations collected by the participants, the project team in Zaragoza used an affinity diagram. Since there was only limited time, it was agreed to select a long and a short route. For

example, in the first district, the Pilar Square was the most popular route. Since this was a long route (distance from Senior Citizen Centre), the second route had to be a short route. Here the second popular route, a route to the Medical Centre, which passes by El Corte Inglés (Shopping Centre) was chosen.

Working with Open Data

Collaborative Maps

The next objective was to agree on the actual route (most adequate, convenient, nice and/or fast) and mark the route on the collaborative maps. This was done collaboratively and visualised on a digital screen. To do so the project team used the City Council Website's collaborative map service as a tool for decision making, sharing experiences and configuring the way through which the participants observe their district (new collaborative cartographies available to everyone).

In addition, the facilities published by the City Council as open data appeared on the map on which the routes were marked, which was very useful to detect those


FRIENDLY ROUTES
FREQUENT DESTINATIONS
MóvilEdAd
NAME:
DATE :
PERSON 1
Any type of limitation?
DISTINATION 1:
DISTINATION 2:
PERSON 2
Any type of limitation?
DISTINATION 1:
DISTINATION 2:
PERSON 3
Any type of limitation?
DISTINATION 1:
DISTINATION 2:
PERSON 4
Any type of limitation?
DISTINATION 1:
DISTINATION 2:
PERSON 5
Any type of limitation?
DISTINATION 1
DISTINATION 2:
PERSON 6
Any type of limitation?
DISTINATION 1:
DISTINATION 2:

Fig. 2 Frequent destinations

elements that the participants considered necessary to have listed in the map. The facilities published by the City Council as open data appeared on the map on which the routes were marked. This was very useful for determining those elements that the participants considered relevant elements of the map (Fig. 3).

All data were visualised on the same digital map. This provided the opportunity to both: decide on the exact route that would be taken to the final destinations and give participants the opportunity to learn about this interactive tool and familiarise themselves with the digital services of the City Council (Fig. 4).

Once destinations were agreed and the routes were marked in the collaborative maps, the participants had to agree which aspects/elements of a route were important to be analysed while walking this route. The following criteria were proposed by the city council:

- Benches
- Traffic signal timing
- Curb recesses
- Bus stops (access difficulties)
- Interesting points (public bathrooms).

After discussing these criteria, the participants agreed to retain them and did not add any further elements. In order to consider them, a template/form was developed that participants could complete while walking the designated routes. For each element, participants had to list the kind of improvement requirement and the exact geo-location (coordinates).

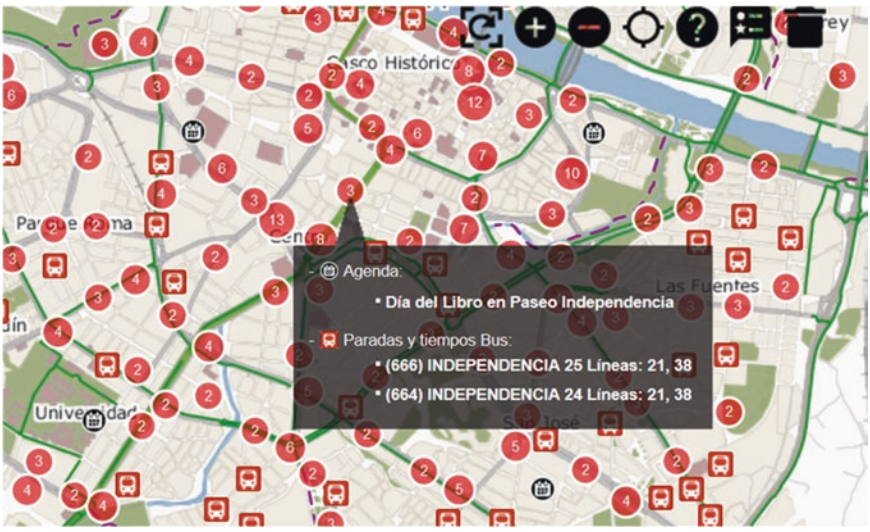


Fig. 3 Screenshot of collaborative maps service

This form was evaluated and improved after the first walks. After the first round of walks, the pre-selected criteria were slightly adapted and categorised in primary and secondary elements:

Primary elements:

- State of sidewalks (Tiles, slides, paving, recesses…)
- Benches
- Traffic lights and crosswalks
- Points of interest (public bathrooms, green spaces, fountains, bins, dirt, mailboxes, etc.).

Secondary elements:

- Bus/tram stops (access, information panel, etc.

Before the walks, each of the older participants was assigned a task. They were either responsible for taking photographs, for documenting the GPS coordinates or walked in pairs of two to observe, analyse and document ideas for improvement. For both routes, the starting point was the Senior Citizen Centre. The long route, was carried out in two sessions (the first, from the beginning to the midpoint of the route and the second the remaining section). During the walks, the group observed the different elements to evaluate in order to improve the route. The walk was carried out as a group, although the observation and documentation was individual.

Fig. 4 Routes 1 and 2 as depicted in the collaborative map for centro district

Whenever a member of the group detected a possible improvement proposal, the group discussed it, and in cases where it was confirmed as an interesting proposal for improvement, a photograph and location references were taken.

When reaching the midpoint of the route (in the case of the long route), the route was reversed in the opposite direction, so that the team had the opportunity to review the proposals made and even incorporate new ones. When returning to the Senior Citizen Centre, the photographs were projected with the objective of deciding if the proposal was going to be maintained or not. For this purpose, the information obtained and the suggestion for improvement as well as its motivation were analysed. If, on this basis, a suggestion was selected, the requested improvement was described as comprehensively as possible.

The following session, started at the midpoint of the long route and followed the same methodology. This process was appropriate and, apart from the time constraints, did not pose any problems. The process allowed every participant to actively participate and put suggestions forward, it also allowed the whole group to come to a shared consensus (e.g. based on the shared experience of walking the route together).

The last session in any district, was dedicated to the complete itinerary of the two routes in order to validate the information that appears in the collaborative maps. The participants checked if the markers that appear in the collaborative maps corresponded with the proposals they made. All the information was displayed on tablets, while the group walked the route and this way could be evaluated on site. This task was described as rewarding and satisfying by the participants, as they saw that their proposals had been introduced on the City Council website—one step closer towards the realisation of an improvements.

In order to correctly locate each improvement an excel sheet was designed to gather all the information. Below are two screenshots of the collaborative maps developed. Every mark represents a required action (Fig. 5).

Summary of Co-Creation Process and Output

For the work carried out in Zaragoza, the first co-creation project in Bremen provided a starting point, as both cases were interested in map-based services. Whereas this was a new way of engaging (older) citizens in the creation of services, Zaragoza was already very advanced in the technical provision of open government data (e.g. the city council has been working on their APIs for more than a decade now). The co-creation project in Zaragoza hence, was not reliant on the technical infrastructure provided by the Mobile Age project but used their own infrastructure to ensure the sustainable provision and maintenance of the service. The service was also continuously promoted on the city council's Website.

The results of the co-creation project, informed on the one hand repair activities of the city council in order to maintain the physical infrastructure; they also informed investment decisions for improving the physical infrastructure (e.g. the installation

Fig. 5 Final collaborative maps (https://www.zaragoza.es/sede/servicio/mapa-colaborativo/579)

of new benches). Part of the recommendations developed by the co-creation project were pitched for the annual participatory budgeting process in which the city pledges to finance civic suggestions. It was hence relayed back to citizens who could take the final decision on which improvements should receive funding.

The canvas below provides a summary of the final service outcome (Fig. 6).

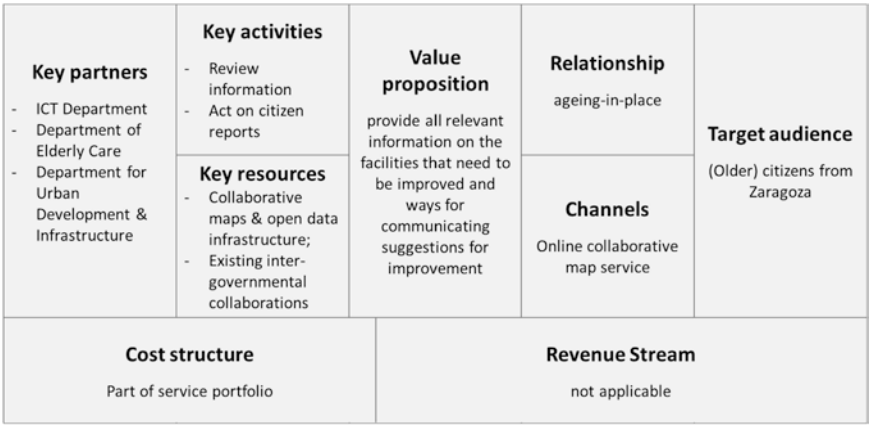


Fig. 6 Final canvas for co-created service in Zaragoza

Learning from Co-creation Practice

In the three preceding chapters, I presented two in-depth accounts of co-creation projects conducted in Bremen, Germany and a comparative case of a co-creation project conducted in Zaragoza, Spain. In the following, I reflect on the learnings from these three co-creation projects and attend to the central research questions posed in this book:

1. *Governing co-creation and sharing control*: What are the implications of different modes of governing and managing co-creation for the sharing of control? How do specific methods facilitate the sharing control?
2. *Sharing expertise*: How can a variety of stakeholders be engaged in meaningful ways? What are specific challenges and opportunities for sharing (lived) experiences to co-create digital public services for older adults?
3. *Enabling change*: What types of public services are most suitable for co-creation and to what extend do they enable individual and/or social change?

In the following, each of these questions is attended to in a separate section.

Governing Co-creation and Sharing Control with Citizens

From Arnstein's (1969) ladder of citizen participation, we have learned that there are different degrees of sharing control between public administrations and citizens. In the review of different approaches to co-production of public services and co-design of information systems, different roles users may take in such a project were identified. These roles may be assumed by any relevant stakeholder (group), e.g. older adults, social care service providers, intermediaries, and government/public administration.

One of the most apparent differences in the governance structures of our co-creation projects was their different embedding in existing infrastructures,

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_8

collaborations, policy frameworks, and initiatives. These aspects had so far only received little attention in studies on co-creation. Through our three projects, we have demonstrated however, that this has an impact on the ways in which co-creation is conducted and the options for participation, scoping and sustainability. While in Zaragoza government units initiated and facilitated the co-creation process, in Bremen this task was assumed by a research institute. In Zaragoza, the core project group consisted of two departments of the city administration, which were supported by senior citizen centres. In Bremen Osterholz, we decided to establish a permanent group of eleven older residents that were engaged throughout the whole process (from idea generation and development of a service concept to the co-creation of software and data to the implementation and maintenance of the service). In contrast, in Bremen Hemelingen, a project board consisted of a research institute, software developers and a network of social care service providers. Table 1 provides a summary of the differences of our governance structures and interactions with different local actor groups.

In Zaragoza, the *scoping of the co-creation project* was driven by its alignment with the city's engagement in the Global Network of Age-Friendly Cities and Communities (GNAFCC) and was expected to contribute to the city's overall policies and strategies. The main drivers of the process were two departments: the Technical Office of participation, transparency and open government, and the Department for elderly care, which had an established working relationship. For the co-creation activities and recruitment of older adults, the project team used its existing collaborations with senior citizen centres. The open data infrastructure and relating IT-infrastructure played an important role in the planning of the project. For example, the co-creation process made use of an already existing collaborative map service. In contrast, the research institute in Bremen was more open with the scoping of the two projects. The role of certain local actors shifted as the scoping of the project and service idea evolved. This impacted on the roles and decision-making power of participants. Table 2 compares the three projects in relation to different aspects of sharing control as derived from the reviews of participatory approaches such as co-production, co-design and civic open data use.

In all projects *users participated in the decision-making process* (as advisors as well as representatives). Their participation was always voluntary. The *requirements for users to act*, expected to some degree knowledge of possible technological options; they needed access to relevant information and had to have the possibility to take an independent position (from the facilitators). In the following, I analyse the specific engagement of (1) local government, (2) social care service providers and (3) older citizens.

Local Government

While the city council organised and managed the co-creation project in Zaragoza, local government assumed a supportive and consulting role in Bremen. This resulted in differences concerning the openness of the processes, the scoping of the

Table 1 Summary of different governance structures and interaction with older citizens in multi-stakeholder co-creation projects

Field site	Bremen Osterholz	Bremen Hemelingen	Zaragoza
Co-creation facilitators (project board steering activities)	Research institute (ifib) Software developer (FTB)	Research institute (ifib) Software developer (FTB) Network of local service providers	Local government:-Technical office of participation, transparency and open government—department of elderly care
Involved local government/public administration	District council City information provider	District council District marketing City information provider	Core project group + department of urban development and infrastructure
Involved older citizens	*Core group of 11 older adults*: •16 regular workshops for a duration of 10 month *80 older residents*: •12 focus groups in which each resident participated once	*46 older residents*: •7 Walking workshops •3×2 Focus groups *Core group of 5 older adults*: •additional 11 tablet workshops	*Core groups of 6 to 8 older adults for each of the three districts with different skills and impairments*: •8 workshops for each district
Involved social care service providers	3 neighbourhood managers 2 representatives from different Christian congregations 1 social service centre 1 representative from the centre for migrants and intercultural studies 2 representatives from social welfare organisations •10 meetings and participation in workshops of core group	Network of local service providers including: 3 senior citizen meeting places 2 social care service providers 1 district marketing 1 neighbourhood manager •8 regular meetings and participation in walking workshops and tablet workshops	3 senior citizen centres from 3 districts
Other involved organisations and individuals	Intermediaries: •8 interviews and participation in workshops of core group		

Table 2 Sharing control in Bremen Osterholz, Bremen Hemelingen and Zaragoza according to characteristics of co-production, co-design and civic open data use

	Bremen Osterholz	Bremen Hemelingen	Zaragoza
Rationale for sharing control	The needs of users should dominate the *design of the service*		Exploiting potential of open data infrastructure
	The information system should depend on *interface needs*		Allow for user-centred and creative ways of open data-based service development
Additive co-production to enhance the impact of *civic engagement*			
Parties involved	Commitment for both *users and systems developers* to cooperate	Facilitators steer process and allow for selective user involvement	Collaboration between public *service provider* and *citizens/service users*

co-creation projects as well as their governance. Table 3 summarises different roles and tasks of local government in the three co-creation projects.

The scope of action for local governments differed between the three co-creation projects (Fig. 1). In Zaragoza, the city government controlled the planning of the co-creation project and kept the responsibility of maintaining the service. They invited citizens at particular points of time to share control over the process. In contrast, in Bremen, the local governments were either not or only marginally involved in the planning. For both co-creation projects in Bremen, the city information provider assumed control over the maintenance of the service (in collaboration with local social care service providers). In all cases, the final solution was dependent on the existing IT-infrastructures and had to be aligned with the cities' strategy and policies. For Bremen this meant that we lost some of the design outcomes (e.g. age-friendly map design), because the city information provider wanted to use the same map-style across all of its services.

> Learning Point 1: Local governments can assume different roles in a co-creation process. If they are to assume control over the maintenance of the result, the solution needs to respect framing conditions such as existing policies and strategies, existing IT and (open) data infrastructures, interoperability requirements, budget constraints and legal and organisational restrictions.

Social Care Service Provider

In both co-creation projects in Bremen, we made the experience that involving an already existing group of intermediaries and social care service providers with experience in collecting, editing and providing information is beneficial to the

Table 3 Level of co-creation: roles and tasks assumed by local government units

Role		Bremen Osterholz	Bremen Hemelingen	Zaragoza
Planning	Facilitator	Engaging stakeholders (identify local stakeholders and support recruitment by promoting the project) Provide facilities	None	Selection of pilot districts Engaging stakeholders (identify and engage local stakeholders, ensure access to older adults) Manage and organise co-creation activities
Build	Explorer	Co-creating a service concept (explore information needs via interviews)	None	Co-creating a service concept (explore information needs as part of Zaragoza's age-friendly city initiative)
	Idea former	None	None	Develop questionnaire for exploring ideas to use collaborative maps
	Designer	None	None	Design and implement digital service
	Data provider/ curator/ creator	Provision of data on institutions and public services in the district Review and validate data	Support of the content provision by providing video material on walks	Publish and provide data on facilities and co-created data
Run	User of service/app	Evaluating the service (interviews)	None	None
	Provider of service/app	Integration of app in the official city portal Maintain data	Integration of app in the city portal Maintain data	Integration of service in the City Council's website
	Diffuser	Promoting the app and the service on several events, supporting the dissemination of the service concept for other districts	Promoting the app and the service on kick-off event	Transfer of the service (applying the methodology and offering the generic tools to other cities and districts)

process as well as the sustainability of its outcome as those key partners might also carry on or support the service beyond the duration of the project (*Lesson H-1.2*).

Social care service providers took different supporting roles in our co-creation projects. However, the prerequisite for their commitment was that the outcome would benefit their work. In our co-creation projects, social care service providers assumed all roles but the one of a designer. One of the main learning points was that in the context of age-friendly cities and communities, intermediaries and social care service providers should also be understood as future users and hence be involved as such in co-creation processes. Overall, the close collaboration with social care

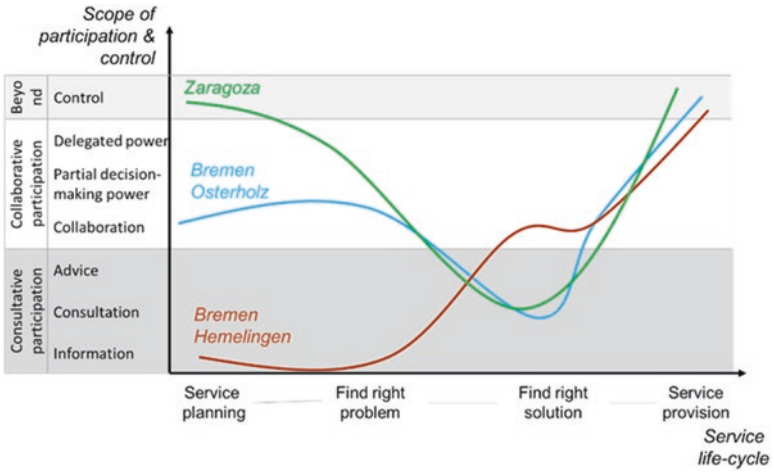


Fig. 1 Comparing different governance structure with respect to scope of action of local government

service providers in Bremen Osterholz and Bremen Hemelingen was highly beneficial to the co-creation process in several ways:

- They acted as *gate-keepers* to local government and supported the recruitment of older adults.
- They acted as *champions* of our project and endorsed the process during council meetings.
- They acted as *communicators* by promoting the project in the local newspapers, their own publications and the district fair.
- They served as *data providers* with data about their own services and resources.
- They may *ensure the sustainability* of the service.

Learning Point 2: Social care service providers and intermediaries can take different (supporting) roles in co-creation processes. However, the prerequisite for their commitment is that the outcome will benefit their work and align with their existing service portfolio and funding.

In Bremen Hemelingen, we aligned our co-creation process closer to the services and resources of local social care service providers and intermediaries. Older adults were invited to participate as part of the service offerings of these service providers. We hence circumvented "cold recruiting" as in Bremen Osterholz and embedded our project as part of their existing service infrastructure. For example, the meeting places offered a variety of courses and meetings. They were ideally positioned to adopt our tablet courses as part of their service portfolio. Likewise did the neighbourhood walks fit well with the services provided by some of our collaborating

service providers. Hence, recruitment was done more effectively through social care service providers, because they are already actively involved with a broad range of older residents. The drawback was that some older residents may not have been addressed because of a bias against certain social care service providers (e.g. the church, a certain neighbourhood).

> Learning Point 3: When embedding the process in existing services and activities, potentially only a certain part of the target group is addressed (e.g. through the church or in particular neighbourhoods). This may imply that complementary activities with other stakeholders ought to be conducted.

Engaging social care service providers for the recruitment requires a deep understanding and commitment of these intermediaries to the co-creation process. They may also help to reach out to older adults, who cannot participate throughout the whole life cycle of a project. For example, in Bremen Hemelingen, we conducted

Table 4 Roles and tasks of local service providers

Role		Bremen Osterholz	Bremen Hemelingen	Zaragoza
Planning	Facilitator	Engaging stakeholders (support recruitment)	Engaging stakeholders (identify and contact senior citizens groups, organise walks to attract older adults) Planning (organise focus groups)	Engaging stakeholders (support recruitment) and provide meeting space
Build	Explorer	Co-creating a service concept (explore information needs in interviews)	Co-creating a service concept (explore information needs in meetings)	None
	Idea former	None	Co-creating a service concept (constant feedback on refined service concept)	None
	Designer	None	No	None
	Data provider/ curator/ creator	Collect data (focus groups with older adults)	Review, validate and complete collected/ co-created data	None
Run	User of service/app	Evaluating the service (interviews)	Evaluating the service (interviews)	None
	Provider of service/app	None	Maintaining data on walks	None
	Diffuser	None	Promoting the app and the service on kick-off event	None

focus groups with older adults with mental health issues and a group of older adults from a senior residence home. Similarly, in Bremen Osterholz, we conducted focus groups with about 80 additional participants as part of the service co-creation and user testing. In Zaragoza, the city conducted a large survey as part of their diagnostic process before the project.

Table 4 provides a summary of the roles and activities assumed by social care service providers across the three co-creation projects. There was little engagement in Zaragoza apart from support of the recruitment and providing a meeting space. Bremen Hemelingen, was the only process in which social care service providers were regarded as target users as well.

The relative lower internet usage of older adults requires different communication channels than offering the service via an internet portal. Intermediaries who so far served as information brokers have to assume a digital information broker role for the new digital services as well (*Lessons H-2.1*, *H-3.2*). In the case of Bremen Hemelingen, we achieved this by engaging intermediaries and service providers in the core project group/project board who already organise walks for older adults in the district and welcomed the benefits of richer digital information.

Learning Point 4: The more beneficial social care service providers and intermediaries perceive a service to be for their work, the more likely it is that they will maintain it or support its maintenance (in particular with respect to data maintenance).

Older Adults

If we take the involvement of citizens in the co-creation of digital public services serious, it means that the initiators of such a process need to share control. Recruiting people for the duration of a co-creation project with open objectives and tasks unfamiliar to most older adults is a great challenge. Across the three co-creation projects presented in this book, the recruitment strategies emphasised that digital skills were welcome but no precondition. Given the focus on ageing in place in all projects, it was important to engage older adults with good local knowledge and local ties. Local social care service providers were key to the recruitment of older residents.

Bremen Osterholz

The decision-making process and scope of action in the first co-creation project in Bremen Osterholz was different to Bremen Hemelingen and Zaragoza. The emphasis in exploring the problem space was much higher, in particular because of the weight given to the exploration of the participants' life worlds and lived experiences. The cultural probes, complemented through interviews and joint reflection workshops allowed participants substantial control over the direction of the project

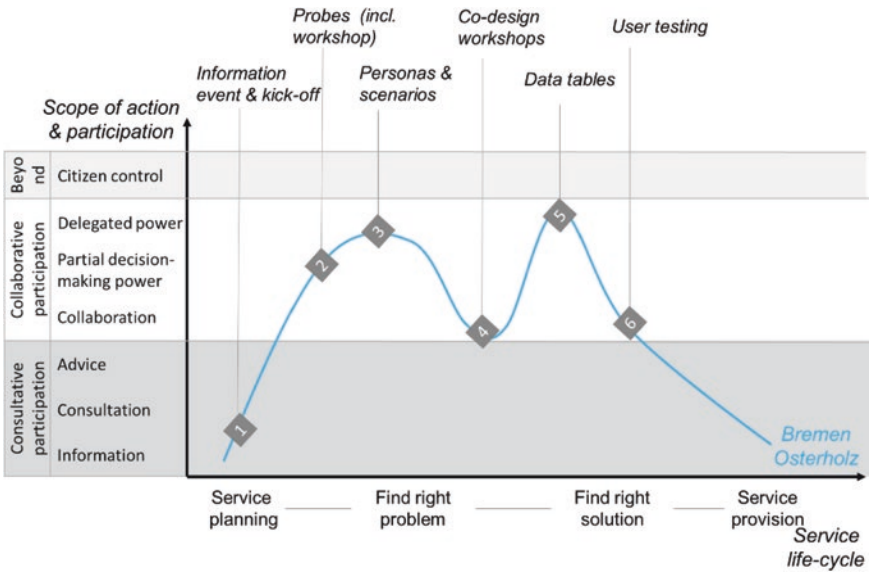


Fig. 2 Participants' scope of action in Bremen Osterholz

(#2 in Fig. 2). Based on the probes and reflective workshops, we co-created personas and scenarios, which helped to define the problem and value proposition (#3). Participants identified information needs of older residents and their resources based on these personas and scenarios. In subsequent co-design workshops, we negotiated what was possible within the frame of the project: in terms of technical feasibility, long-term sustainability and local government commitment (#4). Participants had again partial decision-making power in structuring data tables (our standardised forms), e.g. what kind of attributes were relevant (#5). However, because of considerations about the sustainability of the co-creation outcome, these were also shaped by the requirements of the city information provider bremen.online with respect to suitable data structures (e.g. format of opening hours). Not all participants contributed equally to the creation of data and texts. In particular, the editorial work was very challenging for some and we had to engage further participants. Finally, the user testing was conducted in collaboration with participants and based on the co-created scenarios (#6). In Bremen Osterholz, the older participants had no stake in the provision of the service. Its maintenance is ensured through the city information provider and local social care service providers. Overall, this process only engaged a limited number of older residents directly in the co-creation project. Their contribution was complemented with the input of social care service providers and about 80 older residents were involved in focus groups at the beginning of the project for exploring the problem area and at the end of the project for user testing.

Bremen Hemelingen and Zaragoza

The data walks as conducted in Bremen Hemelingen and Zaragoza provided a way for older adults to become engaged in defining classifications (e.g. what kind of attributes are relevant to any given object). In both cities, we conducted walks for co-creating data. While in Bremen Hemelingen we conducted an initial and dedicated "ideation walk" to define relevant categories, attributes and information needs, this activity was included in the first walk in Zaragoza in which participants refined the documentation template. In both cities, we conducted a series of walks to collect information and create data. In Bremen, the focus was on collecting data about the walk and potential ideas for improvement (e.g. missing benches). Participants also realised that supplementary data, such as street lightening would be important. In Zaragoza, participants' focus was on documenting incidents (e.g. damaged roads, high curbs) and collecting suggestions for improvement (e.g. additional benches). The walks in Zaragoza were conducted by the facilitators and the core groups of older adults, which had been selected by the senior citizen centres. In contrast, in Bremen Hemelingen, social care service providers also planned and participated in the walks. Since walks were part of their service portfolio, these walks were announced via their communication channels (e.g. leaflets, newsletters) and open to anybody wanting to participate. Hence, the district walks addressed all older people who were interested in exploring the district or the different neighbourhoods jointly.

None of the walks was longer than 90 min in order to include also older citizens who are less mobile. All walks included a break. In Bremen as well as Zaragoza, people with walking aides and mobility impairments participated. In Bremen, we usually scheduled a lunch or coffee break to discuss the route and take stock; in Zaragoza participants always returned to the senior citizen centres for a debriefing session. In both cities, we emphasised the value of local knowledge.

While in Zaragoza, the same group of people participated in all walks in a given district, in Bremen the participants changed. In general, the walks in Bremen were well attended, but only a few participants engaged in other, more technology-related tasks later on in the process. The neighbourhood manager suggested that this was due to people's prime interest in neighbourhood walks, or more specifically only walks in particular neighbourhoods. She argued that this may have been due to people being interested in meeting acquaintances and being able to socialise during the walks rather than wanting to develop a digital district guide. She further suggested that participants were interested in the history of the district and wanted to learn more. Judging from the number of participants per walk, we could clearly see that the two historical walks had the highest number of participants. Table 5 provides an overview and compares the different types of walks in Bremen Hemelingen and Zaragoza. Overall, we conducted one *ideation walk* in Bremen Hemelingen and six *data co-creation walks*. In Zaragoza, nine data co-creation walks were conducted.

Two participants from the later formed design group confirmed in our evaluation interviews that they experienced the recruitment strategy in Bremen Hemelingen as open and accessible. One stated that she particularly liked the opportunity to "have no barrier, just being able to see how it goes". Another one stated that she liked the fact that people got "lured out of their house". A potential weakness identified by

Table 5 Comparing ideation and data co-creation walks in Bremen and Zaragoza

	Ideation walk	Data co-creation walks	
Type of walk	Bremen Hemelingen	Bremen Hemelingen	Zaragoza
Occurrence in project	1	6	3 × 3 (3 in each of the 3 districts)
Goals	Defining relevant categories/ information needs	Collect data on pre-defined categories	Review categories (first walk) Collect data on pre-defined categories
Number of participants	5	Between 5 and 20 (usually with 5 active members)	6
Participants	Facilitators	Facilitators	Facilitators
	Older adults	Older adults	Older adults
	Social care service providers	Social care service providers	
	Software developers	Software developers	
Roles of participants	Explorer	Navigator	Navigator
	Idea former	Photographer	Photographer
		Note-taker	Note-taker
		Data creator	Data creator
Duration	60 min	60–90 min	60–90 min
Duration of event	~2 h	~2 hours (repeated walks over the duration of a co-creation project)	~2 h
Event makeup	Walk-discussion (stop at café)	Walk-break-walk (stop for lunch or coffee and cake)	Walk—discussion—debriefing (start and finish at senior citizen centre)
Outcome	Initial list of information needs	Direct participants' attention to (data about) urban infrastructures in relation to ageing in place Written notes on walks	Data on walks to be uploaded to collaborative maps

participants related to the socio-economic diversity of participants. A neighbourhood manager suggested that we mainly engaged senior citizens from the "middle class". This was confirmed by a participant from the core group who can be considered part of this "middle class". According to their view, the challenge was to get those people involved with low socio-economic status ("Getting them, that's the art"). Another participant, herself at this "lower end of the income scale" by contrast observed that residents from the better-off neighbourhoods were missing, as they did not have as much of an incentive to leave their gardens for a walk as residents without private outdoor spaces. Since we organised the walks in Bremen Hemelingen and Zaragoza in collaboration with social care service providers, we mainly addressed those older adults who were already participating in their activities. In

addition in Bremen, others joint through newspaper announcements. Because walks are an everyday activity, the threshold was rather low.

In both co-creation projects, we conducted user test walks with older citizens at the end of the projects. In both cases, these were conducted with participants that contributed substantially to the projects. While in Bremen the focus was on identifying functional and design issues that needed attention, the walks in Zaragoza were meant to validate the data on incidents that were visualised on the collaborative maps. This kind of content evaluation had been integrated into tablet workshops in Bremen. In addition, participants had volunteered to assess the content by re-visiting the walks and updating data accordingly. Table 6 summarises the *user test walks* as conducted in Bremen and Zaragoza.

Overall, the scope of action and level of participation for older adults differed along the process. In Bremen Hemelingen and Zaragoza, the scope of action in defining the problem was to some extent limited as in both cases, the projects set out to describe walks (#1 in Fig. 3). In Bremen the reasons for focusing on walks was derived from the first co-creation project in Bremen Osterholz. In Zaragoza, the problem focus on walks was derived from a survey of citizens regarding the city's age-friendly policies.

In Bremen Hemelingen, there was some more scope as participants decided on the types of walks and ways of describing them (#2). In both cases, participants refined lists of pre-defined categories and collected data on the walks according to structured templates. In addition, in both cases, participants proposed and decided on the actual walks to be worked on, collected data and produced content (#3). Finally, participants tested the service (#4).

The level of participation in Zaragoza was higher with respect to running the service, as citizens were actively asked to contribute data on incidents via the collaborative maps. In contrast, in Bremen Hemelingen, older adults became users of the service with limited scope for amending it. There is however, an option to

Table 6 Comparing user test walks in Bremen and Zaragoza

	User test walks	
Type of walk	Bremen	Zaragoza
Occurrence in project	2	1 × 3 (1 in each district)
Goals	User testing of new app	Validate data in collaborative maps
Number of participants	3–4	6
Type of participants	Facilitators	Facilitators
	Older adults	Older adults
	Software developers	
Roles of participants	User	User
	Tester	Data validator
Duration	60 min	90 min
Duration of event	~2 h	~2 h
Event makeup	Walk—debriefing	Walk—discussion
Outcome	List of technical issues	Validated data on collaborative maps

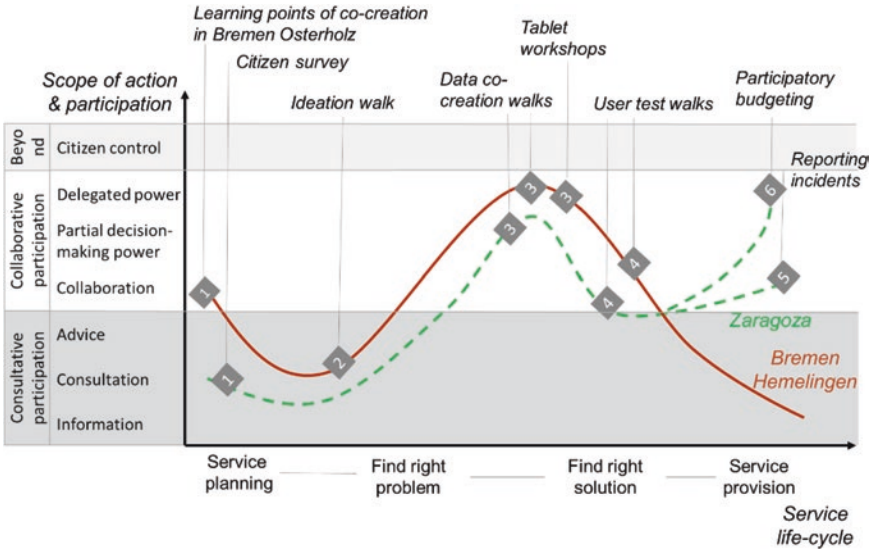


Fig. 3 Comparing different types of walking workshops in Bremen and Zaragoza with respect to sharing control

produce new walks and submit them in digital form to the city information provider. So far, this has not happened. Overall, the process in Bremen was open to anybody interested, whereas in Zaragoza, only those participants selected by the senior citizens centres could participate. The final service however, is open to all citizens in both cases. Since the Zaragoza service relies on citizens' further contribution (reporting incidents), the running of the service is "co-produced" (#5). All suggestions for improvements from the co-creation process are included in the participatory budgeting process. Decision-making is hence delegated to citizens (#6). In Bremen Hemelingen, citizens may inform the service providers about necessary changes to the information provided in the app (e.g. closed roads, new cafés).

Learning Point 5: The ways in which control may be shared with older adults, depends on the types of co-creation methods employed. In all cases, interventions need to allow for a meaningful engagement with participants' everyday life. Explorative methods such as probes allow for sharing control over the definition of the problem to be solved, ideation methods such as walks or standardised forms allow sharing control over classification schemes, prototyping allows for sharing control over design solutions.

Sharing Knowledge and Expertise

In order for co-creation projects to be successful, interventions are required that facilitate a role shift from older adults as (potential) users to co-creators. Co-creation projects need to allow for the sharing of expertise and establish older adults as experts. What is of importance in co-creation processes is the collaboration and sharing of knowledge across government, social care service providers, software developers and senior citizens. In chapter "Co-creating Digital Public Services", it was argued that boundary objects may facilitate perspective making and perspective taking within and across communities of practices (Boland & Tenkasi, 1995; Gasson, 2005; Star, 2010). As all three co-creation projects presented in this book had a specific focus on ageing and neighbourhood, the boundary objects we co-produced had to facilitate the sharing of knowing about ageing (well) in these neighbourhoods.

The *probes in Bremen Osterholz* (also through the interviews and the workshops) provided an opportunity to establish older participants as experts of their life course, ageing practices and socio-material arrangements in their neighbourhoods. They also allowed them to document and reflect on their everyday practices, their socio-spatial networks, and practices relating to old age and technology use. Probes sensitised participants towards their own ways of "doing age" and were hence tremendously helpful in identifying needs and resources. For the facilitators they allowed to develop a better and more profound understanding of these practices and doings. The approach to probes that we adopted was hence fundamentally different to the original one, which left most of the interpretative weight to the designers (Boehner, Vertesi, Sengers, & Dourish, 2007; Gaver, Dunne, & Pacenti, 1999).

Probes facilitated the individual and communal perspective making and perspective taking of participants. Chapter "Co-creation in Practice I: Co-creating a Digital Neighbourhood Guide (Bremen Osterholz)", presented some of the probes that we used during our project and how we used them. In contrast to other accounts found in the literature, the interpretation of probes were not used as an inspiration to us as designers (probes as response), neither were they used as mere representations of the interpretations of the participants. Rather, the probes facilitated a process of perspective making amongst the participants and perspective taking between participants and researchers. There was a transition in the ways in which probes were interpreted from what was important to individual participants to what may be interesting to others.

Data tables in Bremen Osterholz have proven to be an ideal boundary object for enabling collaboration between the different communities of practice involved in co-creation. They provided a "standardised form" (Star & Griesemer, 1989) which allowed for circulation amongst different participants and allowed to collect information in a standardised way. By so doing, they facilitated the development of shared classification schemes. At the same time, they acted as "repositories" (Star & Griesemer, 1989). The older adults participating in Bremen Osterholz used data tables as a tool to collect information. For the city information provider, data tables

stood for a general representation of the interests of co-creators, which they could compare to their own database.

The walking workshops in Bremen Hemelingen and Zaragoza were important for establishing the participants as experts. While walking along routes and places that the participants knew well, they were given the opportunity to contribute their local and/or historical knowledge. In Bremen Hemelingen, several participants described themselves as "contemporary witnesses". In particular, after conducting the data co-creation walks, the participants felt encouraged to share their historical and local knowledge. This experience remained an important point of reference, motivation and confidence in subsequent co-design workshops and meetings. For example, one of the female participants said that even though the men were more knowledgeable with technology, she could contribute with her knowledge about the district's history.

Hence, in all three co-creation projects, we adapted methods that allowed senior citizens to articulate and reflect on different dimensions of social participation and ageing in place (Table 7). The first dimension of socio-spatial inclusion that Wiles, Leibing, Guberman, Reeve, and Allen (2012) list is *older adults' sense of attachment and social connection*. This includes participants' knowledge about their neighbourhood and is grounded in their everyday experience of growing older in the district. This dimension came to be expressed in participants' wish to include nice places and walks into the digital district guide in Bremen Osterholz rather than merely listing organisations (e.g. related to health services). As such, nice places are

Table 7 Articulation of socio-spatial dimensions of social inclusion in probes and walks

Socio-spatial inclusion	Participants' expertise and their tacit knowing of their district	Articulation in probes in Bremen Osterholz	Articulation in walks in Bremen Hemelingen and Zaragoza
Sense of attachment and social connection	Knowing a neighbourhood grounded in everyday experiences of growing older in the district	Expressed through own socio-spatial networks as depicted in maps, participants are experts for their neighbourhoods	Participants planned routes either for recreation and historical interest (Bremen) or frequently used (Zaragoza)
Sense of security and familiarity	Knowing where to find relevant information and resources definition of what relevant information is	Avoidance of places where a lot of young people "hang out" Location of toilets, benches Access to public transport (information)	Participants defined the categories and attributes that were relevant for describing walks
Sense of identity, linked to independence and autonomy	Knowing where organisations and places are located, which services are provided, and how to access them	Nice places, defined by green areas Places of historical importance	Participants felt confident to judge the suitability of routes and make suggestions for improvement

dependent on the circumstances, abilities and preferences of older adults. In Zaragoza and Bremen Hemelingen, participants planned routes—either because they judged that these were routes frequently used by all older residents (Zaragoza) or because the routes were particularly well-suited for recreational walks or historical interest (Bremen Hemelingen).

The second dimension listed by Wiles et al. (2012) relates to a *sense of security and familiarity*. Knowledge about places in the neighbourhood is important in order to be able to plan a visit or tour. One of the tasks of participants in all co-creation projects was to define what information was relevant and important, what kind of attributes were useful. In Bremen Osterholz, this dimension came to be expressed through data on the location of toilets and benches, but also through information about public transport (e.g. how to reach a place) or information relating to accessibility. In Zaragoza, the sense of security was addressed by paying specific attention to the infrastructural problems in routes and ways to improve their age-friendliness. In Bremen Hemelingen, participants suggested to include additional information (e.g. on street lightening) to increase their sense of security.

The third dimension relates to a *sense of identity, linked to independence and autonomy*. In Bremen Osterholz, participants expressed a need to know where organisations and places are located, which services they provide and how they can be accessed. For example, information about the accessibility of public buildings enables people with mobility impairments to better plan their trips and hence increases their independence and sense of autonomy. This dimension was expressed through detailed information about nice places (such as the descriptions). In Bremen Hemelingen and Zaragoza, the participants felt confident to judge the suitability of routes and make suggestions for improvement. Their identities as knowledgeable subjects were confirmed through the ways in which the walking workshops were conducted.

Overall, the probes and walks enabled participants to reflect and articulate their tacit knowing. For example in Bremen Osterholz, certain beliefs and assumptions participants had about particular places in the district and whether and why they liked to go there or not were articulated through the probes. Being open and trustful with each other as well as being able to take perspectives about some of the differences, helped to identify why nice places were an important feature of the district guide and which. Hence, probes enabled perspective making and perspective taking within design teams of older residents developers, researchers and others. They proved to be a method to be used early on in the process to facilitate ideation and exploration. They also provided a basis for developing a shared understanding of the problem area and types of categories and classifications participants considered relevant. However, such a method needs to be coupled with an intervention that compares existing classification systems with these new ideas and supports a negotiation process between the two. In this respect, the data tables as standardised forms were very useful.

The walks allowed participants to define relevant data structures, categories and information based on their own experience. Participants suggested and planned routes in both Zaragoza and Bremen. They subsequently collected and validated

data on pre-defined categories. In Bremen Hemelingen, participants volunteered to guide a historical walk or facilitated contact with a local historian. Eventually, participants in Zaragoza and Bremen Hemelingen contributed feedback to the prototypes as life-world experts.

Learning point 6: *Probes* and *walks* established older adults as experts in the co-creation process. They sensitised participants towards their own ways of "doing age" and were hence tremendously helpful in identifying and articulating needs and resources. In particular, the walks in Bremen Hemelingen, allowed a variety of people to contribute to the overall process, even if they did not engage in the prototyping part. *Standardised forms* such as data tables or documentation templates for walks facilitated the development of shared classification schemes.

Enabling Change

Individual Change

This book investigated the extent to which co-creation projects can respond to the needs and interests of older citizens and thereby potentially enable change on the individual level. There was not one particular need to be satisfied with the co-creation projects, but rather older adults named five overlapping interests:

- doing something for their home district or getting to know the district better,
- engaging with new technology,
- learning new things,
- doing something to improve the image of their neighbourhood/district, and
- socialising with others.

Most of the participants mentioned an interest in the district or a specific neighbourhood as motivation to join the co-creation activities. For others, doing something for their district of residence was a strong motivation. One participant emphasised her sense of self-efficacy to be politically engaged and not to leave things to "the politicians". Her participation in the process was part of her local political engagement.

Many participants stated that they wanted to improve (the image of) their neighbourhood/district. In the case of Bremen Hemelingen, this related strongly to the issue of segregation that was emphasised by the participating older adults as well as other stakeholders. The walks were relevant to those who wanted to learn more about the district and share their knowledge. In addition, participants expressed an interest and the feeling to need to engage with new technology. This interest was mainly grounded in their feeling of being socially excluded through non-use and the need to familiarise themselves with new digital technology. Only few participants were genuinely interested in learning how software development "works".

All stakeholders we interviewed stated that the final digital service was relevant to older users. A social activities manager we interviewed in Bremen Hemelingen said, that "going for a walk is much more part of the reality of older adults than of younger generations". In addition to the overall relevance of walks for older adults, the service providers, intermediaries and participants defined the value of the service for particular groups of older adults: Most emphasised the value for older people who do not know the district very well or have limited financial resources. The information provided also allowed for better planning of walks and hence increased people's confidence in being able to "master" a walk in an unknown neighbourhood.

Hence, similar to accounts from other data walks, the participants were able to engage with their neighbourhoods in different ways. Drawing on an everyday activity such as walking and turning this experience into a digital public service, created value for different groups of older adults.

Overall, our findings suggest that for older adults, data walking workshops proved to be an effective and enjoyable form of engagement. This age group has a sustained interest in their neighbourhoods and what it means to grow older in a particular place. Walks combine a social practice with physical activity; both are viewed as having a positive effect on health and well-being. Furthermore, giving older adults the opportunity to share their experiences and knowledge was appreciated by the participants. Collecting this information and making it available in a digital service further values the participants and at the same time is beneficial to a broader target audience.

Hence, using this experimental form of engagement allows not only for critically engaging with data (Hunter, 2018; Powell, 2018; Van Zoonen, Hirzalla, Engelbert, Zuijderwijk, & Schokker, 2017; Wieringa & van Es, 2018), but also to engage a variety of citizens in civic tech activities to co-design, implement and evaluate digital public services that benefit their communities. Data walks are a promising method to facilitate "participatory open data projects" (Sieber & Johnson, 2015) by engaging citizens that are often excluded as partners in digital innovation. They are a method to enrich the current civic tech formats and allow a variety of citizens to engage with data about their neighbourhoods, districts and cities in a meaningful way. Such walks attract participants beyond the "usual suspects", but they are also in themselves a meaningful activity to contribute to social participation. Hence, even if not all participants of walks continue their engagement in the digital service development, they still benefit from participating in and contributing to the process and its outcome. What needs to be admitted is that not everybody is willing or able to participate in a longer-term process. Nevertheless, such walks provide an opportunity for any community member to become involved selectively. Through such interventions, older adults cease to be subjects of digital innovation and become co-creators.

What is however challenging is to sustain these activities and ensure sustainable change. The logic of funded projects with a specific time frame, is that their lasting impact is rather selective. What is required beyond the mere co-creation of a technical artefact is to embed the resulting service into the existing service infrastructure.

In addition, an infrastructure for continuous collaboration is required so that co-creation projects are not limited to one-off engagements but become the norm in public sector innovation.

> Learning Point 7: In co-creation, old age is not understood as a problem that needs a technological fix, but rather older adults' expertise, lived experience and embodied knowledge become resources for the co-creation of value, knowledge and technology. Co-creation will only produce a lasting change on the individual level, if it is embedded in a continuous collaboration between government, social care service providers and older citizens.

Social Change

One of the main reasons for having users participate in co-creation projects is that they bring their expertise and lived experience into the process so that a successful service outcome is more likely. What we had to realise was that the claim for openness and user-centricity created a tension with respect to compliance with the framing conditions of our projects. For example, residents of an elderly care home in Bremen Hemelingen pointed out that there was no bus stop in front of their home allowing for more mobility in the district. They were hence not in need of better information services about the district but lacked physical access to the district in the first place. Although a valid point and certainly a major hindrance for the residents' social inclusion, creating new bus stops, was by no means part of our co-creation project and out of scope of our grant agreement. This incident was one of many that demonstrated that a co-creation project was indeed a continuous negotiation and manoeuvring to identify a problem definition for which a solution was indeed within the scope of the project.

Latour (2007) argued that framing is something that actors constantly do. However, as Callon (1998) points out: "overflows are the norm: framing is expensive and always imperfect". Figure 4 depicts how overflows are present in the first phase of a co-creation project which aims to "find the right problem" and in the third phase which aims to "find the right solution". *While exploring the life worlds of participants and reflecting on the results, the scope of a co-creation project may be exceeded in that the outcome of the exploration activities do not necessarily correspond to framing conditions such as existing policies and strategies or existing collaborations*. Similarly, *while developing potential solutions, users may propose design solutions and classifications that are incompatible with existing legal and organisational restrictions, existing IT and (open) data infrastructures or procurement laws*.

Overflows are also productive as they allow adding value locally. For example, during the walks in Hemelingen, we noticed that there was a lack of benches in certain parts of the walk. A request was made to the local district council to fund benches in specific locations along the route. While overflows can be productive, it

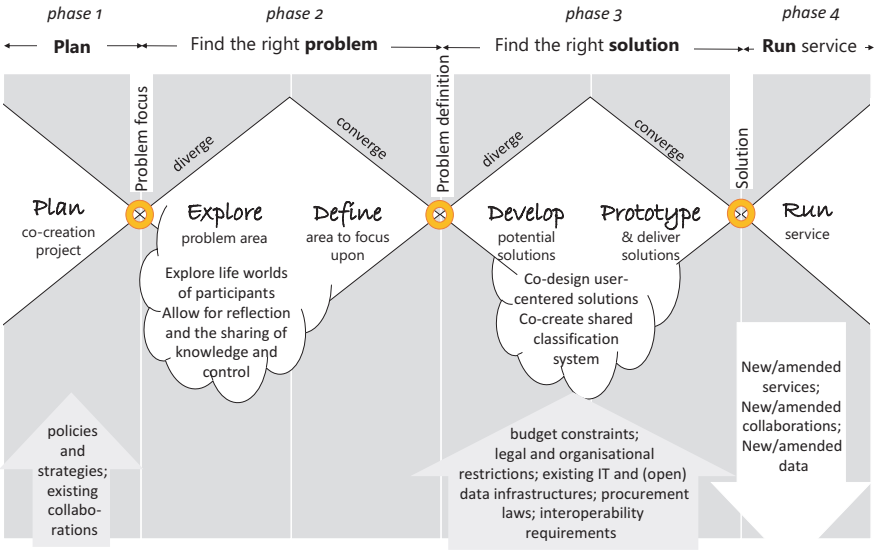


Fig. 4 Co-creation produces overflows and cannot always respect the scoping of a project

is important for co-creation facilitators to be transparent about the restrictions and framing conditions. In general, the output and outcome of a co-creation process can be distinguished between data, apps and the service to be run. In addition, there may emerge new or amended collaborations between different stakeholders; policies and strategies may be developed further.

In addition, *the co-creation of services may also challenge current inequalities in the use of digital services*. For example, it has been noted that issue trackers such as FixMyStreet which report incidents in road infrastructures to public authorities are used over-proportionally by citizens with higher socio-economic demographics. Through such tools, they are hence able to make problems in their neighbourhoods more visible and potentially receive more attention. In Zaragoza, the co-creation project supported the use of such a collaborative tool by older adults. This hence made the place-making practices of older residents visible and allowed them to seek the attention of their public authority.

In the long term, social change will only be effective, if the sustainability of the co-created services is ensured. In Mobile Age, this was a key concern for the whole team. As described above, Zaragoza included the services in their existing service portfolio. In Bremen the services were adopted by the city information provider. Even though the official city portal had agreed to maintain the services in Bremen, it turned out that this was not as easy as anticipated. We were in close contact with the portal providers throughout the process to ensure compatibility. However, our co-creators made a number of design decisions that could not be implemented on the official portal due to its own guidelines and infrastructural requirements. Differences included for example the embedding of the services in the overall

district guides (at the city information portal you can see several other headings on the top and different social media channels on the bottom). The map that had been co-designed with older adults could not be used as a layer, because the city portal uses Google Maps as default. Hence, in the end, we had to dismiss certain design features in order to ensure the sustainability of the service.

Learning Point 8: The more open the process and the less restricted by existing infrastructures, the more difficult it is to make it sustainable. Facilitators of a co-creation process need to be transparent about the framing conditions. The social change stipulated by a co-creation project may then extend the outcome beyond the co-created service to new and amended collaborations, further development of strategies and policies but also changes in the IT and (open) data infrastructure and a cities service portfolio.

All three projects started with a concern on including older adults in the design of digital futures. This concern aligns with a number of policy frameworks such as the World Health Organization (WHO), OECD or the Covenant on Demographic Change that have identified requirements/needs for age-friendly cities and communities. The chapter on ageing societies and technological innovation closed with a review of current policy initiatives. According to the WHO, a more supportive and enabling social and physical environment is essential for people to age in better conditions. The WHO age-friendly cities approach proposes a framework of eight interconnected domains, as shown in Fig. 2 of chapter "Ageing Societies and Technological Innovation". Considering these eight domains can help to identify and address barriers to the well-being and participation of older people: built environment and outdoor spaces; housing; transportation; social participation; respect and social inclusion; civic participation and employment; communication and information; and community support and health services.

In the following, I summarise how the three Mobile Age projects described in this book contributed to a range of objectives and actions associated with the action areas. Overall, there are a number of ways in which the *action area social participation* cross-cuts with others. Mobile Age has demonstrated that technology can

Table 8 Practice examples for outdoor environments from local age-friendly action plans and assessments compared to Mobile Age contributions (adapted from WHO, 2017)

Action plan	Mobile age contribution
Provide benches and toilets	Mapping benches and toilets Installing new benches/repairing broken benches
Provide safe and clean environments	Information about safe and clean environments (e.g. lightening)
Provide places for recreation and leisure	Information on places for recreation and leisure
Provide parks and green spaces	Information on parks and green spaces

indeed play a supporting role in each of these. The action area *outdoor environments* is associated with the objective to provide for places to be and stay outdoors. In Mobile Age, we collected data about outdoor environments as shown in Table 8.

With respect to the action area *transport and mobility***,** one of the objectives is to provide an infrastructure for active mobility and walkability. The WHO action plan suggests, amongst other things, to promote walking among older people. Mobile Age contributed to this by providing information on accessible and interesting routes.

The action area of *information and communication* seeks to provide a "range of opportunities for social participation that are accessible for older people" (WHO, 2017). One recommendation on how to implement this is to "empower older people to participate in activities and increasing awareness of existing activities". This was one of the core contributions of Mobile Age as it informed about events and their accessibility. The action areas of *social inclusion* as well as *civic engagement and employment* are meant to be advanced by "supportive environments for social exchange and places and providing opportunities for social contact in the community and neighbourhood".

During our co-creation projects, we learned that the *impact of a co-created service goes beyond equipping older adults with relevant and appealing information*. The information provided in such a service also makes deficits in the physical infrastructure visible and can contribute to its improvement. When we presented the project to the district council of Hemelingen, members of the committee for construction and environment showed interest in the results and offered to discuss improvements. In Zaragoza, suggestions for improvement were collected on the collaborative maps. Some of the issues marked down, were immediately attended to by the city administration (e.g. road repair); others were referred to the participatory budgeting process (e.g. installation of new benches). Hence, digital information services are only a necessary but not sufficient means to improve social inclusion and e-inclusion. To achieve the desired impact, an information service developed in a co-creation process has to be embedded in the larger non-digital institutional environment and resources of a neighbourhood/district/city.

Learning Point 9: The co-creation of digital public services is not just a process to co-design technology, but also a process to co-create value from socio-technical innovations. The results of a co-creation process are not merely a technical artefact and related data, but a service that is embedded in new (or amended) collaborations between local actors and existing service infrastructures. Co-creation hence contributes to joint socio-technical future-making that produces new publics and enacts alternative imaginaries about old age.

Conclusion: Co-creating Inclusive Digital Futures

This book has attended to the ambivalences and challenges associated with demographic ageing and the increasing digitalisation of social life and public services. One of its key arguments is that the co-creation of digital public information services needs be understood in relation to the wider public sector information infrastructures. The requirements and scope of co-creation processes go beyond approaches such as co-production, co-design or civic open data use. *Co-creation of digital public services demands a different set of engagement methods than traditional co-production approaches*, because co-production so far only marginally considers *digital* service design. The co-design of digital public services, however, comes with its own challenges—in particular when engaging older and/or non-tech savvy citizens. *Co-creation also goes beyond approaches to co-design*, because such approaches are mostly limited to the design of intra-organisational information systems or stand-alone applications. Co-created digital public services however, need to be sustainably provided and maintained for all citizens. Hence, a broader range of issues needs to be considered than for many of the research-led co-design projects that promote co-creation. *Co-creation also goes beyond the civic use of open data*, because it is based on a collaborative relationship between service and data providers on the hand and a broad range of citizens on the other. In addition, working with (open) data is just one of several streams of activity in co-creation.

Based on three co-creation projects conducted as part of the Mobile Age project, this book demonstrated that co-creation is a multi-stakeholder process, which involves activities beyond the ones typically associated with co-production, co-design or civic open data approaches. Figure 1 provides a summary of the streams of activity including corresponding pre-conditions and co-creation results. Ideally, the co-creation process and results contribute to the overall strategy and policies of the local communities, governments and service providers involved. Existing collaborations in between and across government units and social care service providers come to be amended and new collaborations emerge as a result of the co-creation process. Existing services are the basis for new digital services and hence the result-

J. Jarke, *Co-creating Digital Public Services for an Ageing Society*, Public Administration and Information Technology 6,
https://doi.org/10.1007/978-3-030-52873-7_9

Fig. 1 Framing conditions and resulting change of co-creation projects

ing service will become embedded in the existing service portfolios of government and social care service providers. Only then can a service be sustainably maintained. Likewise, the existing data infrastructures will include new or amended/validated data sets that represent the needs and requirements of the service users (e.g. through new/amended data structures and attributes).

In addition to this general assessment on the different types of pre-conditions, activities and results, the book examined specific challenges of co-creating digital public services with older adults. These related to:

1. the sharing of control over decisions concerning the definition of a problem to be solved and the design of its solution;
2. the sharing of knowledge and expertise;
3. the enabling of individual and social change.

Chapter "Learning from Co-creation Practice" has already provided learning points for each of these aspects in relation to the engagement of older adults. In the following, I conclude with some more general observations.

The first and positive conclusion—relating to the governing of co-creation and the sharing of control—is that *co-creation is indeed an appropriate method to develop digital public information services* that meet the needs of older users and achieve an output that is better than existing, comparable services. In Bremen, we developed digital mobile services in two co-creation projects which are now running

on the city information portal and which are maintained by local partners.[1] In Zaragoza, the collaborative maps are integrated into the existing city information service infrastructure. From the experience of these three co-creation projects, there is no one best way to set up and govern a co-creation process. Rather, we identified three framing conditions or fitting challenges: a *representational fit*, a *target fit* and a *problem fit*, which are depicted in Fig. 2 and discussed below.

Representational Fit The co-creation projects described in this book differed with respect to their definition of the intended targeted audiences. Two different approaches can be observed in the two cities:

- *Open recruitment*: In Bremen the participants of the co-creation processes were—to some extent—self-selecting. They either heard about the projects from local social care service providers (e.g. via leaflets), through newspaper articles or through acquaintances. They then decided themselves whether this project was of interest to them and they were qualified to contribute.
- *Targeted recruitment*: In Zaragoza, the collaborating senior citizen centres pre-selected six to eight senior residents per district based on a number of characteristics defined by the two departments of the city council that facilitated the process. These characteristics included those differences within the target group of older adults, which the core project group considered most relevant (e.g. mobility/immobility, digital literacy skills, gender).

There are hence differences with respect to whether co-creators are considered as advisors to a co-creation process (its problem definition and final solution) or as representatives of a target audience, a distinction that is prominent in co-design approaches. As Arnstein (1969) pointed out, there needs to be some kind of legitimation of co-creators to assume the role of representatives in civic participation projects. This accountability is less rigid in participatory design projects in which

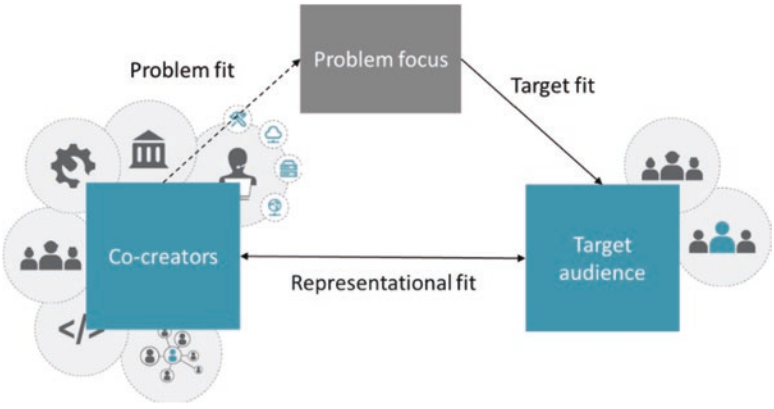


Fig. 2 Framing conditions of co-creation projects (adapted from Jarke & Kubicek, 2019)

[1] (1) www.bremen.de/osterholz/senioren (2) www.bremen.de/hemelingen/senioren.

users are generally understood as either advisors or representatives. For co-creation, this poses a challenge with respect to representing (and taking into account) the life worlds and media use practices of a broad variety of citizens.

Target Fit In Zaragoza, the target audience of the service was defined by the city administration through specific characteristics. The individuals participating in the co-creation process were hence always also representing certain, well-defined parts of the senior population. In contrast, in Bremen, the participants themselves defined what characteristics made a difference with respect to "doing age" in their neighbourhoods. Based on these characteristics we co-created personas and scenarios. The target audience of the co-creation process in Bremen became hence refined as part of the co-creation process and through continuous engagement with participating older adults and intermediaries. These were two, distinct ways of constructing the ageing population as target audience of a co-created service.

Problem Fit The refinement of the target audience had implications for the problem definition and the subsequent development of a service idea. Overall, these approaches made a difference to how future users of a digital service came to be scripted. For example, in the case of Bremen, the primary target audience came to be defined as those older adults living in the district who are still relatively mobile and independent.

In all projects, citizens only became involved to a limited degree in the delivery of the co-created services. However, in Zaragoza in order for the service to run, citizens need to report incidents and suggest improvements. They also need to participate in the participatory budgeting process. The role of service providers (and intermediaries) depends very much on the type of problem area but most importantly on the role local government assumes. The more the anticipated service falls into the area of responsibility of social care service providers, the more responsibility they will assume during a co-creation process. Figure 3 provides an approximation to the scope of action of government (as facilitators or digital information service providers), social care service providers and older adults. There is a delta with respect to the role government plays during the second phase (find the right problem) and third phase (find the right solution) as it is doubtful that government will only assume a consultative role in a co-creation project, if they are facilitating the process. The scope of action for each co-creator group is determined by different factors. One the one hand, *government's scope of action* is determined by the overall public information infrastructure, including existing collaborations, policies and strategies, existing IT and (open) data structures, procurement laws, interoperability requirements, budget constraints and legal and organisational restrictions. Similarly, *social care service providers' scope of action* is determined by the alignment of a problem area to their existing service portfolio, their policies and strategies, their funding schemes and embedding in existing ICT-infrastructures. On the other hand, *the scope of action of older participants* is determined by their life worlds, digital media use practices as well as their ability and willingness to participate.

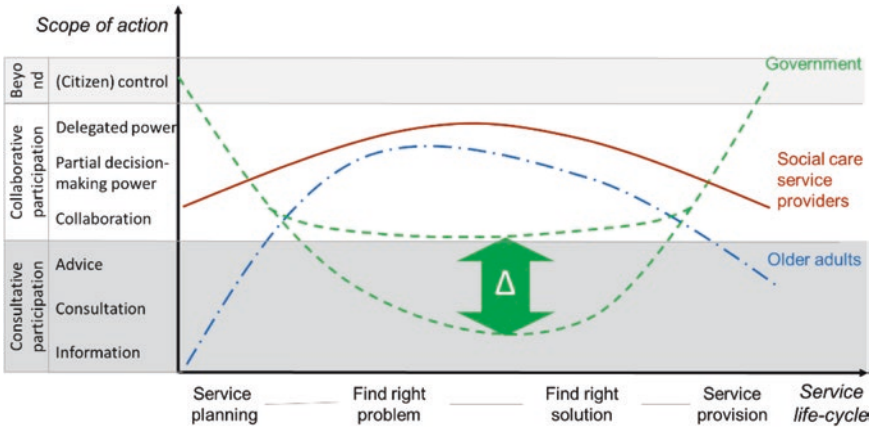


Fig. 3 Scope of action in co-creation projects

Hence, co-creation is indeed an appropriate method to develop digital public information services. However, there exists—throughout a co-creation process—a tension between on the one hand, a need for standards and alignment to existing public information infrastructures in order to ensure continuity and sustainability, and on the other hand, customised and flexible uses of information services which are based on the very local and situated life worlds of older participants.

The *second conclusion—relating to the sharing of expertise and knowledge*—is that the *co-creation of digital services works well with older adults, including those with little or no digital literacy skills*. However, the performance and achievements of co-creation processes seem highly contingent and dependent on several factors. Even though, *older adults are important civic actors* contributing to their local communities and families as well as to society as a whole, they are—so far—rarely included as (design) partners when it comes to public socio-technical innovations. If, however, technical innovations are designed without them, old age is mainly understood as a problem that needs a technological fix. What our three co-creation projects demonstrated is that co-creation can challenge this assumption: *In co-creation older adults' expertise and lived experience become resources for the co-creation of societal value, knowledge and technology*. Indeed, when older adults are involved in the process of identifying, conceptualising and designing digital public services, these *services become more relevant and meaningful for all ages*.

In order to do so, a co-creation process needs to provide meaningful and suitable interventions: In co-creation, older adults need to be enabled to explore their life worlds and reflect on them (*perspective making*). They also need to be enabled to share this with others (*perspective taking*). In the projects described, we used probes as well as ideation walks for perspective making between older adults and perspective taking between participants and co-creation facilitators (e.g. government). Both types of interventions produced a range of boundary objects, which allowed co-creators from different communities of practice to communicate and collaborate;

they allowed to manage the tensions between diverging, differently situated viewpoints (Bowker & Star, 2000).

The outcome of each of the exploration phases were problem definitions in form of scenarios based in the life worlds of the participants. These were aligned with the public information infrastructures through standardised forms such as data tables in Bremen Osterholz or questionnaires and documentation sheets for the walks in Bremen Hemelingen and Zaragoza. Such interventions, hence, allowed for the development of shared classification schemes and subsequent co-creation of sustainable solutions. Figure 4 provides an overview about how different types of boundary objects allowed for perspective making and perspective taking across different communities of practice. For example, probes and walks worked well in combination with data tables and walking templates as they enabled diverse groups of actors (service providers, older citizens, and software developers) to communicate effectively and engage in co-creation.

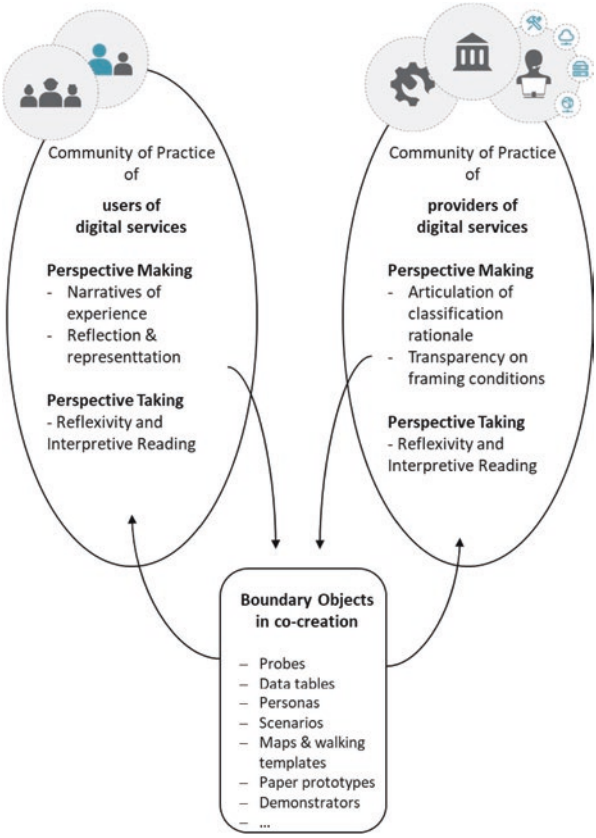


Fig. 4 Boundary objects facilitated the perspective making and perspective taking across communities of service providers and service users

Hence, the co-creation of digital services works well with older adults, including those with little or no digital literacy skills. It requires a combination of methods from co-design to co-production approaches that can balance the tensions between situated knowledges and use practices versus standardised public service infrastructures.

The *third conclusion—relating to enabling change*—is that not every digital public service is equally suited for co-creation. Technology design and the development of new technologies have—throughout human history—been envisaged as ways of responding effectively to societal challenges, problems and obstacles. In particular, information and communication technologies are amongst those that are viewed to have changed social order and sociality profoundly (e.g. Castells, 2000; Latour, 1990, 2007). They are also situated in a discourse of innovation and progress, a discourse that the public sector cannot avoid.

With regard to the readiness of government and public administration, and their legal and technical discretion as well as the relevance of the knowledge and possible contributions of citizens as co-creators, local information services should be given first priority. In particular, Mobile Government offers many opportunities where either printed information or static websites can be improved by apps for mobile devices and meet the promise of anytime-anywhere-access to required information. Figure 5 depicts the suitability of different types of public services for co-creation. Based on our experience, we identified local information services as most suitable as they require a high degree of speficity to local contexts and hence allow a greater scope of action for the participating co-creators.

A lasting social as well as individual change can only be implemented if the resulting service does indeed respond to the problem definition. A *positive impact* of a digital service on social problems depends on the extent–and more importantly–the ways in which citizens come to use a service. We have learned that co-

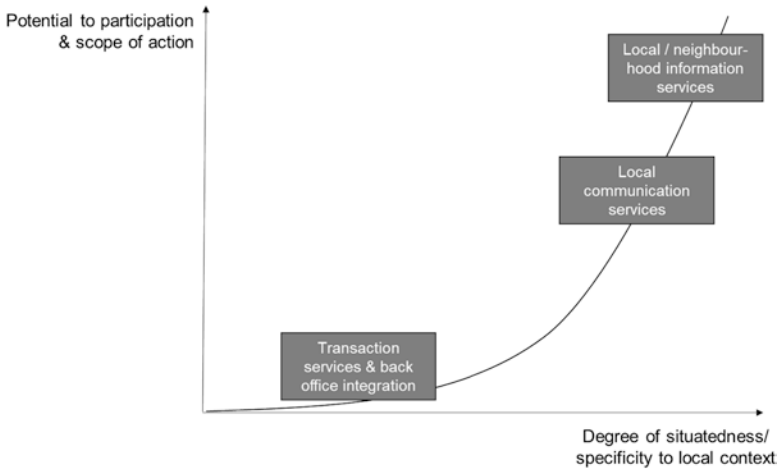


Fig. 5 Suitability of services for co-creation

creating a service makes this service more appealing for the target group of older adults.

However, there is a challenge concerning the *access and usage* of a service. So far, older adults are less likely to use digital public services than younger generations. In our co-creation projects, we drew two different consequences: 1) we supported the access to the provided information through the provision of additional printed materials and 2) we supported the access and usage of the digital service through tablet courses during the co-creation projects and—to the extent possible—after their termination. Hence, a multi-channel approach (e.g. providing information online and in print) is necessary for a transitional period. Such printed material may raise interest in the digital counterpart. If appropriate support structures are in place, the co-created services may motivate older adults to take part in courses imparting digital literacy skills.

In sum, there are six challenges to co-creation that we identified across the three co-creation projects (see Fig. 6). There is a *target fit* with respect to the definition of a co-creation's target audience in relation to its problem focus. As a co-creation project progresses, the target audience becomes more and more refined and may lead to the exclusion of those citizens who are not represented in the co-creation process. This is based in a *representational fit*: Do those people who participate in a co-creation project represent the target audience adequately? Depending on the representational fit of co-creators, this may lead to a *problem shift*, which means that the specific concerns of those included in the process, overlay the needs of a wider population. A fourth challenge is a *resource fit* and relates to the abilities of those

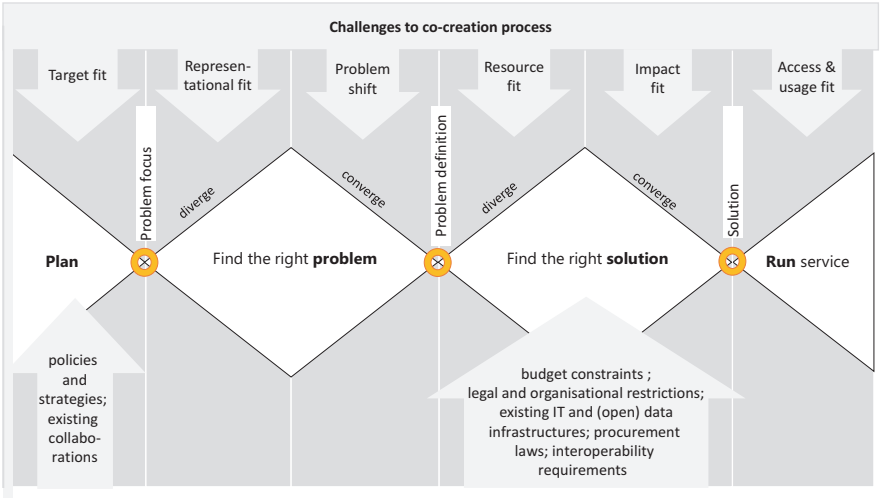


Fig. 6 Challenges to co-creation process

older adults participating. A co-creation process requires an adaptable and continuous recruitment strategy in order to allow for the engagement of additional co-creators whenever skills or specific knowledge are required that go beyond (the capabilities of) the core participants. A fifth challenge is an *impact fit* and relates to the match between the original problem focus and the co-created solution. A final challenge relates to an *access and usage fit*: A lasting social change and impact may only be achieved, if the take-up of the resulting service by its target audience is actually accomplished. All of these challenges are *framed by the public information infrastructures* as part of which the digital public services is being co-created.

To conclude, co-creation may become a way to improve the lack of user-centricity and user experience of digital public information services. However, there is no guarantee for its success. It is a complex multi-task and multi-stakeholder process, more demanding than traditional citizen participation. Due to the openness and complexity inherent to any co-creation process, providing strict guidelines and recommendations is not possible. However, the learning points identified in this book provide evidence on ways to co-create better, more user-centric public services with and for older adults: If co-creation is based on a continuous engagement and participation of (older) citizens then a more inclusive digital future is possible.

Appendix: Cultural Probes from Co-creation Project in Bremen Osterholz

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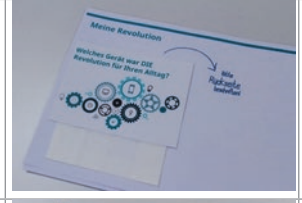
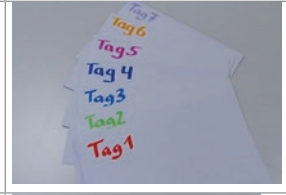
https://doi.org/10.1007/978-3-030-52873-7

	Rationale	Explanation	Cultural probe	Example/picture	Question
1	Convey a positive image about participants as being active (display with digital devices, cameras) and connecting with Osterholz (map)		**Cover**		n/a
2	Personal information		**General information about participants (once)** Gender Year of birth (former) occupation Living circumstances (alone, in partnership, with family, other)		Exploit the potential of open (government) data
3	Develop an understanding of the everyday activities of the participants	Diary allows participants to record everyday activities	**Diary (daily):** Please record what you have done today (morning, lunch, afternoon, evening)		
4	Document the communicative practices of the participants and their media repertoires Develop an understanding of what kind of relationships are mediated through technology	Media diary allows participants to reflect on use patterns and gives researcher a first glimpse	**Media diary** allows participants to reflect on use patterns and gives researcher a first glimpse		What are your communication patterns and what role do digital devices play?

	Rationale	Explanation	Cultural probe	Example/picture	Question
5	Document media repertoires		**Media repertoire questionnaire (once)** Participants were asked to assess how often they use specific media (TV, radio, phone etc.).		Which media do you use on a daily basis for what purpose?
6	Develop an understanding of the use patterns of Internet technologies Develop an understanding of a participant's relationship to technology		**Internet service use questionnaire (once)** Participants were asked to provide information about for what purposes they have used the Internet in the past 3 months (e.g. emails, chats, online-banking, routing, online-shopping)		Which types of services did you use the Internet for in the last 3 months?
7	Learning about **biographical relevance** of technology		**Postcard 1** Participants were asked to reply on the back of the postcard to the question: "What was the technical invention that revolutionised your everyday?"		
8	Understand relationship to space-related dimension of inclusion (e.g. bonds to living environment)	time line allows to capture time dimension	**Timeline Osterholz (once)** Which events have changed life in Osterholz over the past years/ decades und what implications did this have to you personally? Please add year and explanation. Mark the three most important ones		What is your personal relation to Osterholz, your district and your neighbourhood?

	Rationale	Explanation	Cultural probe	Example/picture	Question
9	Understand social inclusion with respect to primary networks and space.	Map allows to capture spatial dimension	**Map (once)** 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). On the right is the map of participant #1		How connected do you feel to people/ places and what is the spatial dimension (neighbourhood, quarter, district, clubs)? Which social networks are you part of and where do you meet?
10	Understand the reach of people's activities, and understand their relation to space	Map allows to capture spatial dimension	**Mobility maps (daily)** The participants received 7 printed district maps and were asked to draw their movements each day, if possible with explanations about modes of transport etc.)		Which places do you go regularly to? What are your mobility patterns?
11	Understand participants emotional bond to the district (places, people, animals, etc.) Develop a common understanding (between co-creators) of what may need to be seen in a service that aims to improve social inclusion	Photographs allow to see Osterholz with the participants' eyes	**Disposable camera** What do you do/where do you usually go/With whom do you speak if…? • You feel lonely • You are upset • You need help • You want to relax • You want to get diversion Please take pictures of places, people, objects and/or animals		What are the places/ people that are important to you? How do they look like?

	Rationale	Explanation	Cultural probe	Example/picture	Question
12	Learning **about how people perceive of the future** of the district (positive/negative)	**imagining** the future may invoke associations about visions & ideas for service	Postcard 2 Participants were asked to reply on the back of the postcard to the question: "How will Osterholz look in the future?"		What could be better/ improve in the district?
13	Learning about **what makes Osterholz unique**	**sketching** allows for participants creativity	Postcard 3 Participants were asked to draw a doodle and imagine an emblem of Osterholz		What do people perceive as unique about the district?
14			Postcard 4 Participants were asked to reply on the back of the postcard to the question: "In the old days everything was better?!"		

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