

Navigating Relationships and Boundaries: Concerns around ICT-uptake for Elderly People

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ABSTRACT

Despite a proliferation of research in the use of ICTs to support active and healthy ageing, few have considered the privacy and security concerns particular to the elderly. We investigated the appropriation of tablet devices and a neighborhood portal as well as emerging privacy and security issues through ethnographic and action research in a long-term participatory design (PD) project with elderly participants. We discuss two major themes: a) the tensions related to perceived digital threats and the social pressures of online disclosure to the social environment; and b) the relation of these issues to the ICT appropriation process and the referring challenges we encountered. We argue that there is a need to understand the interleaving of physical and virtual habitats, the various ways resulting in discomfort and the senior citizens' actions – which at first glance appear contradictory. We consider the implications of the issues observed for examining privacy and security concerns more broadly as well as discussing implications for the design of the portal and the shaping of social measures for appropriation support.

Author Keywords

Privacy; elderly people; ethnography; action research; participatory design; disclosure; appropriation; communities of practice; design case studies;

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous

INTRODUCTION

Recent demographic changes in Europe such as increasing life expectancy and reduced birth rates are linked to drastic changes in respect of age structures. The number of people aged 80 and over will have doubled by 2025; yet at the same time, the availability of workers in the care sector will be drastically reduced [11]. In its program 'Innovation for Active & Healthy Ageing', the European Commission faces these challenges for the future, attributing information and

communication technology (ICT) a major role in the development of innovative solutions for preventive and curative measures. ICT is seen as a major driver for quality of life and everyday support increasing the agency of the elderly in their everyday lives [12]. One of the major challenges in the development of effective and efficient solutions for active and healthy ageing identified by the commission are *"privacy and ethical issues that cannot be overlooked and require a holistic approach. All development of new solutions should strongly involve the users in order to ensure that they are addressing the real needs in an acceptable way, if seen from the perspective of ethics and privacy"* [12:21]. However, sustainable implementation of these IT-based innovations often fails as they are not embedded in the everyday lives and practices of elderly people and their surrounding social networks. This underscores a practice-based research agenda in HCI and CSCW, especially research and design for and with older adults, which aims to create socio-technical solutions which in turn enable sustainable sense-making and safe usage of ICT tools by all members of society.

Practice-based design in HCI appears in methodological framings such as Participatory Design (PD) and Living Labs in real life contexts [6,8,16,19,22,39]. The aim of these approaches is to better understand the social fabric in which future technologies are to be used, and how current end-user practices and attitudes may influence the design and appropriation processes of the final product to be developed. In regard to PD with the elderly, research has demonstrated the importance of taking elderly people's attitudes and (self-) images into account. These images are often based on a low familiarity with new media and result in anxieties and reluctance to get in touch with ICT and hence affords certain measures to develop technology which is meaningful and useful to the elderly [5,27,53].

Privacy and security issues and concerns are another huge factor impacting on successful ICT appropriation by the elderly [29,42]. Some work is underway in the context of IT development for the elderly but is, however, mainly concentrated on research fields such as smart home, Ambient Assisted Living (AAL) and sensor technologies in homecare contexts, where privacy and security intrusion is a big concern. In many cases, however, it is being approached from technology-oriented perspectives [6,9,22]. There is practice-based work on tensions and concerns around privacy and security issues in homecare settings

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[1,24,38] focusing on sensitive places in the home and collaborative engagement in medical treatments in the everyday surrounding. However, in regard to elderly seniors who master their life still on their own without assistance there is not much knowledge so far on how self-directed ICT appropriation evolves, e.g. in the context of a city quarter community approach as in focus of our study. This study responds to the European Commission's call to address privacy better and presents a discussion of the elderly-relevant technology issues of privacy and security through management of social relationships and personal boundaries. We contribute to bridging this gap by reporting on issues concerned with personal data management in the context of new ICT appropriation processes [50] by older, independently living adults.

We report on data from a PD project with elderly people focused on fostering social interaction and awareness in a neighborhood through an online portal. Based on a long-term study, including interviews and co-design workshops, we report on existing practices concerning privacy in the "physical" world (e.g. the handling of regular mail) and their relation to emerging practices in the course of ICT appropriation. Further, we explicate that the privacy-related practices and attitudes of elderly people are inherently located in social processes and their activities of boundary management in their everyday lives. We further show how these findings influenced the design of the neighborhood portal and finally, we reflect privacy and security issues in the context of co-design processes with the elderly.

RELATED RESEARCH

Participatory IT Design with Older Adults

PD methods are being progressively integrated into human-centered technology design contexts. Especially when working with particular diverse target groups who exhibit a low level of familiarity with new media, as is often the case with elderly people, participatory design methods help to overcome the *symmetry of ignorance* [13], a mutual lack of knowledge. Elderly or non-tech-savvy people lack insight of what is possible with modern technology and often cannot articulate their needs in respect to possible IT support. Researchers on the other hand often lack understanding about the everyday life concerns of groups of future users [27,32]. The scope of collaboration between researchers and user groups may vary as well as the approaches; from studies based on cultural probes [17], to the usage of prototypes in participatory design workshops [26,30,45] and long-term projects focusing on the appropriation of IT artifacts in real world circumstances, an approach which we applied in our study.

Privacy and security concerns are cross-sectional issues which are at stake in many research topics in the field of ICT for ageing (e.g. in AAL, telehealth, robotics, etc. [9,14,29,42,49]). However, there is a paucity of practice-based and empirically grounded research which develops a perspective on privacy and security issues in elderly

people's everyday lives in relation to their social networks and socio-cultural living environments. With an ethnographic and action-research based research design we would like to contribute to a more socio-technical and empirically grounded perspective on elderly peoples' practices in relation to their attitudes and practices of personal data management.

Privacy, security and the aging society

Literature concerning security aspects of modern technology in the context of elderly users is rather thin on the ground, too. Studies which investigate the use of passwords for authentication by elderly users usually conclude that passwords pose a huge obstacle due to assumed memory deficits and do not consider them to be sensible mechanisms for data access management [44]. Regarding a general notion of security concerns, Rader et al. discuss the idea that non-expert users can gain knowledge about online security through stories from friends, family and media [43]. Although their argumentation is based on a study with students, the underlying assumption could possibly be transferred to other non-expert users such as older adults, too. In general, Adams and Sasse [2] describe security measures as being too complicated and not based in users' practices, thus resulting in workarounds.

There are several publications on privacy concerns regarding elderly people as patients [46,56], in care situations [28,29], and smart home contexts [9,42]. However, most studies discuss the topic from a technology-centric point of view and do not take real usage and appropriation processes of ICT into account, which is why results are consistently on a relatively superficial level, presenting arguments such as that older adults mostly tend to underestimate privacy risks, for example, and tend to have a rather "naïve" notion of their own privacy [29:239]. As we do not fully agree with this perspective, our study attempts to provide a more differentiated picture on various aspects of personal information-sharing practices and evaluations of data and data flows from observations and interactions with elderly ICT users in real everyday appropriation contexts.

Privacy as a social process and boundary management

While privacy has a variety of definitions, this paper relies on Altman's sociological notion of privacy that describes a dialectic and dynamic process of constantly negotiating personal boundaries and territories inside social systems. This definition is characterized by a constant fluctuation between disclosure and concealment of aspects of the self towards other people or groups [3]. Altman argues that privacy is an ongoing social process depending on the individual, their context and situation. Thus his notion of privacy does not only cover the management of disclosure and concealment but inherently the management of relationships.

Palen and Dourish [41] argue that the investigation of privacy concerns against the backdrop of new technologies should consider “*the whole of the social and institutional setting in which technologies are deployed*” due to the dialectic and dynamic nature of privacy [41:135]. Barkhuus seizes on this idea of considering social and institutional settings and emphasizes a need for a more precise investigation of socio-cultural contexts in which technology is to be deployed – especially the existing practices for managing privacy [4]. The outcomes of negotiating privacy highly depend on the individual contexts in which it takes place. To investigate these contexts, Barkhuus builds on Nissenbaum’s notion of *contextual integrity* [37] and defines privacy as a dynamic “*flow of information rather than a static act of sharing*” [4:1].

Technology Appropriation

Since there are only a handful of studies on privacy and ICT in relation to elderly people, little is known about how they make sense of and form a consciousness about privacy and ICT and how it affects their social fabric when ICT is introduced. To investigate these issues, we should investigate how elderly people approach ICT, thus applying the lens of *technology appropriation*. Under this term, researchers describe suitable measures for the support of successfully adapting certain artifacts to a certain practice (inside a certain social context), a crucial process regarding the acceptance and future use of technology [10,40,50]. As a framework for investigating this rather long-term process, design case studies (DCS) can be applied [55]. The DCS approach comprises an ethnography-based pre-study for a profound understanding of the envisioned field of practice; a cooperative prototyping phase, and a long-term appropriation study which aims at an understanding of changes in the social practices brought about by the usage of the technologies introduced; and by this to be able to measure the success criteria of the project. In applying this approach, design ideas may be grounded and carefully explored in actual practices. This enables researchers and designers to continually and iteratively refine and re-design the artifacts in-situ, promising a better understanding of the practices and thus better suitability of the developed artifacts for these practices. However, applying DCS and co-design measures with elderly, technologically inexperienced people often presents another challenge: self-induced marginalization in society and thus a decreasing urge to participate [36,51,53]. This challenge can be tackled by specially designed workshops, emphasizing practices of elderly people’s everyday lives and experiences [33]. These workshops can be considered as the basis for some kind of *Community of Practice* (CoP), a socio-constructivist, praxeological concept for investigating and describing a framework for situated, practice-based learning [23,52].

Here, a main concept is Lave’s & Wenger’s interpretation of Vygotsky’s *zone of proximal development* (ZPD) [52], namely *Legitimate Peripheral Participation* (LPP) [23]. LPP aims to describe the highly social process of gradually

integrating novices into an established community by taking part in their ongoing practices, routines and habits, thus being able to adopt and refine skills, informally learn basic principles and develop an identity inside the community. CoP and LPP enable us to observe and describe the learning process of elderly people while approaching and appropriating modern ICT. As a measure to further support the learning process, especially with the goal of sustainable learning, *scaffolding* can be considered. The term *scaffolding* was coined by Wood et al., building on Vigotsky, [54] as a concept to support learners in constructivist settings. Hung [21] connects the scaffolding approach to communities of practice. He argues that the learning process of an individual inside a CoP can be holistically (or, in his terms, as a *continuum*) supported by means of scaffolding. This extends throughout different stages of engagement: *simulation* in a controlled environment, *observation and participation* together with qualified practitioners and *in-situ practice* on the learner’s own.

METHODS & SETTING

This paper is based on in a long-term participatory design (PD) project which we conducted with tenants of a living quarter in a German mid-sized city. The project aimed at establishing socio-technical measures to support mutual help and social inclusion. Measures encompassed and linked both, information technology as well as social activities to foster community building on the local level. One of the technical measures included the development of a web-based neighborhood portal. The portal is accessible on private devices at home and on public displays in front of the houses, secured by an RFID-based login. We developed the portal in a participatory design process together with interested, voluntary tenants as our co-designers. All of the interested tenants were between 60 and 86 years of age and had no prior knowledge in the area of new media and ICT. For over 36 months, we conducted regular workshops with interested elderly tenants (and a much smaller number of younger tenants). This was to investigate how the tenants approached and handled the tablet PCs and online services on the one hand, thus enabling the establishment of a shared common thinking space for later use of the portal. On the other hand, our measures aimed at preparing all participants to undertake an active role in the participatory design process [22,33,34].

In the course of the appropriation of the tablet PCs, in personal chats with the participants and during the PD workshops and common prototyping endeavors, topics repeatedly emerged which can be allocated to the current privacy discourse. On the one hand, this happened due to our efforts to prepare the participants for threats potentially arising from the use of ICT. On the other hand, the participants themselves expressed security concerns. We conducted several interviews to firmly understand the individual behavior, attitudes and concerns regarding the information flow of the participants.

To sensitize researchers and participants for each other's interests and limitations [13], to establish a trust relationship and to generally enable the elderly tenants to actively engage in the PD process, we took further prior measures: starting with regularly meeting the participants in a community room located in the quarter, we brought cake and made coffee, sat together with the participants and talked to them about their problems, fears and wishes in order to learn more about their everyday lives. Simultaneously, we brought tablet devices and started showing them apps, websites and general features which could support them in the daily challenges they mentioned. After a short period of time, we distributed tablet devices to 15 interested participants which they could take home and use on an everyday basis. Following the distribution of the devices, we began to implement fortnightly workshops. At the beginning, we used the workshops solely to support the participants in appropriating the devices, certain apps and features, such as interactive maps, email, instant messaging and web browsing. After about six months, we divided our workshops into two parts: the first part was dedicated to appropriation support and troubleshooting. In the second part, we started to work on the portal design together with the participants as co-designers.

The workshop sessions were documented by writing extensive field notes after each session by every attending researcher (mostly between two and five researchers). In the manner of action research [20,25], we were highly immersed in the workshop groups. In total, we conducted about 70 regular and three larger-scaled workshops. After about two years of workshops, semi-structured interviews were conducted with five women from the long-term participating core group. The aim of these interviews was to gain insight into personal development during the project. We therefore consciously focused on interviewing longer-term regular participants, since it was easier for them to reflect on their individual progress during the project. The interviews were audio-recorded and subsequently transcribed.

Given the length of the study and the sheer amount of data, the primary analytical process entailed focused thematic coding with data reduction through theoretical sampling. Three researchers were involved in the coding process, which proceeded iteratively and continually to enable theoretical sampling. During the process, various issues emerged around social interaction and learning which have been addressed in several publications [33–35]. Since privacy emerged as a crucial topic in the analyses, the interviews were aligned to this theme to gain deeper insight into the participants' privacy-related concepts and consciousness. Eventually, the data corpus was analysed again in a *Thematic Analysis* approach [7] with a focus on privacy-related themes.

FINDINGS

The main characters in this study are the five women with whom we conducted interviews. However, the study is embedded in the long-term project with further workshop participants (15 people altogether). At the beginning of the project, the five women were aged between 60 and 77. They have all been retired for several years and - with one exception of a lady who lives with her grandson - they live alone in small flats. They all engage in various social networks in the neighborhood to varying extents. The participants' families vary in size and in the intensity of family bonds. We use anonymized names for the participants when presenting quotes, which have been translated from German by the authors. The quotes are labelled according to their source - interview ("I") or workshop protocol ("W").

Shaping Personal territories & disclosure

Meaning and practices of shaping private and public spaces
In the course of the workshops over three years, and on the basis of informal chats we understood that (in different extents) most participants viewed their flats as a kind of "sanctuary" - a place they felt both autonomous and safe. Their own flat was a place where they felt immune from what other people think about them or their behavior. In many conversations during the workshops as well as in the interviews, the perception of one's self by others in the neighborhood emerged as an important theme for the participants. In many cases, presenting themselves in public in the quarter was linked to feelings of low self-esteem and shame due to their economic situation: some were long-term unemployed and had to apply for social security payments in addition to their pension. Others were widowed or divorced and only received a low pension. This influenced how they constructed their social relationships in the quarter. They often expressed fear that others looked down on them due to their financial limitations, which is the reason why they rather preferred to only interact closely with just a few neighbors. We carefully conclude that low self-esteem and related feelings are one aspect which makes it hard to stimulate social interaction in the quarter in order to build up a broader local community, as was intended by co-designing the platform.

Another aspect impacting on how the elderly people in the quarter shaped their social relationships was a more generational habit of positioning themselves in society [34]. The positioning of self in society (or at a local level) shows different facets of their thinking: firstly, there was often a desire not to appear "needy" in terms of financial issues, or generally dependent on help from another person, as well as in terms of being in need of social contact. Secondly, there was often a general attitude of not feeling relevant to society any more as a retiree. An utterance of a 75-year old female participant may demonstrate this: "*Why are you concerned with us old people? Wouldn't it be better to work with schoolchildren to help them with the new technologies?*" - (W)

We further observed that there are generational as well as socio-economic and education-related aspects which had an impact on how the elderly people constructed their social relationships at the interface of their private and public spheres. Especially their perceived self-positioning at the local level, but also in general society, is an important factor for how they dealt with flows of information about their person. Their self-perception and perception by others constructed a field which participants continually needed to maintain.

Handling mail and email - What mail tells others about me

The handling of mail in the physical world opened up an interesting theme according to disclosure of information on the one hand, but also on practices to mark borders of a “personal territory” [3] on the other. The delivery of mail is an interesting example here. Every tenant has a mailbox in the hall of the tenement. Most of the time, the post(wo)man puts the letters in each tenant's mailbox, thus the letters themselves and the sender are not visible to other tenants. However, sometimes the post(wo)man puts all the mail for the (up to 8) flats in the tenement just on a shelf in the hall; then the tenants have to look through the pile of letters and pick out their mail. When asked how they felt about the possibility that all other tenants in the tenement were able to see the kind of mail they received, different perspectives and attitudes were expressed by the participants.

At first, there was the opinion that the mail itself is not of critical content, and thus it would harm anyone if other neighbors got a look at it: *“it's only bills anyway”* (Gerda – I). However, there are contents that they would possibly only condone being seen by people with whom they have closer relationships, e.g. letters which make their income visible: Julia says that the neighbors who sometimes empty her mailbox when she's away for a longer period of time *“already know that I get social security”* (Julia – I). In general, there is the overall attitude that if someone opened the mail, they *“had no use for it anyway”* (Gerda – I). Except if *“it contains a new credit card or something”*. One participant expresses a contrasting view, not wanting to reveal to others information about the senders of her mail; but then she relativizes again: *“Yes, that's my business. But these days, who writes private mail at all, you know?”* (Lisa – I). The emphasis on *“my business”* must be regarded here against the background of feelings of not being of high value to society. The sanctity of mail incarnates a basic human right for everyone, which is an important feature of the integrity of each citizen, independent of socio-economic aspects.

In addition to the predominant attitude that mail does not invite privacy intrusion and is not an indicator for information they would not like to be visible to others, one participant calls to mind a case in which mail could potentially compromise one's own integrity: after being asked about sensitive mail, Lisa reports that she once got mail from the regional court, inviting her to appear as a

witness. As the envelope displayed the return address, neighbors might have surmised that she was the offender of a criminal activity. Even taking into consideration that neighbors could possibly have thought something untoward about her, she then displayed her strategy for dealing with the situation: *“Everyone can know everything about me”* (Lisa – I). Additionally, she says that it does not bother her what others think of her, because – as she emphasized: *“I live a righteous life”*. This example demonstrates that the visibility of private information through the delivery of mail may potentially harm the participants' integrity if seen by people who are not part of their inner networks. They also show how people demarcate their personal territories: in terms of physicality (*“my postbox”*), but also in terms of psychological strategies to cope with potential situations of uneasiness (being strong enough not to let themselves be affected by possible negative evaluations from others).

Another theme in the context of handling mail is a feeling of uneasiness when receiving mail from senders they have not consciously interacted with so far. Annoyed by the amounts of advertising mail she frequently finds in her mailbox, Daphne wondered: *“And everyone has your information although you never thought they could. How do they know where you live?”* (Daphne – I) She feels a certain uneasiness because she cannot oversee the processes of data collection by the advertisers. Another participant told us about her strategy to cut out her name, address and customer ID from envelopes and catalogues from certain mail order companies before putting them into the publicly accessible wastepaper box. She did so to prevent her information from being used to send adverts. But more importantly, she feared other people could use it to order items in her name. Interestingly, there was a difference in thinking about and feeling affected by adverts in the participants' email inboxes: Here, their general method of handling unknown correspondence was to mostly ignore and immediately delete it. Usually participants did not think further about these emails and did not question them as much as the physical letters. This may hint at a difference between the negotiation of privacy boundaries in their personal *physical territory*, which was of high importance and was considered potentially harmful, and their *digital territory* which they had just recently started to explore and construct, and where such potential threats were not perceived.

Attitudes to being visible in a digital world

This section focuses on the participants' privacy-related attitudes towards the usage of the neighborhood portal, their appropriation of tablet PCs and the perception of internet-based content.

There were different facets of concern in respect to posting content on the neighborhood portal. At first – and linked to narrations that circulated among the people – it was understood that criminals also use digital features to commit crimes against elderly people. Iris feared that portal

entries such as *"I will be on vacation for the next two weeks. Who can water my plants?"* (Iris – W) would serve as an invitation to possible burglars. Participants discussed this example as a new form of danger which became relevant to their lives. When going on vacation or to hospital, they tried to make the flat look lived in by, for instance, asking close neighbors or friends to look after their flat and to open and close the shutters. Asking for help such as this on the internet was perceived to be a new security threat. Here especially the scope of the post was important to participants: the user base of the portal would comprise all tenants of the housing company in the quarter, which entails about 140 flats in 8 tenements. Participants' relationships to the other tenants varied widely: While some knew each other personally, others were considered strangers more than neighbors and thus were not trusted with such information, even though participants reported feeling generally safe among the other tenants. The question of "who can see my posts?" was also relevant apart from the direct fear of possible threats in terms of domestic safety or possible burglary. While the tenants knew the majority of their next-door and in-house neighbors and some of the people in the surrounding neighborhood, they did not know every single person living in the quarter. Thus imagining that people unknown to them might read postings and could obtain information about their person caused awkward feelings among the elderly workshop participants. In this respect, they stated that they could imagine posting something to a tenement in which they know one or more tenants but not to a particular tenement where they didn't know anyone. They also discussed that their willingness to share information differed in respect to diverse categories of information they would post in the portal. They differentiated e.g. notifications addressing interests of the whole quarter - such as information about a summer party or a commonly organized flea market - from messages in which they would display personal issues. These were e.g. to seek for help in certain circumstances (e.g. looking for a ride-share to the supermarket) or to offer help (e.g. I can do some repair/ sewing work on clothes).

The portal thus raised thoughts of becoming visible in their city quarter in a different way than they were used to before the idea of a digital neighborhood portal came up. Navigation of disclosure and exposure to the community in the physical environment had been bound up to this point by their notion of how an elderly tenant "should" behave in the quarter. They perceived the way they were represented by postings in the portal as being contradictory to their concept of how a modest and mainly withdrawn elderly person should live. In their eyes, it offended the social norm of modesty which they upheld in their physical everyday surroundings. This attitude towards what people evaluated as "normal" behavior in respect to self-portrayal was also discussed in a workshop between younger and elderly tenants. The younger ones, familiar with rating/recommender systems (e.g. on Amazon or "likes" on

Facebook) suggested that single contributions in the system could be rated by the other community members in order to raise traffic and awareness in the portal. In contrast, the elderly tenants were against this idea. They said they would feel uncomfortable with this as it would make contributions too conspicuous which they deemed to be of lower importance.

This corresponded to what we discovered to be more or less a generational issue and which we described in the first sub-chapter: again, it is about a certain way of perceiving one's own position in society, linked to the attitude "who would care what I tell". So if elderly people behaved differently than in a modest and withdrawn way, they were afraid of being perceived as strange or awkward by others. Another anecdote supports this assumption of the notion of a certain position in the world and related perceived appropriate behavior: one of the elderly participants told us that she did not dare show the tablet in public at first: *"I do not know if this is good for me, what other people will think when an old person like me is running around with a tablet PC. I think it is a bit embarrassing."* (Lisa – W). However, after a couple of months of usage, her attitude and perception of herself changed from shame to pride in being capable of mastering the new technology. As an example, she spoke about her participation at her granddaughter's 18th birthday party where she took pictures with her tablet and received a lot of positive encouragement and praise from the other (young) invitees. From then on, her own appraisal of her relationship to modern technology and related visibility of practices changed.

Categories of information shared on a messaging app

During our workshops we introduced a messaging app (*Telegram*) and established a group chat including all participants and all regularly visiting researchers. The researchers' initial motivation for introducing the instant messaging app was to enable the participants to ask us or their peers for help when they faced a problem with their tablets that couldn't wait until the next meeting. At the same time we showed them how to take screenshots and how to send them via *Telegram*. On top of this, the participants also started to send holiday greetings or messages at the weekend, wishing everyone a good time. To fuel the use of the group chat, we started to share photos, e.g. from conferences or private trips. Subsequently the participants started to share their photos as well. These photos were taken e.g. from their surrounding (e.g. flowers or a nice evening sky), on their vacations, decorations in their homes, funny pictures and photos of our workshops for the people who couldn't attend. Regarding the content of the messages and pictures, we observed that they mimicked what the researchers had sent. There was one instance where the participants displayed behavior different to that of the researchers. Some researchers shared photographs which included members of their family (spouses, children), e.g. in vacation photos or in Christmas cards. While the participants adopted many of the above-

mentioned opportunities to share photographs, they never – not even once – shared pictures of their family in the group chat. However, they often – and very proudly – showed us pictures of their children, grandchildren and great-grandchildren in person during our meetings. In retrospect it is interesting how differently the research team and the elderly workshop participants draw a line between content fitting to be shared or not. The participants signaled to us that they were pleased to receive these messages from us. However, they themselves were very restrictive with pictures of their children and grandchildren. They perceived the group more as a closed community with specific context and tasks where it would not be appropriate to add material which would depict and therefore somehow integrate their families.

The tablet as a personal territory

The participants who regularly attended workshops built close relationships to each other with a certain share of mutual trust. This was manifested e.g. in a behavior of mutually exchanging their tablets to let other participants use it, to show something new or to help solving a problem. This is remarkable insofar as all participants hesitated and even refused to hand over their tablets to others in the group (apart from the researcher team).

Nevertheless, in the interviews Julia told us a story about her loss of trust in a co-participant. Julia reported that Daphne, with Julia's permission, once took her tablet to download and install some games for Julia's grandson. However, the child's parents removed the games from the homescreen when they visited Julia, to keep their son from playing too much. During one of the following workshop sessions, Daphne noticed that the games were gone from the homescreen and asked Julia if she could borrow her tablet for a minute. She then completely uninstalled the games without a word before giving back the tablet. When Julia noticed that the games had gone, she responded with anger and disappointment. She stated that she doesn't think it's ok to just delete things from someone else's tablet since it could have been precious photographs or other personally important data. As a consequence, Julia announced that she will *"never hand over her tablet to Daphne again"* (Julia – I). This anecdote demonstrates that "looking at the other tablet" is accepted, but manipulation by another person is perceived as an encroachment into one's own territory. Shklovski et al. demonstrate similar attitudes and practices for mobile phone usage [48].

The participants have been using their tablet devices for three years now. They have integrated them heavily into their daily routines and take the devices everywhere they go. Broad consensus emerged among the participants on the sensitivity of the tablets' contents: *"No, that's not the problem. Everybody can see what's on it. But that's not much."* (Lisa – I) But when talking deeper about certain interfamilial activities around tablet usage, some nuances of inconvenience come to the fore: Julia and Lisa agree that

they wouldn't give it to someone they didn't know and the only people allowed to use it from time to time are their grandsons: *"When my grandson is here, sure, he looks over my shoulder and uses it from time to time, but no one else"* (Lisa – I), *"No, only my grandsons. The boys, they are 13 and 12 and can handle it better than I do."* (Julia – I) Iris argues that *"there's nothing illegal in it but they would then know all the addresses, wouldn't they? And the email addresses."* (Iris – I) And Gerda assumes that her sons *"can have a look inside but they can't make use of anything. But it would be strange."* (Gerda – I) On inquiring as to what extent it would be strange, she states: *"Well, someone else takes it and sees what you have been doing, sees your pictures and stuff. Actually, it's none of their business."*

Security concerns and other reasons for sticking to "analogue" practices

Financial transactions: ATMs and shopping

In their everyday lives, the participants mostly rely on cash transactions when regularly buying things. When asked about paying by credit or bank card, the participants invariably responded with rejection, showing fear of technology. Most answers were rather unspecific: *"I'm afraid something is unsafe with this thing. I don't trust it"* (Julia – I), *"I don't use that, I'm against that"* (Daphne – I) or *"Then the others have my bank account number and everything, too"* (Gerda – I). Oftentimes, the rejection of such technology is based on information from single "horror stories": *"You hear that a lot on television. How they do that with the ATM. How they find out the codes. When they stick such small devices to the machines"* (Julia – I) or *"snoop over your shoulder"* (Daphne – I) in order to get the PIN code. Some of the participants even apply methods to keep their PIN code safe. Even though it is recommended not to write the PIN down, Lisa did it, but thought about a safe system. She encrypted her new PIN code and wrote it down so that *"no one else is able to read it"* (Lisa – I).

Fear of being compromised is not the only reason for the preferred use of cash. It's also a habit that has remained unaltered from times where ATMs and credit card terminals were not as widespread as they are now. Another reason mentioned by several participants is that it's easier to "keep track" of their own expenses. Regarding the overall rather low income of the participants, being in total control of their own finances is crucial. However, in some special cases it would be ok for the participants to pay by credit card. Daphne's statement serves as an example for such a case: she would pay by card instead of cash if she saw *"something nice and wasn't carrying enough money in my pocket but really wanted to buy it"* (Daphne – I). Other participants describe very similar situations, oftentimes emphasizing that they would pay by card only if it spared them a lot of trouble, like having to walk very far to get to a bank branch. Correspondingly, regular costs like rent, utilities, insurance and telephone bills are paid for by direct debit by all participants because it's more comfortable: *"I*

don't want to always fill in all that stuff and walk all the way to the bank." (Lisa – I)

When ordering by mail, the participants also rely on rather outdated methods like payment by invoice. This method offers the advantage of being safer for buyers since they don't have to pay in advance and the possibility of deferred payment. Nonetheless, Lisa made a surprising discovery while ordering something by phone: *"I'm already nervous when I dump old catalogues. There's always my complete address and customer ID printed on them somewhere. So I shred that part in tiny pieces and eventually dump the rest of the catalogue."* (Lisa – I) When she was asked why she thinks her customer ID from some mail order company is extraordinarily sensitive she answered: *"If you order something by telephone they only ask for your customer ID. And then they say 'Hello Ms. Smith' and you just say 'yes', they already have your address and everything. Then you can order anything and have it delivered anywhere. I noticed that when I ordered something and directly sent it to my daughter."* (Lisa – I)

Ordering online by invoice is nearly impossible, at least in consumer shops and for this reason most participants strictly refuse to order online. Mainly they are afraid of making their bank account number public somewhere without knowing what exactly happens to it. Daphne puts it very drastically: *"If someone wants to have my bank account number, the alarm bells start ringing in my head! I myself would never let my bank account number be known anywhere. Because the world is such a bad place. There are some kind of hackers or what are they called on the internet, they get access to my bank account number and clear out my account completely? No!"* (Daphne – I) Iris argues similarly: *"I wouldn't trust them. Send money to some corner of the world that I don't know at all. I don't do that."* (Iris – I) In contrast, Gerda sometimes has her grandson order goods from Amazon for her. She is not afraid of exposing her bank account number on Amazon's website since *"the complete number isn't displayed, only the last two digits"* (Gerda – I). This is apparently a misunderstanding because the remaining digits are stored in some databases, of course. Another strategy for ordering online if other ways are inconvenient or not possible is to ask their children to order items: *"Then I asked my daughter if she would order it for me and I gave her the money. But I wouldn't do it for myself, no."* (Iris – I) In these cases they rely on their children who are – in the mothers' eyes – familiar with online shopping proceedings and who know how to navigate safely.

Dealing with passwords & evaluating the threat of phishing
Interestingly, phishing emails don't seem to pose a major threat to the participants. They are aware of this kind of scam through their experiences with telemarketing and fake "you-have-won-calls" on the phone, in which case the participants simply hang up. Accordingly, phishing emails are mostly deleted immediately. However, sometimes the

participants kept ominous-looking emails and asked each other or us at the following workshop about the email, just to make sure.

A significant issue regarding online privacy and the security of elderly people is the aspect of passwords and user accounts in general [51]. There are two main problems that occur regularly: 1) passwords are wrongly memorized or not memorized at all; 2) user accounts and referring credentials are mixed up. These issues lead to situations where, e.g., participants enter their password in the wrong textbox and wonder why it is visible and not covered by dots. At one point, a participant entered her password for the neighborhood portal in the URL box in the browser, resulting in several open tabs with Google search results for her password string. The same participant asked about the consequences for her emails when we changed the password of her Skype account. This problem grows with the number of different accounts the participants obtain over time: email, Skype, instant messengers, the neighborhood portal, Facebook etc. When we installed apps with them, the participants always noted down their passwords on a piece of paper. However, most of them have trouble keeping track of the paper sheets and not only forget passwords regularly, but also lose their paper notes sometimes. In contrast to the handling of the bank account number – which everybody can recall or has noted down encrypted – the passwords for the tablet applications are not kept that meticulously. Additionally, the recovery of passwords – actually an easy process for a tech-savvy person – is an overwhelming practice for the participants, for which they always ask us to help. We introduced several strategies for dealing with passwords, e.g. mnemonic tricks. We also handed over a notebook and a folder for sheets to help keep their passwords in one place. Here again, we had to decide on a working strategy: usually one would not recommend writing down a password. However, due to their problems remembering, in this case we did so.

DISCUSSION

Concepts of data and digital data flows in the elderly

There are many reasons for the difficulties with IT appropriation and acceptance among the elderly, ranging from privacy and security to concerns about self-presentation. These can often become compounded when tasks are delegated, e.g. the common delegation of financial activities to family or friends [51]. The need for delegation combined with memory difficulties created significant challenges for managing simple security mechanisms, such as passwords, without compromising independence. Similar to other researchers [51], we designed alternative approaches such as the use of RFID card log-in for the outside monitors, which many of the elderly tenants found helpful.

In fact, security concerns dominated many of the conversations, sometimes to the exclusion of other discussions, indicating that such concerns are paramount in

decisions regarding technology use. Concerns about security were not exclusive to the digital domain, but came up just as often in discussions of handling personal boundaries in physical space, e.g. the handling of postal mail or making the flat a safe space. Security in this sense is then part of the territorial behavior of managing boundaries – securing boundaries by locking doors and deleting or destroying addresses and customer IDs on the envelopes before putting them into the wastepaper bin. Yet security-related concerns should not be conflated with the notion of privacy. Alongside thinking about managing data and protecting themselves from unnamed attackers, our participants worried deeply about managing personal disclosure in social situations, new to them through the use of technology [47]. Thus, territory management [3,48] is a twofold practice: it is both privacy (the social process of negotiating access to one's self) and security (the practical and instrumental process of securing access to boundaries through objects) [48].

Shifting norms from physical to digital territories

The perspective on privacy in terms of managing disclosure of personal information in the physical world as well as for interactions with the tablets opened up a more socio-constructivist stance on how the elderly manage themselves and their relationships [36]. Our participants navigate new digital social spaces and data flows by departing from more familiar, physical experiences where it made sense to do so. Technologies make social practice visible and salient in new ways, forcing technology users to negotiate emergent social tensions and to learn how to interpret each other across domains. We noted that visibility in the neighborhood portal and specifically the option of public judgment of performance through ratings caused significant discomfort. What was seen as a simple neighborly exchange of help in sewing or sharing a ride to the supermarket became fraught with worry when the requests were moved to the online portal. On the one hand, a simple neighborly act of helping to repair clothing could now turn into a performance review of the helper potentially not being very good at sewing after all. On the other hand, the broadcasting of helpfulness contradicted the norms of modest behavior [36].

However, we also observed that behavior towards perceived norms could change when practices were evaluated as sense-making and meaningful in their every-day lives. We have reported on the example of the elderly lady who at first felt ashamed when being seen with her tablet. After a few months of interaction with the device and participation in the experience-based PD workshops however, her feelings changed to pride in her newly acquired abilities and in her being able to actively participate in the “digital world.” As the ability to use the tablet transformed into a source of pride, this participant also received praise from younger people, further reinforcing this change in attitude. In relation to Nissenbaum's concept of “contextual integrity” [37], applied by Barkhuus [4] to explain how

people retain or change their social media practices in relation to social norms, we were able to pinpoint some socio-cultural factors in the elderly during their appropriation of digital devices. What people hold as “norms of appropriateness” may then change at the intersections of physical and digital personal territories. There are similar reflections on “boundary management” in the field of AAL/telecare which may help to better understand related practices and attitudes. [1] denominate activities that people engage in to “*maintain the order of the home when managing disease and adopting new healthcare technology*” as the “elaborate boundary work”. By this, the high complexity of appropriation of AAL/telecare (or similarly in our sample ICT for local community building and usage of the internet) is being stressed. ICT appropriation is being framed into negotiation processes “involving modifications, negotiations, integrations and segregations as people both deal with the disease issue and work out how to get on with life.” [15]

Thus, these findings may also be regarded in a broader perspective such as [15,19] provide for technologies in the AAL domain: more practice-based studies are needed to overcome technology-driven assumptions in IT projects [19] for the elderly and for becoming more careful in respect to the support of the diversity of ageing experiences and the everyday-life conducts of elderly persons as well their socio-technical infrastructures. We thus recommend in respect to the formulation of design implications to comprise them as twofold aspects in a. creating and providing sustainable learning spaces and b. appropriate technological functionalities aimed at providing interaction spaces in which the elderly feel to operate safely against the background of their every-day conducts and attitudes.

Creating sustainable learning processes in a CoP

Research in gerontology, which is concerned with the support of older adults in ICT uptake, point to the importance of long-term support measures to the elderly in the appropriation of ICT [31]. Our approach for a sustainable learning environment for elderly, technologically inexperienced people regarding the vast area of ICT is based on Lave's and Wenger's concept of Communities of Practice (CoP) [23]. Our community has not been gathered to learn for the sake of learning but to enrich certain established everyday life practices with ICT support. Informal coffee-and-cake-settings helped providing a cozy and casual environment in order to prevent stress and limit frustration in their learning experiences. In regard to their appropriation practices, discussions about and negotiation of their usage of the devices and software (tablet PC and the portal), the workshops served as a fruitful environment for their ongoing learning process. The workshops also provided a space for negotiating and discussing tensions in regard to constructing their “new” digital territories and related possible threats. Hung's notion on “scaffolding” [21], helps

to look at the different stages of engagement they passed through in regard to their personal data management strategies: individual approaches to digital data management often started with observation and imitation of our (the researchers') and other participants' practices in the workshops. Further, tensions could be reflected and discussed in the group on the basis of real situations encountered by participants in their utilization of the tablets and the portal in their everyday environments. However, our study with elderly ICT novices shows an important difference to Hung's scaffolding concept which he developed in relation to the learning processes of school children. The last step of scaffolding would be autonomous application of the learning content. Due to ongoing changes in technology, the elderly will always be in need of ongoing appropriation support. Thus, for the domain of "IT for the ageing society", scaffolding must encompass such measures for ongoing support. For the time after the project's end, we have thus installed several self-help measures, including the CoP which developed among the workshop participants over time. Further, we have supported them in finding technology-affine people to substitute the research team as learning facilitators in the workshops when the project ends. We report on building up a repertoire of self-help measures for ongoing technology appropriation in detail elsewhere [34].

Implications for the design of the neighborhood portal

In order to support the elderly tenants in their constructions of personal territories in digital environments, we chose a specific approach that let the tenants handle their degree of visibility to the community. When posting a message, they are able to choose to which of the 8 tenements this will be displayed in (they may choose only the tenement they live in; other houses where they feel at ease; or all tenements). In several PD sessions, we made sure that this setting is easy to operate. This approach differs from what is reported by Barkhuus on her study on high-school students dealing with their friends' networks on Facebook [4]: Barkhuus reports that students did not like to change the settings of the groups of receivers when posting messages and rather used the "greatest common denominator" in the formulation of their messages in order to keep their contextual integrity (i.e. follow social norms in the interaction with their social networks) as well as to prevent laborious customizations on the platform.

For the above-given reasons, we decided in favor of another approach. In addition, we learned that the kind of information to be posted also influenced the feelings of a possible endangering of one's image of self [18]. Finally, the opportunity to actively manipulate one's own visibility to the community was also perceived as a positive contribution to self-empowerment – a theme which is often implied (in different facets e.g. as to have a voice or not, the level of self-esteem, and possible limited leeway.) [22] discuss this aspect in the course of participatory IT design

with elderly persons as building 'mastery', i.e. competencies and confidence for real participation in the design decision making and usage of new media.

In regard to Palen and Dourish's notion describing privacy as a dialectic and dynamic process for privacy boundaries and their emphasis to look at how the technology fits into the cultural practices instead of specific privacy settings [41], we here see both aspects as being important: on the one hand, the enabling of actively operating privacy settings may influence the acceptance of the system, allowing the users to feel safe in respect to their identity management strategies. On the other hand, the possible settings are in direct conjunction with the person's manoeuvres in physical space, i.e. in their life worlds. Technology destabilizes the dialectic of relational practices and forces renegotiation [47] – the way we implemented this privacy setting feature helps the users to manoeuvre between their desires in the physical and in the digital contexts.

CONCLUSION

In this paper we have contributed to research on privacy and security issues from the perspective of socio-technical and empirically-grounded perspectives, which to date has only scarcely been done for the domain of "IT for the ageing society". A qualitative and action-research based neighborhood project built the basis of our research which enabled us to examine how elderly people approach and reflect their personal data management when starting to use digital devices and the internet in relation to their social interactions in their everyday surroundings. By relating to socio-technical frameworks and theories of privacy and security research, we were able to flesh out some findings on the social embedding of the elderly people's personal data management reflections and strategies. The paper contributes to the sparse literature on socio-technical approaches to privacy and security issues of the elderly by taking in the perspective on privacy as socially negotiated boundary management and disclosure in a social system as well as demonstrating ways of conceptualizing the challenges in building systems for the elderly.

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REFERENCES

1. Rikke Aarhus and Stinne Aalokke Ballegaard. 2010. Negotiating Boundaries: Managing Disease at Home. *Proceedings of the 28th International Conference on Human Factors in Computing Systems CHI '10*, ACM, 1223–1232.
2. Anne Adams and Angela Sasse. 1999. Users Are Not The Enemy. *Communications of the ACM* 42, 12: 41–46.
3. I. Altman. 1975. *The Environment and Social Behaviour: Privacy, Personal Space, Territory, and Crowding*. Brooks/Cole Publishing Company, Monterey, CA.
4. Louise Barkhuus. 2012. The Mismeasurement of Privacy: Using Contextual Integrity to Reconsider Privacy in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems: 367–376*. <http://doi.org/10.1145/2207676.2207727>
5. Eva Brandt, Thomas Binder, L Malmborg, and T Sokoler. 2010. Communities of everyday practice and situated elderliness as an approach to co-design for senior interaction. *Proc. of OZCHI '10*: 400–403.
6. Tone Bratteteig and Ina Wagner. 2016. What is a participatory design result? *Proceedings of the 14th Participatory Design Conference: Full papers 1*: 141–150.
7. Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3: 77–101. <http://doi.org/10.1191/1478088706qp063oa>
8. John M. Carroll and Mary Beth Rosson. 2007. Participatory design in community informatics. *Design Studies* 28, 3: 243–261. <http://doi.org/10.1016/j.destud.2007.02.007>
9. Jane Chung, George Demiris, and Hilaire J. Thompson. 2016. Ethical Considerations Regarding the Use of Smart Home Technologies for Older Adults: An Integrative Review. *Annual Review of Nursing Research* 34: 155–181.
10. Sebastian Draxler, Gunnar Stevens, Martin Stein, Alexander Boden, and David Randall. 2012. Supporting the Social Context of Technology Appropriation : On a Synthesis of Sharing Tools and Tool Knowledge. *CHI '12*: 2835–2844.
11. European Commission. 2015. *Background Paper: Growing the European Silveconomy*.
12. European Commission. 2015. *EU Summit on Innovation for Active and Healthy Ageing 2015*.
13. Gerhard Fischer. 2000. Symmetry of Ignorance, Social Creativity, and Meta-Design. *Knowledge-Based Systems* 13, 7: 527–537.
14. Geraldine Fitzpatrick and Gunnar Ellingsen. 2012. A Review of 25 Years of CSCW Research in Healthcare: Contributions, Challenges and Future Agendas. *Computer Supported Cooperative Work (CSCW)*.
15. Geraldine Fitzpatrick, Alina Hultgren, Lone Malmborg, D Harley, and W Ijsselsteijn. 2015. Design for Agency, Adaptivity and Reciprocity: re-imagining AAL and telecare agendas. In *Designing Socially Embedded Technologies in the Real-World*, Dave Randall, Kjeld Schmidt and Volker Wulf (eds.). Springer Publishing Comany, 305–338.
16. Asbjorn Følstad. 2008. Living Labs for Innovation and Development of Information and Communication Technology: A Literature Review. *eJOV* 10, August: 99–131.
17. Bill Gaver, Tony Dunne, and Elena Pacenti. 1999. Design: Cultural Probes. *Interactions* 6, Jan./Feb.: 21–29.
18. Erving Goffman. 1959. *The presentation of self in everyday life*. Doubleday Anchor Books, Garden City, NY.
19. Jean D Hallewell Haslwanter and Geraldine Fitzpatrick. 2016. Why do few assistive technology systems make it to market ? The case of the HandyHelper project. *Universal Access in the Information Society*. <http://doi.org/10.1007/s10209-016-0499-3>
20. Gillian R. Hayes. 2011. The relationship of action research to human-computer interaction. *ACM Transactions on Computer-Human Interaction* 18, 3: 1–20. <http://doi.org/10.1145/1993060.1993065>
21. David Hung. 2005. Preserving Authenticity in CoLs and CoPs: Proposing an Agenda for CSCL. *CSCL '05*: 227–231.
22. Suhas Govind Joshi and Tone Bratteteig. 2016. Designing for Prolonged Mastery. On involving old people in Participatory Design. *Scandinavian Journal of Information Systems* 28, 1: 3–36.
23. Jean Lave and Etienne Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press, Cambridge.
24. Young S Lee, Joe Tullio, Nitya Narasimhan, Pallavi Kaushik, Jonathan R Engelsma, and Santosh Basapur. 2009. Investigating the Potential of In-Home Devices for Improving Medication Adherence. *Pervasive Computing Technologies for Healthcare, 2009*, IEEE, 1–8.
25. K Lewin. 1946. Action research and minority problems. *Journal of Social Issues* 2, 4: 34–46.
26. Stephen Lindsay, Daniel Jackson, Cas Ladha, Karim Ladha, Katie Brittain, and Patrick Olivier. 2012.

- Empathy, Participatory Design and People with Dementia. *Proc. of CHI '12*: 521–530.
27. Stephen Lindsay, Daniel Jackson, Guy Schofield, and Patrick Olivier. 2012. Engaging Older People using Participatory Design. *Proc. of CHI '12*: 1199–1208.
 28. Linda Little and Pam Briggs. 2009. Pervasive healthcare: the elderly perspective. *Proc. of PETRA '09*.
 29. Lesa Lorenzen-Huber, Mary Boutain, L. Jean Camp, Kalpana Shankar, and Kay H. Connelly. 2011. Privacy, Technology, and Aging: A Proposed Framework. *Ageing International* 36, 2: 232–252. <http://doi.org/10.1007/s12126-010-9083-y>
 30. Michael Massimi and Ronald Baecker. 2006. Participatory Design Process with Older Users. *Proc. UbiComp2006 Workshop on future media*.
 31. Tracy L Mitzner, Julie B Boron, Cara Bailey Fausset, et al. 2011. Older Adults Talk Technology: Technology Usage and Attitudes. *Computers in Human Behavior* 26, 6: 1710–1721. <http://doi.org/10.1016/j.chb.2010.06.020>.
 32. Claudia Müller. 2014. *Praxisbasiertes Technologiedesign für die alternde Gesellschaft*. Josef Eul Verlag, Lohmar.
 33. Claudia Müller, Dominik Hornung, Theodor Hamm, and Volker Wulf. 2015. Practice - based Design of a Neighborhood Portal : Focusing on Elderly Tenants in a City Quarter Living Lab. *CHI '15*.
 34. Claudia Müller, Dominik Hornung, Theodor Hamm, and Volker Wulf. 2015. Measures and Tools for Supporting ICT Appropriation by Elderly and Non Tech-Savvy Persons in a Long-Term Perspective. *Proceedings of the 14th Conference on Computer Supported Cooperative Work (ECSCW 2015)*.
 35. Claudia Müller, Dominik Hornung, Theodor Hamm, and Volker Wulf. 2015. Appropriation of Tablet PCs by Non-Tech Savvy Seniors: Options and Obstacles of Sustainable, Practice-based Learning in the Elderly. *Proceedings of The Computer Supported Collaborative Learning (CSCL) Conference 2015*, International Society of the Learning Sciences, Inc. [ISLS], 701–702.
 36. Claudia Müller, Cornelius Neufeldt, David Randall, and Volker Wulf. 2012. ICT-Development in Residential Care Settings: Sensitizing Design to the Life Circumstances of the Residents of a Care Home. *CHI '12*, 2639–2648.
 37. Helen Nissenbaum. 2004. Privacy as contextual integrity. *Washington Law Review* 79, 1: 101–139. <http://doi.org/10.1109/SP.2006.32>
 38. Aisling A O’Kane, Helen M Mentis, and Eno Thereska. 2013. Non-Static Nature of Patient Consent : Shifting Privacy Perspectives in Health Information Sharing. *Proceedings of the 2013 Conference on Computer Supported Cooperative Work (CSCW-2013)*, ACM, 553–562.
 39. Corinna Ogonowski, Benedikt Ley, Jan Hess, Lin Wan, and Volker Wulf. 2013. Designing for the Living Room : Long-Term User Involvement in a Living Lab. *Proc. of CHI '13*: 1539–1548.
 40. Maarten Overdijk and WV Diggelen. 2007. Appropriation of a graphical shared workspace: The learner-tool connection. *Proc. of CSCL '07*: 570–572.
 41. Leysia Palen and Paul Dourish. 2003. Unpacking “privacy” for a networked world. *Proceedings of the conference on Human factors in computing systems - CHI '03*, 5: 129. <http://doi.org/10.1145/642633.642635>
 42. Sebastiaan T.M. Peek, Eveline J.M. Wouters, Joost van Hoof, Katrien G. Luijckx, Hennie R. Boeije, and Hubertus J.M. Vrijhoef. 2014. Factors influencing acceptance of technology for aging in place: A systematic review. *International Journal of Medical Informatics* 83, 4: 235–248.
 43. Emilee Rader, Rick Wash, and Brandon Brooks. 2012. Stories as informal lessons about security. *Proc. of SOUPS '12*. <http://doi.org/10.1145/2335356.2335364>
 44. Karen Renaud and Judith Ramsay. 2007. Now what was that password again? A more flexible way of identifying and authenticating our seniors. *Behaviour & Information Technology*.
 45. Mark Rice and Alex Carmichael. 2011. Factors facilitating or impeding older adults’ creative contributions in the collaborative design of a novel DTV-based application. *Universal Access in the Information Society* 12, 1: 5–19. <http://doi.org/10.1007/s10209-011-0262-8>
 46. Thomas Scheffler, Sven Schindler, Marcus Lewerenz, and Bettina Schnor. 2011. A privacy-aware localization service for healthcare environments. *Proc. of PETRA '11*: 1. <http://doi.org/10.1145/2141622.2141683>
 47. Irina Shklovski, Louise Barkhuus, Nis Bornoe, and Joseph “Jofish” Kaye. 2015. Friendship Maintenance in the Digital Age: Applying a Relational Lens to Online Social Interaction. *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing - CSCW '15*: 1477–1487. <http://doi.org/10.1145/2675133.2675294>
 48. Irina Shklovski, Scott D. Mainwaring, Halla Hrunn Skúladóttir, and Höskuldur Borgthorsson. 2014. Leakiness and creepiness in app space: perceptions of privacy and mobile app use. *Proceedings of the*

- SIGCHI Conference on Human Factors in Computing Systems*, ACM, 2347–2356.
<http://doi.org/10.1145/2556288.2557421>
49. Tom Sorell, Heather Draper, and T Sorell. 2014. Robot carers, ethics, and older people. *Ethics and Information Technology* 16, 3: 183–195.
<http://doi.org/10.1007/s10676-014-9344-7>
 50. Gunnar Stevens, Volkmar Pipek, and Volker Wulf. 2010. Appropriation infrastructure: mediating appropriation and production work. *Journal of Organizational and End User Computing* 22, 2: 58–81.
 51. John Vines, Mark Blythe, Stephen Lindsay, Paul Dunprhy, Andrew Monk, and Patrick Olivier. 2012. Questionable Concepts: Critique as Resource for Designing with Eighty Somethings. *Proc. of CHI '12*: 1169–1178.
 52. Lev Vygotsky. 1978. *Mind in Society: Development of Higher Psychological Processes*. Harvard University Press.
 53. Lin Wan, Claudia Müller, Volker Wulf, and DW Randall. 2014. Addressing the subtleties in dementia care: pre-study & evaluation of a GPS monitoring system. *Proc. of CHI '14*: 3987–3996.
 54. David Wood, Jerome S Bruner, and Gail Ross. 1976. the Role of Tutoring in Problem Solving *. *Journal of child psychology and psychiatry* 17, September 1974: 89–100.
 55. Volker Wulf, Claudia Müller, Volkmar Pipek, David Randall, and Markus Rohde. 2015. Practice-based Computing: Empirically-grounded Conceptualizations derived from Design Case Studies. *Designing Socially Embedded Technologies in the Real-World*.
 56. Martina Ziefle, Simon Himmel, and Wiktoria Wilkowska. 2011. When Your Living Space Knows What You Do : Acceptance of Medical Home Monitoring by Different Technologies. *Symposium of the Austrian HCI and Usability Engineering Group*: 607–624.