

# Searching for Empathy

## A Swedish Study on Designing for Seniors

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### ABSTRACT

This paper is a call to rethink how we describe groups of users and create design tools that may influence the design practice and foster specific mentalities. Many times, research literature plays an important part in the design process and decision making, yet the role it has in creating an understanding of the user is seldom discussed. To support a project focusing on designing for seniors, a multidisciplinary team selected relevant literature for the beginning of the design process. The literature selected consisted of ‘mental’ design tools such as methods, considerations, and design domains to support understanding and designing for seniors. This paper describes the tools suggested by the articles and concludes with a reflection on the effect of the literature we choose on the design process using the project as a design case.

### CCS CONCEPTS

### KEYWORDS

Human-computer Interaction, design, theory, practice, preconceptions, stereotypes, be in service, personas

## 1 Introduction

Technology has potential to support people’s life, especially the needs of the populations considered to be marginalized, in a way that was impossible before [2,10,21,28,57,58,61]. It can support people in need of wheelchairs [61] and people with neurodevelopmental conditions on the way they navigate [2], the way they convey information to their caregivers [28], even the way their condition is treated [21]. When designing technology for such populations, as well as seniors [57,58], the designers may perceive them as different than themselves, which might be challenging in regards to empathy building [32]. In general, designers are faced with wicked problems [6,55] that they need to solve in the best possible way, so as to be in service of the users and other stakeholders [42]. In order to achieve this, the designers attempt to understand the users’ needs, wishes, and values and find the balance between, literature research, practical constraints, and the ideal solution [42]. They can use relevant literature, and field studies such as interviews or observations, in order to get familiarized with and informed about the users’ world. The literature study, a review of previous work, can provide them with information about the users or different methods to understand the users. However, this is only a part of their role. In order to design good quality products the designers should empathize with the user [32,38] which oftentimes may be more difficult than it sounds [32]. As empathy lacks a specific definition [22], in this article we use the definition by Battarbee et.al described as the emotional understanding of the users [3]. Due to the complex nature of design, various design tools have been created to help the design process such as methods, models, and guidelines e.g. the design guidelines presented in [28]. Even though these tools are rarely used by the practitioners as they were intended [29,41,60,68], the practitioners still consult them to support the design practice [60] often as part of their literature study. While a general understanding of the user group’s needs may be possible through the literature study, building empathy may be more difficult, resulting in lower quality products [32,63]. Therefore, we argue that it is important to understand *how design literature and tools support the designers on empathy building or motivate them to think about building empathy with the users.*

In this article, we investigate how a literature study supported a multidisciplinary design research team to design for seniors, as well as supporting them on empathy building. The researchers proposed articles, representative of their respective disciplines that they thought were relevant for designing for seniors and adaptive interfaces. The proposed work conveyed information about their field and how it could contribute in the design process. The selected studies have later been analyzed using the lens of empathy i.e. how the articles support empathy-building (understanding of feelings) with the specific user-group.

This article starts with a short background on design and the importance of users in user-centered design as well as the importance of facilitating empathy, and continues by describing the context and methodology of the research. Then, the results follow, and the article finishes with a reflective discussion on the design tools presented in the selected articles.

## 2 Background

**Design**, by nature, is tricky as the issues it addresses are complex, wicked [6,33]. It usually involves more than one type of stakeholders apart from the users of the final product who may have different or even contradictory agendas. The solutions of design practitioners are unique and difficult to replicate because they are based on the designers' knowledge and related literature at the time, the combination of the designers' and other stakeholders perceptions of the ideal solution, and the situational constraints such as time and resources [41,42]. Regardless of the chaotic nature of design, as human beings we need to have a structure [44], therefore we study the design practice and get familiarized with the theory to give guidance to the practitioners and researchers by creating tools for designing, e.g. methods, frameworks, and models. We know that as hard as we try to produce the best design tool, if practitioners use them, they do so in their own way [29,33,60,68], and most possibly never follow them to the letter [29,60]. Still, creating design tools is meaningful as they can support the design process at least partially. However, in our efforts to try to create a structure in design we should remember that the designers (both practitioners and researchers) will face the chaotic nature of design as well as the chaotic and diverse nature of the users and other stakeholders.

Good design tools are influenced by the practice [60] and later they influence the practice, as we shape our tools and the tools shape us [14,35]. In this never ending circle it is important to understand if we perpetuate mentalities and preconceptions through our tools. For example, until recently in many societies the medical model of disability was the most dominant model. According to the medical model there is a normal healthy body and mind and when someone deviates from it, they should be fixed with the use of modern medicine [36]. The model has been criticized for diminishing people to only mind and body excluding their social context as a source of their defectiveness [66], namely, the same person in a different environment may be perceived as normal. If a tool aimed to support designing technology for seniors is influenced by the above definition of disability, it may lead designers to focus on the physical and mental "deficiencies" of the users regardless if the users themselves see this as an issue or not.

**Users** are in focus especially for those who practice user-centered design [1,51]. When designers are in service of the users, they need to identify the users' needs, wants, and values [42,43]. To be able to be in service needs a dynamic relationship between the two equal parties i.e. the designer and the user [42]. The designer should be able to understand the users, empathize with them [15], and try to break out of preconceptions and stereotypes - even though the last may seem hard to ignore when set in place [30]. Many ways have been developed to understand users, ranging from interviews, observations, and participatory props workshops [4,40], to data on their biology, cognition, and behavior on their devices. After the user research, the persona creation is usually set into place, this can be a conscious persona creation or even a subconscious creation. In general, a designer has always someone in mind when designing regardless if they use personas [9]. The aim of the personas (or the "someone" the designer has in mind) is to keep the designers focused on the user group that they are designing for and their needs [13,30,49], as well as to make them relate and empathize with the users, as empathizing with the users results in better quality services and products [23,32]. The personas are fictional characters created by the data derived and interpreted through the user research without describing a specific user but trying to represent the target user group [30,63]. The direct contact of the designers and the users is often difficult to achieve which may lead the designers to understand the users' data or information but to lack empathy towards the users. For example, understanding of the user would be the fact that a user walks slower than expected, empathizing would be to understand what it feels for them. Slow walking may have happened gradually, what this entails e.g. is it a change the person acknowledges, is it perceived as a burden, is slow movement a problem because they are in a hurry, or is it just their reality and they do not care whether they move fast or slow?

Due to time and budget limitations, access to users may be difficult, thus, the personas, or the "someone" the designer has in mind, could be created based on secondary data. Secondary data can consist of literature, experts' opinions (e.g. [28]), and/or designers' knowledge and experience with the particular users from their everyday environment [9,32] excluding data that they can get directly from the users. Following this method may be fast and cheap but one can also easily fall into stereotyping [30,32]. This is particularly challenging when the users are perceived as different than the

designers [32], e.g. seniors. It is worth noticing that personas created without engaging with users have been criticized as they can end up being design oriented instead of user oriented, and based on reasoning instead of data [31,50].

**Empathy** is harder to achieve when the contact with the users is inexistent or when the design team is different than the team who is doing the user research. In this situation, the emphasis is given to the way the literature or the user research team convey the users' characteristics to the design team, and especially, how they convey empathy for the user group [63]. Empathy lacks a specific definition [22]. The Cambridge dictionary describes it as "*the ability to share someone else's feelings or experiences by imagining what it would be like to be in that person's situation*" [17]. The Oxford dictionary describes it as "*the ability to understand another person's feelings, experience, etc.*" [18]. This article uses the empathy definition by Battarbee et.al described as *the emotional understanding of the users* [3]. Empathy may seem intuitive, however, that is usually not the case [32].

Empathetic design has been referred to as an extension of user-centered design and different tools have been created to focus specifically on empathy building [67]. It may feel easier to empathize with the users, if one has contact with the users themselves but this is not always the case. When the contact with the users is lacking, one way to convey empathy is through the use of props (such as wheelchairs) and roleplaying [67]. Another way to convey empathy, especially when the design and the user research teams are different, is to use Visser and Kouprie's framework as described in their workshop paper [63]. During this workshop the organizers used a four stage framework for empathy [38]. The framework describes that for a person to empathize with the user, designers need to (1) familiarize themselves with the users, (2) get immersed into the users' world, (3) reflect to their own experience of the users' world, and finally (4) distance themselves before designing as to understand the differences between their own and the users' experiences [38]. This underlines that the understanding and reflection on the differences between the designer and the user is equally important as the understanding and reflection on the commonalities [67]. By the above descriptions of making designers empathize with the users, empathy seems anything but intuitive. However, it is still possible and vital for avoiding design-oriented personas and compromising the quality of the design.

**The designers** consult the literature for their work regardless if they follow it to the letter [29,60,68]. The literature usually aims to support designers in the design process, understanding the users. For example, studies of users produce guidelines, methods, and design considerations for the needs of a user group (e.g. older adults, children, and people with disabilities). The designer, most possibly due to limitations of the real world [33,42], will search for methods and user models to use them as a basis for user research or as a way to gather data for the user group, i.e. the articles take the place of a user research team. Therefore, we need to reflect on how the tools support designers regarding building empathy about the user group, and how the tools support their understanding of the real users' needs apart from the design considerations and solutions they may offer. We argue that it is relevant to reflect on how empathy building is integrated in the design process.

**In this paper** we reflect on the literature study conducted to support a multidisciplinary team of researchers – who also were acting as designers – in a project called Digital Seniors. The project takes place in Sweden where more than 70% of Swedish seniors age range 66 to 75 use mobile internet daily, and more than 50% of the seniors over the age of 76 also have the same behavior [59]. The aim of the project is to design gracefully adaptive user interfaces for people over 64 years old. The researchers collected the most relevant articles from their respective fields in order to understand designing for seniors and adaptive interfaces in order to form a basis for their primary design. The articles, among others, propose design guidelines for seniors, descriptions of senior user groups, and design consideration for adaptive systems. A sixth researcher, the first author, was then invited to read all the articles and create a more holistic image of the literature both on understanding older adults and on designing for them. This literature study, which was part of the project, served as an inspirational case to reflect on how the literature supported the team on empathy building.

### 3 Methods

**The context** of the research was the interdisciplinary project called Digital Seniors, which is running in Sweden. The project's aim is to design gracefully adaptive user interfaces for people over 64 years old. The research team consisted of five experts in the fields of Human-Computer Interaction, Social Media Studies, Psychology, Adaptive Systems, and Engineering. When starting the project, they conducted a literature study suggesting scientific articles that would support the design process of adaptive interfaces regarding seniors' needs. The articles would give the first idea of the different disciplines in the adaptive systems and designing for seniors, and they would serve as a basis for the initial design that would later be enriched with the users' insights through other data collection methods. The sixth researcher who got invited to extract the design lessons from the articles, used the design process that ensued as a case to reflect on how the literature influenced the design process. The selection of the articles was based on the experience and interpretation of the researchers in relation to their discipline and the aim of the project. The researchers worked on collecting the literature focused on what their field had to offer in relation to designing for seniors and/or adaptive systems, in order to both learn from previous work and to avoid "inventing the wheel again". In the next step, they

read the articles proposed and chose at least three articles each as “must read papers” for their design process. Finally, a sixth researcher, and the first author of this paper, read and summarized the suggested literature and extracted the design lessons one can take from those articles. The last researcher had a background in computer engineering, human-computer interaction, and worked with psychological theories in the past. Her multidisciplinary background and her previous experience with design methods and tools supported her on having a basic understanding of the different fields and conduct the analysis of the papers.

**The analysis** was conducted on two levels. First, it had the form of an open thematic analysis based on the results and discussions of each paper, as part of the literature study in the design process of the project. At this level, the researcher focused on the design suggestions of each article and the rationale behind the suggestions to create categories. Then, at the second level, she placed the lens of empathy and reflected on how the literature could support the design team on empathy building apart from understanding the users, the different fields, and the different design suggestions. That is, how the papers integrated empathy in their design suggestions. Then the articles were reread and analyzed with the lens of empathy promotion, as empathy is important for the design process [32,38,63,67]. Empathy in this paper is perceived as *the emotional understanding of the users* [3] i.e. the users’ feelings and experiences. The articles were analyzed based on how they promote empathy to the reader or how they motivate the reader to empathize with the user through the design implications or the descriptions of the user. The results of the analysis were discussed with two of the experts, and the first draft of the paper served as a common ground to resolve any inconsistencies.

## 4 Results

As the articles aimed to support the design process for adaptive systems for seniors with past knowledge in the different fields, some of them were literature reviews which give a broader view of what is known until the year of publication. In total, the design team proposed 65 papers that they found relevant to examine when designing for seniors and adaptive systems. After reading these papers each expert picked at least three as “must read papers”, resulting in 19 must read papers (three of them were suggested twice). [Table 1](#) the suggestions by discipline. In the following section, we describe the papers before moving on to the analysis of how they supported empathy-building and design.

**Table 1: Must read articles as selected by the design team**

Field	Code/Ref	Method <sup>a</sup>	Title	Year
<b>Engineering</b>	E1/ [39]	Exp.	Multi-layered interfaces to improve older adults’ initial learnability of mobile applications.	2010
	E2/ [25]	Exp.	Beyond Performance: Feature Awareness in Personalized Interfaces	2009
<b>Adaptive Systems</b>	AS1/ [34]	other	Steps to take before intelligent user interfaces become real	2000
	AS2/ [37]	other	Adaptive Interfaces and Agents	2008
	AS3/ [26]	other	User Modeling in Human Computer Interaction	2001
	AS4/ [20]	Lit.	Designing User Interfaces for the Elderly: A Systematic Literature	2017
<b>Human-Computer Interaction</b>	HCI1/ [54]	I.S.O.	Modeling the Oldest Old: Personas to Design Technology-Based Solutions for Older Adults	2011
	HCI2/ [52]	I.S.O.	Interviews with digital seniors: ICT use in the context of everyday life	2016
	HCI3/ [62]	Lit.	An age-old problem: Examining the discourses of ageing in HCI and strategies for future research	2015
	HCI4/ [24]	Exp.	Rethinking Age in HCI Through Anti-Ageist Playful Interactions	2017
<b>Social Media Studies</b>	SMS1/ [5]	I.S.O.	“Tell It Like It Really Is”: A Case of Online Content Creation and Sharing Among Older Adult Bloggers	2016
	SMS2/ [12]	Lit.	A literature survey on older adults’ use of social network services and social applications	2016
	SMS3/ [11]	other	Usability Analysis on online Social Networks for the elderly	2009

Field	Code/Ref	Method <sup>a</sup>	Title	Year
<b>Psychology</b>	P1/ [65]	Lit.	Computer use by older adults A multi-disciplinary review	2010
	P2/ [53]	I.S.O.	Factors Predicting the Use of Technology: Findings From the Center for Research and Education on Aging and Technology Enhancement	2006
	P3/ [27]	Lit.	Cognitive Aging and Computer-Based Instructional Design: Where Do We Go From Here?	2010
<b>Engineering &amp; Adaptive Systems</b>	E-AS/ [56]	Exp.	StencilMaps and EphemeralMaps: Spatially stable interfaces that highlight command subsets	2015
<b>Human-Computer Interaction &amp; Adaptive Systems</b>	HCI-AS [45]	/ Exp.	"My Hand Doesn't Listen to Me!": Adoption and Evaluation of a Communication Technology for the 'Oldest Old'	2015
<b>Human-Computer Interaction &amp; psychology</b>	HCI-P / [64]	I.S.O.	"Who over 65 is online?" Older adults' dispositions toward information communication technology	2015

<sup>a</sup> **Exp.** indicates an experiment using technology. **Lit.** indicates literature review or analysis. **I.S.O.** indicates Interviews, Observations, or Surveys. **Other** indicates other methods or other publications e.g. a book.

## 4.1 Description of the selected articles

The articles were selected to support the multidisciplinary team on designing adaptive systems for seniors. The experts in the team were from the fields of Engineering (E), Adaptive Systems (AS), Human-Computer Interaction (HCI), Social Media Studies (SMS), and Psychology (P). Three of the articles were selected from more than one field as "must read": the article E-AS was selected both by the engineering and the adaptive systems field, the article HCI-AS was selected both by the human-computer interaction and adaptive system fields, and the article HCI-P was selected by the human-computer interaction and psychology fields. In this section we present the summary of the articles and their design relevant contributions based on the fields supporting them.

The engineering articles (E1 and E2) were focused on learnability. **E1** presents a design framework applied in a mobile environment. The framework is called MultiLayer Design and focuses on first presenting a simpler version of an application (in this case a mobile menu) and with time to introduce new features to the user. The model failed to increase the learnability of seniors; however, it was reported that seniors would prefer a simple, personalized version of the menu. The **E2** and **E-AS** have no specific user group. E2 gave a list of heuristics/advices for improving the design of menus regarding the awareness of the users on the functionalities of the application without preventing them to execute the actions they already know. E-AS tested three menu-designs to understand which is better regarding speed, accuracy and awareness of the options needed to execute.

From the adaptive systems field, four articles (AS1-AS4) were suggested, focusing on the design of an adaptive system based on the user models. **AS1** presents the challenges the development of intelligent user interfaces has, regardless user target group. The article seems to be based on a literature study without explicitly describing it in the methodology part. **AS2** is a book chapter introducing basic concepts and techniques of adaptive interfaces. **AS3** combines user modeling literature to address issues the Human – Computer Interaction field faces based on an analysis of the field in three transitional periods (1) interfaces to interactions (2) casual users to diverse ability and skill users, and human-computer interaction to human – problem-domain interaction. The last one being more recent is analyzed in relation to user modeling. Finally, **AS4** was a systematic literature review of papers related to technology and seniors or people with disabilities (as they experience similar difficulties). The review categorizes all challenges of this user group reported in the publications (physical and cognitive issues, and computer experience) and the related solutions (interface and control design, input controls, natural language, and cognitive evaluation).

In the Human – Computer Interaction field four articles (HCI1-HCI4) were chosen, that were targeting to understand and model the seniors and their use of technology. **HCI1** creates two personas from qualitative and quantitative data that are representative of their sample and they are "intended to help information designers to ground new designs by conceptualizing technology users by" these two personas. The article ends with some recommendations related to physical and cognitive differences of the seniors. In **HCI2**, the authors interviewed seniors to explore how they use communication technology in their daily life. It results in a list of activities such as reading the news, seeking

information they knew but they forgot, and use the library services. They also described that the users have diverse reading preferences regarding digital and paper material and that they perceive printed information as more reliable than online information. Moreover, the authors found that the seniors had some pressure from the family to become digital. Article **HCI3** is a literature review analyzing the discourse in the ACM literature that refer to seniors. They found that the seniors are perceived as a social financial burden, negligent towards their medication, having health issues preventing them to use technology, having a reduced social life, and finally being a homogenous group. The article concludes with a couple of suggestions on motivating designers to break free from the stereotypes created for older adults and embrace diversity. Finally, **HCI4** describes the knowledge the authors have received while designing and testing games for raising empathy towards seniors, targeting caretakers. They discuss related design factors and explicitly refer to the term “empathic design”.

From the field of Social Media Studies three articles (SMS1-SMS3) were chosen, presenting considerations and advice on social media design. Paper **SMS1** uses qualitative data from 20 interviews thematically analyzed to understand the value of blogging for seniors. The seniors, according to the authors, find blogging a form of self-expression, a way to develop their identity after retirement, as well as a way for social contribution, socializing and meaningful engagement. The authors reported that seniors chose blog posting because they perceive it as more meaningful and fulfilling way of communication than other social media, such as Facebook, which were perceived to foster shallow connections and meaningless information sharing. **SMS2** seems in the same line as AS-HCI but more focused on social media. It reviews literature on how a social media can be designed to be adoptable by seniors. It discusses thirteen categories related to family network, expansion of the social network, privacy, grouping connections and functionalities, the importance of photos/media, direct communication, tangible value (e.g. transmission of a handwritten note), user interfaces, personalization/adaptation, multimodality on interaction with the interface, offline and reciprocity needs of the users. **SMS3** was a review of three social media networks for seniors in relation to their user-friendliness (physical and cultural aspects), and internet access among seniors (described as “*e-education*”). The article discuss that seniors are indifferent on accessing international social networks because they have mainly domestic social needs, that they have cognitive and physical decline, and that they learn better by videos or other people, in contrast to the younger population.

The researcher from the psychology field proposed three articles (P1-P3). One of them (P3) presents a combination of psychological theories that can help when designing technology for seniors and the rest created a description of the senior user. **P1** analyzes eight databases from different disciplines to find articles in relation to technology and senior users. The data were analyzed and categorized based on social cognitive theory [8]. The social cognitive theory consists of three interrelated components, behavior, person, and environment. The categorization showed which components and relations have been studied the most. **P2** is a multidisciplinary survey that categorizes factors predicting technology use. They support that general use of computers, computer experience, breadth of computer use, experience and use of the internet as well as breadth of the internet use can be predicted by different combinations of aging, ethnicity, intelligence, computer anxiety, self-efficacy, and education. The article referred to the senior population as rarer users of technology, whose motivation and self-efficacy depends on their first experiences using computers, reporting that less use of technology can lead to social ramifications. The third article, **P3**, supports that with the use of Cognitive Load Theory and Cognitive Theory of Multimedia Learning it would be possible to design technology easy to use and learn by seniors. The theories provide knowledge on the senior user’s cognitive state and based on that what learning techniques would be efficient.

Finally, **HCI – P** describes the profile of seniors based on the analysis of surveys from the perspective of the dual constructs of perceived usefulness and perceived use of system [16]. They found that seniors with higher education and living or being close with families (rather than living alone) use more technology than those with lower education or those who live alone. They also found that the more casual users of technology they are the better and more positive experiences and feelings about technology they had. The authors present a socio-ecological model to describe the different motivation levels of the seniors regarding technology. The article **HCI-AS** also underlines the social environment of the seniors. It presents four factors for “*elder-centric design*” related to sociocultural environment, users’ attitude, digital literacy of the user, and usability. The data were based on five participants and the researchers supported that the users’ social environment is important for the adoption of technology in this age group of users.

## 4.2 Findings

In this section we present the articles based on what they offered in the design processes. Eight articles offered design suggestions/considerations (D), six articles focused on describing or presenting the users (U), four articles focused on both (D/U), and one article mapped the research on the relation between technology and seniors (R). Five of the articles were not senior specific but they were used to understand adaptive systems in general. [Table 2](#) shows an overview of the findings.

**Table 2: Summary of the articles' design contributions.**

Code	Seniors	Design suggestions	Focus
E1	Yes	Simple adjustive multilayered (common functions on top) or nonlayered menus	D
E2	No	Design implications related to user awareness on personalized interfaces	D
AS1	No	Presenting challenges related to intelligent user interfaces	D
AS2	No	Introduction to adaptive interfaces agents	D
AS3	No	Presentation of user models	U
AS4	Yes	Challenges and solutions related to user interfaces for seniors	D/U
HCI1	Yes	Two senior personas and 11 design recommendations	D/U
HCI2	Yes	Describe the role of technology in the everyday practices of seniors	U
HCI3	Yes	Presents preconceptions fostered by the literature - research agenda	U
HCI4	Yes	Design tactics for designs aim to raise empathy for seniors	D
SMS1	Yes	Presents which needs of seniors are covered by blogging and design considerations	U
SMS2	Yes	Design considerations	D
SMS3	Yes	Presents usability issues seniors face on social media, solutions, and examples	D/U
P1	Yes	Presents the research space in relation to technology and seniors based on SCT	R
P2	Yes	Profiling seniors based on their background and the use of technology	U
P3	Yes	Present psychological theories to support designing for cognitive aging	U
E-AS	No	Tradeoffs of three menus' interface design	D
HCI-AS	Yes	Design and evaluation factors	D
HCI-P	Yes	Profiling seniors based on their background and the use of technology	D/U

**Design suggestions.** About half of the articles presenting design suggestions or considerations had no user target group. AS1 and AS2 focus on adaptive systems, what design challenges they face and how they can be solved. They suggest that the system should adapt based on the user needs which they will be able to understand based solely on the users' interaction. The articles are theoretical, and the users are presented through the system perspective, meaning that the user actions shape the system so as the system to learn to serve the user. The other two articles (E2 and E-AS) focus on a similar matter (how to adjust menus) and present results on which method is more efficient or faster than the other. Article E2 has an interesting focus on designing for awareness e.g. for the system to show what it can do without interfering with the users' actions instead of just focusing on how fast a task is done. These articles focus on results derived from the user actions and they give valuable insights on which menu design is good and for what reason or how to design an adaptive system. However, the users are seen only from the results of their actions which makes it hard to convey what the users think or feel when they do an action. An example can be seen in the article E1 where the seniors-users were asked to use different complexity menus and then state their opinion. This article (like E-AS) measured how fast the seniors did a task – under the assumption that the speed of a task's completion is important - and later asked them which interface they preferred. From this article we learned that the seniors prefer to (1) have a menu that is stable, does not change through the time of use or because of the use, and (2) have a one level menu regardless if they need to scroll down to find their item. The article is giving practical information on what type of menus we should design but *lacks to describe the rationale behind the information*. Why do they want what they want? Is it because they have memory issues, or is it because they have difficulties on navigating in the menu, or is it because they dislike or get frustrated when searching in the layers of the menu? Is the speed of the task completion interesting to them? Is a long, one level mobile menu the best we can do for them or if we empathize and reflect on our and their experience with these menus, we may find a different way of designing? One article (SMS2) summarizes design suggestions of the literature and give an extensive list of recommendations which can give a clear idea on what seniors may need (e.g. social interaction with family) and how the social network should be designed to facilitate different abilities users. Though the suggestions are valuable for designing, *it is hard to understand what they mean to the users*. For example, social networks should support maintaining family relations but why? Is this important to seniors because they have only their family or because they want to see their grandchildren? What does it mean for them to see or not to see their family or grandchildren? Similarly, the article HCI-AS shows what characteristics technology should have so as to be adopted by seniors but lacks further explanation on the rationale. Finally, one article (HCI4) is focused on giving suggestions on how to design for raising awareness of specific seniors' experiences e.g. individuals with Alzheimer's condition. Even though this article does not give any suggestion on how to design for seniors it gives an idea of how difficult is to empathize with them, since the caregivers who may even have daily contact with them have also similar difficulties.

Four articles present **both design suggestions and user presentations**. One article (AS4) summarized past literature on how seniors are presented, and related digital advices proposed. Another (HCI1) based their profiles and solution on collecting qualitative and quantitative data of the users and then suggest some design advice based on what they learned from the users. One used a survey (HCI-P) to understand the type of seniors using technology and then suggested a model of understanding the adoption of technology by seniors. Finally, one article (SMS3) evaluates social networks targeting seniors based, among others, on seniors' characteristics also focus on their behavior, physical and cognitive decline. Two things can be noticed in these articles. First, some *design suggestions for seniors are presented already in extensively used design tools for good practice targeting no specific user group* such as Nielsen's heuristics [47,48], some also referred to the importance of the system to be intuitive to use when designed for seniors also discussed in good design practice [19]. Second, the users' "deficiencies" are presented and often used as an obstacle to interaction with the system, which can lead designers to *over focus on the "dysfunctions" of the users instead of their needs*.

**Presenting users.** Six articles were presenting user profiles or user characteristics to help us have a better understanding on users' perception, needs, and wishes in addition to the four articles presenting both design guidelines and user characteristics. Article AS3 presented a general user model to visualize the mental model of the user about the technology they use, and the needs a technology can cover. Two articles (P2, and HCI-P) focus on describing the characteristics of seniors already using technology, giving a better understanding on who is using technology, but not *what needs technology covers*. Two articles (HCI2 and SMS1) present what is meaningful for the users and what the users do on social media or with technology. The articles have *quotes of the participants which can be a form of raw data used to raise empathy* [38,63] and they give a deeper understanding on seniors' needs e.g. the change of identity and how this influence the users. Finally, one article reports how ACM literature describe seniors and what preconceptions exist. This article helped us on reflecting on our perceptions and thoughts about the seniors.

## 5 Searching for empathy: Possibilities and obstacles

When doing design work, it is common to include a review of previous work, and consult the scientific literature [42] to understand the field and the users; this is called a literature study in this article. This process is seldom problematized or discussed as part of design and empathy building with the users. Therefore, in this article we examined and categorized how a selected group of publications supported the design process, through their design suggestions, on understanding and empathizing with the seniors/users. We divided the 19 articles based on what they offered in the design process (those proposing design advices, those describing the users, and those doing both) and how they facilitate empathy. The reviewed articles used literature and field studies to present design tools such as considerations, domains, and factors that can influence design. Design practitioners use these tools in their own way [29,33,60,68] to inform and shape their work as well as navigate through the unpredictable and chaotic nature of design [6,33,42]. They use the theory/literature (e.g. tools we design) as one of the three components (reality, ideal solution, and theory) to create a design for a particular situation [42]. In this section we reflect on the role of these tools in relation to the other design components and how these tools shape the practice [42] regarding empathy.

Designers aim to be in service to the users, understanding their needs, wants, and values [42,43], therefore it is crucial to empathize with the users [23,32]. In the 19 articles only one (HCI4) raised the issue of empathy to seniors. The articles based on the theory or previous publications gave us valuable insights on how to design for seniors, but it was difficult to raise empathy by listing the suggestions without presenting any user experience. The ones describing users' characteristics were more informative in regards of user profiling, however, only two of those used quotes that can make the reader be more in touch with the user. The one article that showed how ACM literature perceive seniors supported us on reflecting on our perceptions towards them. In this section we would like to raise the issue of medicalization of seniors, and the technology adoption by the seniors in relation to design advices proposed from the articles.

**Medicalization.** From the 14 articles focusing on seniors seven underlined the cognitive and physical abilities of seniors. Two of them specifically placing them in the same category as people with disabilities because they face similar physical or cognitive difficulties. Only two of the articles offered a different perspective. One, underlined that seniors in ACM literature are seen as a socioeconomical problem and that they are perceived mainly from their physical and cognitive abilities. The second, promoted a design for empathizing them by experiencing different situations they may face. The focus of the literature to the physical and mental differences of the users, the association of seniors to the people with disabilities and the report that many articles perceive seniors as a socioeconomical problem shows that, often subconsciously, we have a specific lens that we look this user group through. If the tools we design present seniors only partially, e.g. as cognitively and physically defective, then the designers will put their focus where the tools lead them (i.e. that seniors need support to compensate for their deficiencies). For example, if a tool presents seniors based on their cognitive or physical decline then two things can happen. On the one hand, the tool may create



a distance between the designer and the user through comparison [7,63] (the user as a person with cognitive issues belongs to a vulnerable group, a group people would avoid associating themselves with [46]). On the other hand, the cognitive decline may be an issue for the designers' reality but may not necessarily be an issue to the user. For example working fast and producing fast and good quality results is the reality of many working people, however, this may differ from the reality of the user, a senior may feel fine on spending more time in a task if they can be sure that they are in control. Therefore, we need to understand the users, create our own experience based on that understanding but also distance ourselves and reflect in the difference of the experiences [38,63,67]. If designers use a tool that diminishes seniors to physical and cognitive capabilities (without explaining how seniors experiencing them) they may have a partial understanding of the seniors' life. For example, they may reflect on how they would have reacted if they had such capabilities but not how the senior user experiences those declines. The same applies to people with disabilities. If, for example, we create a tool based only on what the healthcare experts have to say about the patients' needs (e.g. [28]) we may convey understanding on users' needs but we may fail to convey empathy. Therefore, the tool we design for them should motivate or support designers to understand users as a whole [67]. Of course the reality constraints [33] may limit the resources for the designers to understand the users as well as they wish, but theory could underline important parts to be researched for the better understanding of the users and keep the balance of the three components [42]. *The tools we create, design suggestions or profiles of users, can present the users as a whole or explain the perspectives covered and the ones that may be excluded.* In this way the designer can understand better the consequences of their design.

**Adoption, teaching/learning and design.** Ten of the 14 articles refer to learnability of a system or the adoption of the technology by the seniors. Most technology today is complex, and training may be needed, but it does not need to be complicated. Five of the articles proposed, among others, that for seniors the interfaces should be consistent, let them be able to skip tasks, avoid computer jargon, be clear on messages to the users, and avoid ambiguous affordances. The interesting part is that these senior focused advices are also suggestions for good design regardless of the user. Let the users skip tasks is related with the user control and freedom, heuristic 3 of Nielsen's heuristics [47,48], having a language the user can understand is also one of Nielsen's heuristics. Similarly, about showing if a task is completed or not, is related to the visualization of the system status (heuristic 1), and what the user should or should not do is related to the affordances we create and correspondently to error prevention, heuristic 5 and intuitive design [19]. Thus, *are the senior users special and need training or is it that the "young, healthy" user who we may have in our mind can cope with technology that does not always follow good practice?*

In the context of our ongoing study in Sweden, many seniors are part of a heavily digitalized society. They use parking mobile apps, mobile payments, Snapchat to share pictures with their family, e-mails to communicate with friends and arrange their volunteering activities and Facebook mobile apps to keep in touch with friends and family who live away. They have fears about malicious emails, the use of their data by the online companies, who approaches them online, and they often get overwhelmed with the amount of information they get online. They have many offline activities which may or may not be connected to their online presence. Of course, they do have some physical decline; some of them have long-sightedness and they use glasses to see and others may have shaky hands and they use pens to navigate on their cellphone. However, the above description could be for any user, not just seniors. For example, some people may be able to process a bigger amount of information than others, some may be more concerned about their data use, and some may use more technology skilled than others. By diminishing users on what they can or cannot do instead of what they need, want, and value we do not design in service [42,43] of users but build on their capabilities that they may or may not be interested in, themselves.

## 6 Conclusion

This study aimed to understand, by reflecting on design practice during a project targeting senior users of technology, how the selected publications for designing for a senior population support empathy in the design process together with the design considerations they offer. The articles helped on understanding part of the users' abilities, characteristics, and activities but they were focused mainly on the physical and cognitive state of the users as well as the differences of this user group (seniors) in comparison to others (younger healthy adults). They lack on promoting empathy towards the user as a whole and on presenting the user experience.

The article presents a case of a multidisciplinary design team working in a specific context with a specific task, i.e., researchers acting as designers in Sweden conducting a literature study to find representative scientific publications in their field which can support them on (1) understanding and designing adaptive technology for seniors and (2) help them have an understanding of each other's' discipline to the subject. Had the research been conducted in a different context and with a different aim, the results may have differed. Moreover, the articles were collected based on what could support the team in their design process, and the notion of empathy was applied later as a reflection on the tools we use e.g. what they offered in the design process and what we should be aware of when we are using them. The

results would have included more instances of empathy, if the notion had applied from the start of the search. However, searching with such a lens may have been unrealistic for a design case, as often designers will search methods or examples to support their design process instead of a specific lens on understanding these methods. The literature study was not highly structured or done according to a particular literature review approach, but this is not always the case in design research projects, where the focus is to get an overview of the field. Therefore, the literature study conducted by this design team can be used as a case for reflecting how the study of the literature influences the design process.

We believe that our results and discussion will be valuable in the HCI community especially now at the dawn of a rapidly digitalized society where the time for reflection is limited. As the COVID-19 pandemic requires people to stay at home, societies rapidly digitalize their services. Good design is vital to ensure access to the digitalized services, especially for groups of users that up to now have often been perceived as late adopters, often due to their cognitive, and physical abilities.

The article is a call to reflect on how we design tools and how we describe user groups in our publications. Are we sure we do not perpetuate stereotypes and lead to design that fails to serve the users' needs? As the rapid digitization of the world currently may rush the design process, it is of vital importance to avoid transferring existing stereotypes that may pathologize users instead of targeting to the design of a diverse and inclusive digital society. The next step could be a tool that support designers on reflecting where they base their design and spot residues of the past in the design tools collected by their literature study.

Finally, the tools we create to support the design practice influence people's life. If our tools include preconceptions about a user population (as HCI4 reported) we contribute to the perpetuation of stereotypes in society through the practitioners' designs. The tools shape us and we shape our tools [14,35]; if the tools are used to design crutches for a population who is perceived as deficient by the society we perpetuate this notion. Whereas, if we design "in service for" a specific population's needs, wishes and values; we may create a more diverse society with people using different design without perpetuating the notion of an invisible line between those who can and those who cannot.

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## REFERENCES

- < bib id="bib1">< number>1. </number>Chadia Abras, Diane Maloney-Krichmar, and Jenny Preece. 2004. User-Centered Design. In *Encyclopedia of Human-Computer Interaction*. Thousand Oaks: Sage Publications.</bib>
- < bib id="bib2">< number>2. </number>Amon. 2019. Designing an Urban Support for Autism. In *MobileHCI2019*. <https://doi.org/10.1145/3338286.3344390></bib>
- < bib id="bib3">< number>3. </number>Katja Battarbee, Nik Bearten, Martijn Hinfelaar, Paul Irvine, Susanne Loeber, Alan Munro, and Thomas Pederson. 2002. Pools and Satellites - Intimacy in the City. In *Designing Interactive Systems*, 237-245.</bib>
- < bib id="bib4">< number>4. </number>Kathy Baxter, Catherine Courage, and Kelly Caine. 2015. *Understanding Your Users: A Practical Guide to User Research Methods*. Morgan Kaufmann Publishers.</bib>
- < bib id="bib5">< number>5. </number>Robin Brewer and Anne Marie Piper. 2016. "Tell it like it really is": A case of online content creation and sharing among older adult bloggers. *Conference on Human Factors in Computing Systems - Proceedings*: 5529-5542. <https://doi.org/10.1145/2858036.2858379></bib>
- < bib id="bib6">< number>6. </number>Richard Buchanan. 1992. Wicked Problems in Design Thinking. *Design Issues* 8, 2: 5-21. Retrieved from <http://www.jstor.org/stable/1511637></bib>
- < bib id="bib7">< number>7. </number>Bram. Buunk and Frederick X. Gibbons. 2016. *Health, coping, and well-being: perspectives from social comparison theory*. Routledge.</bib>
- < bib id="bib8">< number>8. </number>S.-c Chan and M.-t. Lu. 2004. Understanding internet banking adoption and use behavior: A Hong Kong perspective. *Journal of Global Information Management* 12, 3: 21-43.</bib>
- < bib id="bib9">< number>9. </number>Yen-ning Chang, Youn-kyung Lim, and Erik Stolterman. 2008. Personas: from theory to practices. In *NordiCHI '08: Proceedings of the 5th Nordic conference on Human-computer interaction: building bridges*, 439-442. <https://doi.org/https://doi.org/10.1145/1463160.1463214></bib>
- < bib id="bib10">< number>10. </number>Beenish M Chaudhry, Louis Faust, and Nitesh V Chawla. 2019. From Design to Development to Evaluation of a Pregnancy App for Low-Income Women in a Community-Based Setting. In *MobileHCI2019*. <https://doi.org/10.1145/3338286.3340118></bib>
- < bib id="bib11">< number>11. </number>Yu Chen. 2009. Usability Analysis on online Social Networks for the elderly. *Helsinki University of Technology*, December 2007. <https://doi.org/10.1.1.537.1967></bib>
- < bib id="bib12">< number>12. </number>José Coelho and Carlos Duarte. 2016. A literature survey on older adults' use of social network services and social applications. *Computers in Human Behavior* 58: 187-205. <https://doi.org/10.1016/j.chb.2015.12.053></bib>
- < bib id="bib13">< number>13. </number>Alan Cooper, Robert Reimann, David Cronin, and Christopher Noessel. 2014. *About Face: The Essentials of Interaction Design*. John Wiley & Sons.</bib>
- < bib id="bib14">< number>14. </number>John M Culkin. 1967. A schoolman's guide to Marshall McLuhan. *Saturday Review*.</bib>
- < bib id="bib15">< number>15. </number>Uday Dandavate, Elizabeth B-N Sanders, and Susan Stuart. 1996. Emotions matter: User empathy in the product development process. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*.</bib>
- < bib id="bib16">< number>16. </number>Fred D. Davis. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13, 3: 340. <https://doi.org/10.2307/249008></bib>
- < bib id="bib17">< number>17. </number>Cambridge English Dictionary. EMPATHY. *Cambridge*. Retrieved May 4, 2020 from <https://dictionary.cambridge.org/dictionary/english/empathy></bib>

< bib id="bib18">< number>18. </number>Oxford Advanced American Dictionary. empathy noun. *Oxford*. Retrieved May 4, 2020 from [https://www.oxfordlearnersdictionaries.com/definition/american\\_english/empathy](https://www.oxfordlearnersdictionaries.com/definition/american_english/empathy)</bib>

< bib id="bib19">< number>19. </number>Tom Djajadiningrat, Stephan Wensveen, Joep Frens, and Kees Overbeeke. 2004. Tangible products: Redressing the balance between appearance and action. *Personal and Ubiquitous Computing* 8, 5: 294–309. <https://doi.org/10.1007/s00779-004-0293-8></bib>

< bib id="bib20">< number>20. </number>Connor Dodd, Rukshan Athauda, and Marc T P Adam. 2017. Australasian Conference on Information Systems Designing User Interfaces for the Elderly: A Systematic Literature Review. In *Australasian Conference on Information Systems*, 1–11.</bib>

< bib id="bib21">< number>21. </number>Jared Duval, Zachary Rubin, Elena Márquez Segura, Natalie Friedman, Milla Zlatanov, Louise Yang, and Sri Kurniawan. 2018. Spokeit: Building a mobile speech therapy experience. In *MobileHCI 2018 - 20th International Conference on Human-Computer Interaction with Mobile Devices and Services*, 1–12. <https://doi.org/10.1145/3229434.3229484></bib>

< bib id="bib22">< number>22. </number>Empathy Robert Elliott, Dominguez Hills, Saybrook Graduate School, Jeanne C Watson, Leslie S Greenberg, and Robert Elliott. 2011. Empathy. *Psychotherapy* 48, 1: 43.</bib>

< bib id="bib23">< number>23. </number>Bruna Ferreira, Williamson Silva, Edson Oliveira, and Tayana Conte. 2015. Designing personas with empathy map. In *Proceedings of the International Conference on Software Engineering and Knowledge Engineering, SEKE*, 501–505. <https://doi.org/10.18293/SEKE2015-152></bib>

< bib id="bib24">< number>24. </number>Gabriele Ferri, Jeffrey Bardzell, and Shaowen Bardzell. 2017. Rethinking Age in HCI Through Anti-Ageist Playful Interactions. *Interacting with Computers* 29, 6: 779–793. <https://doi.org/10.1093/iwc/iwx012></bib>

< bib id="bib25">< number>25. </number>Leah Findlater and Joanna McGrenere. 2010. Beyond performance: Feature awareness in personalized interfaces. *International Journal of Human Computer Studies* 68, 3: 121–137. <https://doi.org/10.1016/j.ijhcs.2009.10.002></bib>

< bib id="bib26">< number>26. </number>Gerhard Fischer. 2001. User Modeling in Human - Computer Interaction. *User Modeling and User-Adapted Interaction*, 11: 65–86.</bib>

< bib id="bib27">< number>27. </number>Pascal W.M. Van Gerven, Fred Paas, and Huib K. Tabbers. 2006. Cognitive aging and computer-based instructional design: Where do we go from here? *Educational Psychology Review* 18, 2: 141–157. <https://doi.org/10.1007/s10648-006-9005-4></bib>

< bib id="bib28">< number>28. </number>Ryan Colin Gibson, Matt Mouley Bouamrane, and Mark Dunlop. 2018. Mobile support for adults with mild learning disabilities during clinical consultations. In *MobileHCI 2018 - 20th International Conference on Human-Computer Interaction with Mobile Devices and Services*, 1–8. <https://doi.org/10.1145/3229434.3229469></bib>

< bib id="bib29">< number>29. </number>John D. Gould and Clayton Lewis. 1985. Designing for usability: key principles and what designers think. *Communications of the ACM* 28, 3: 300–311. <https://doi.org/10.1145/3166.3170></bib>

< bib id="bib30">< number>30. </number>Jonathan Grudin. 2006. Why personas work: The psychological evidence. In *The Persona Lifecycle*. 642–664. Retrieved from <https://www.microsoft.com/en-us/research/wp-content/uploads/2017/01/PersonaBook.pdf></bib>

< bib id="bib31">< number>31. </number>Jonathan Grudin and John Pruitt. 2002. Personas, Participatory Design and Product Development: An Infrastructure for Engagement. In *PDC*.</bib>

< bib id="bib32">< number>32. </number>Maren Haag and Nicola Marsden. 2019. Exploring personas as a method to foster empathy in student IT design teams. *International Journal of Technology and Design Education* 29, 3: 565–582. <https://doi.org/10.1007/s10798-018-9452-5></bib>

< bib id="bib33">< number>33. </number>Nelson Harold G and Erik Stolterman. 2003. Design Judgement: Decision-Making in the Real World. *The Design Journal* 6, 1: 21–31.</bib>

< bib id="bib34">< number>34. </number>K. Höök. 2000. Steps to take before intelligent user interfaces become real. *Interacting with Computers* 12, 4: 409–426. [https://doi.org/10.1016/S0953-5438\(99\)00006-5](https://doi.org/10.1016/S0953-5438(99)00006-5)</bib>

< bib id="bib35">< number>35. </number>Pertti Hurme and Jukka Jouhki. 2017. We shape our tools, and thereafter our tools shape us. *Human Technology* 13, 2: 145–148. <https://doi.org/10.17011/ht/urn.201711104209></bib>

< bib id="bib36">< number>36. </number>Mary Jackson. 2018. Models of Disability and Human Rights: Informing the Improvement of Built Environment Accessibility for People with Disability at Neighborhood Scale? *Laws* 7, 1: 10. <https://doi.org/10.3390/laws7010010></bib>

< bib id="bib37">< number>37. </number>Anthony Jameson. 2009. Adaptive Interfaces and Agents. 105–130. <https://doi.org/10.1201/9781420088861.ch6></bib>

< bib id="bib38">< number>38. </number>Merlijn Kouprie and Froukje Sleswijk Visser. 2009. A framework for empathy in design: Stepping into and out of the user's life. *Journal of Engineering Design* 20, 5: 437–448. <https://doi.org/10.1080/09544820902875033></bib>

< bib id="bib39">< number>39. </number>Rock Leung, Leah Findlater, Joanna McGrenere, Peter Graf, and Justine Yang. 2010. Multi-Layered interfaces to improve older adults' initial learnability of mobile applications. *ACM Transactions on Accessible Computing* 3, 1: 1–30. <https://doi.org/10.1145/1838562.1838563></bib>

< bib id="bib40">< number>40. </number>Anu Makela and Katja Battarbee. 1999. It's Fun to do Things Together: Two Cases of Explorative User Studies. *Personal Technologies* 3, 3: 197–140.</bib>

< bib id="bib41">< number>41. </number>Vasiliki Mylonopoulou, Karin Väyrynen, Agnis Stibe, and Minna Isomursu. 2018. Rationale Behind Socially Influencing Design Choices for Health Behavior Change Related research. In *13th International Conference on Persuasive Technology*.</bib>

< bib id="bib42">< number>42. </number>Harold G. Nelson and Erik Stolterman. 2012. *The design way: intentional change in an unpredictable world*. The MIT Press.</bib>

< bib id="bib43">< number>43. </number>Harold Nelson and Erik Stolterman. 2000. Design as being in service. In *Proceedings of the La Clusaz Conference*.</bib>

< bib id="bib44">< number>44. </number>Steven L Neuberg and Jason T Newson. 1993. Personal Need for Structure. *Journal of Personality and Social Psychology* 65, 1: 113–131.</bib>

< bib id="bib45">< number>45. </number>Barbara Barbosa Neves, Rachel L. Franz, Cosmin Munteanu, Ronald Baecker, and Mags Ngo. 2015. My hand doesn't listen to me!: Adoption and evaluation of a communication technology for the "oldest old." *Conference on Human Factors in Computing Systems - Proceedings* 2015-April: 1593–1602. <https://doi.org/10.1145/2702123.2702430></bib>

< bib id="bib46">< number>46. </number>Paula M. Niedenthal and J. Toby Mordkoff. 1991. Prototype Distancing: A Strategy for Choosing among Threatening Situations. *Personality and Social Psychology Bulletin* 17, 5: 483–493. <https://doi.org/10.1177/0146167291175002></bib>

< bib id="bib47">< number>47. </number>Jakob Nielsen. 10 Heuristics for User Interface Design: Article by Jakob Nielsen. *Nielsen Norman Group*. Retrieved May 4, 2020 from <https://www.nngroup.com/articles/ten-usability-heuristics/></bib>

< bib id="bib48">< number>48. </number>Jakob Nielsen. 1994. Enhancing the Explanatory Power of Usability Heuristics. In *Enhancing the Explanatory Power of Usability Heuristics*, 152–158.</bib>

< bib id="bib49">< number>49. </number>Lene Nielsen. 2019. Personas - User Focused Design (Human-Computer Interaction Series).</bib>

< bib id="bib50">< number>50. </number>Lene Nielsen, Kira Storgaard Nielsen, Jan Stage, and Jane Billestrup. 2013. Going Global with Personas. In *International Federation for Information Processing*, 350–357.</bib>

< bib id="bib51">< number>51. </number>Donald A Norman. 1986. Cognitive Engineering. *User-centered system design*: 31–61.</bib>

< bib id="bib52">< number>52. </number>Anabel Quan-Haase, Kim Martin, and Kathleen Schreurs. 2016. Interviews with digital seniors: ICT use in the context of everyday life. *Information Communication and Society* 19, 5: 691–707. <https://doi.org/10.1080/1369118X.2016.1140217></bib>

< bib id="bib53">< number>53. </number>John R.Giudicessi and BA.Michael J.Ackerman. 2006. Factors Predicting the Use of Technology: Findings From the Center for Research and Education on Aging and Technology Enhancement. *Psychol aging* 21, 2: 333–352. <https://doi.org/10.1038/jid.2014.371></bib>

< bib id="bib54">< number>54. </number>Blaine Reeder, Oleg Zaslavsky, Katarzyna M. Wilamowska, George Demiris, and Hilaire J. Thompson. 2011. Modeling the oldest old: personas to design technology-based solutions for older adults. *AMIA ... Annual Symposium proceedings / AMIA Symposium. AMIA Symposium 2011*: 1166–1175.</bib>

< bib id="bib55">< number>55. </number>Horst W J Rittel and Melvin M Webber. 1973. Dilemmas in a General Theory of Planning. *Policy Sciences* 4: 155–169.</bib>

< bib id="bib56">< number>56. </number>Joey Scarr, Carl Gutwin, Andy Cockburn, and Andrea Bunt. 2015. StencilMaps and EphemeralMaps: Spatially stable interfaces that highlight command subsets. *Behaviour and Information Technology* 34, 11: 1092–1106. <https://doi.org/10.1080/0144929X.2015.1046927></bib>

< bib id="bib57">< number>57. </number>Jaisie Sin. 2019. Interactive Voice Technologies and the Digital Marginalization of Older Adults. In *MobileHCI2019*. <https://doi.org/10.1145/3338286.3344423></bib>

< bib id="bib58">< number>58. </number>Jaisie Sin and Cosmin Munteanu. 2019. An Information Behaviour-Based Approach to Virtual Doctor Design. In *MobileHCI2019*. <https://doi.org/10.1145/3338286.3344391></bib>

< bib id="bib59">< number>59. </number>Statista. 2019. Sweden: daily mobile internet usage, by age group 2019. Retrieved January 24, 2020 from <https://www.statista.com/statistics/544075/sweden-daily-mobile-internet-usage-by-age-group/></bib>

< bib id="bib60">< number>60. </number>Erik Stolterman. 1992. How system designers think about design and methods: Some Reflections Based on an Interview Study. *Scandinavian Journal of Information Systems* 4, 1. Retrieved from <http://aisel.aisnet.org/sjis/vol4/iss1/7></bib>

< bib id="bib61">< number>61. </number>Benjamin Tannert and Johannes Schöning. 2018. Disabled, but at What Cost? An Examination of Wheelchair Routing Algorithms. In *MobileHCI 2018 - 20th International Conference on Human-Computer Interaction with Mobile Devices and Services*. <https://doi.org/10.1145/3229434.3229458></bib>

< bib id="bib62">< number>62. </number>John Vines, Gary Pritchard, Peter Wright, Patrick Olivier, and Katie Brittain. 2015. An age-old problem: Examining the discourses of ageing in HCI and strategies for future research. *ACM Transactions on Computer-Human Interaction* 22, 1: 2. <https://doi.org/10.1145/2696867></bib>

< bib id="bib63">< number>63. </number>Froukje Sleswijk Visser and Merlijn Kouprie. 2008. Stimulating empathy in ideation workshops. *Proceedings of the Tenth Anniversary Conference on Participatory Design 2008*: 174–177. Retrieved from <http://dl.acm.org/citation.cfm?id=1795265></bib>

< bib id="bib64">< number>64. </number>Kerryellen G. Vroman, Sajay Arthanat, and Catherine Lysack. 2015. “Who over 65 is online?” Older adults’ dispositions toward information communication technology. *Computers in Human Behavior* 43: 156–166. <https://doi.org/10.1016/j.chb.2014.10.018></bib>

< bib id="bib65">< number>65. </number>Nicole Wagner, Khaled Hassanein, and Milena Head. 2010. Computer use by older adults: A multi-disciplinary review. *Computers in Human Behavior* 26, 5: 870–882. <https://doi.org/10.1016/j.chb.2010.03.029></bib>

< bib id="bib66">< number>66. </number>Susan Wendell. 1996. The rejected body: feminist philosophical reflections on disability.</bib>

< bib id="bib67">< number>67. </number>Peter Wright and John McCarthy. 2008. Empathy and experience in HCI. In *Conference on Human Factors in Computing Systems - Proceedings*, 637–646. <https://doi.org/10.1145/1357054.1357156></bib>

< bib id="bib68">< number>68. </number>Carmen Zannier, Mike Chiasson, and Frank Maurer. 2007. A model of design decision making based on empirical results of interviews with software designers. *Information and Software Technology* 49, 6: 637–653. <https://doi.org/10.1016/j.infsof.2007.02.010></bib>