Article

Exploring heterogeneous ICT use among older adults: The warm experts' perspective

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Abstract
In this article, we (1) examine the various forms of support required by older users (75+) of digital technology and (2) provide a concrete, everyday life rationale for why warm experts play such a pivotal role in the processes of adopting and using ICT. Although warm experts are usually not older adults themselves, they provide an important mediating view on the technology use among older people that has not been rigorously addressed in previous studies. Thus, in our analysis we examine the younger family members' views on acting as warm experts to their older family members. The research data consist of 22 extended group interviews (EGI) and observation carried out in Finland. Based on our analysis, we argue that older adults use ICT in very heterogeneous ways and that the roles bestowed upon warm experts can be understood precisely through this heterogeneity.

Keywords
Aging, digital technology, family, ICT, warm expert

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Introduction

The concept of "warm expert" was originally introduced by Maria Bakardjieva (2005) to describe the significance of novice technology users' social networks in becoming familiar with computers, the Internet, and other new technologies. Bakardjieva (2005) defined warm expert as a person who "mediates between the technological universal and the concrete situation, needs and background of the novice user with whom he is in a close personal relationship" (p. 99). Warm experts were typically favored over professional forms of help, or so-called "cold experts," due to their in-depth knowledge of the novice user. In comparative terms, they were more versed in new information and communication technology (ICT), they were readily available, and they knew how to motivate a novice user embracing ICT.

Recently, researchers have returned to the concept of warm expert to assess its relevance in contemporary digital societies (e.g. Barrantes Cáceres and Cozzubo Chaparro, 2019; Olsson and Viscovi, 2018; Taipale, 2019). In the context of Sweden, for instance, Olsson and Viscovi (2018) show that warm experts are still typically younger family members who provide help and assistance in the domestication of technology for older persons. Their study reveals that the need for assistance in technology use, ranging from the purchase phase to the actual daily practices of use, seems to persist, even though the majority of older Swedes have been using a computer and the Internet for longer than a decade. Barrantes Cáceres and Cozzubo Chaparro (2019), in turn, remind that older adults can also serve as warm experts for their spouses or other older adults who have not yet adopted a certain new technology.

A large majority of people in developed countries are familiar with basic ICT and its benefits in a digital environment where new devices, software, and applications are allegedly more intuitive to use than before. In this light, we explore why warm experts are needed today, and what roles they play in the context of aging and digital society. With these aims in mind, we first ask (1) what are the various forms of support required by older users (75+) of digital technology from the warm expert's point of view. Drawing from this description on the various forms of support, in the second (2) analytical section, we provide a concrete, everyday life rationale on why younger family members, who often serve as warm experts to their grandparents, play such a pivotal role in the processes of adopting and using ICT in later life. While our research material portrays three generations of geographically distributed extended families, we wanted to focus on the segment of older adults aged 75+, who represent grandparents in their respective families. In addition, these older adults, who have born before 1940s, are less likely to have used technology in their working lives.

We suggest that it is possible to clarify the roles of warm experts, and consequently explain why they are needed, by paying attention to the heterogeneous aspects of digital technology use in family contexts involving the diverse group of older adults. This is also why the research data in this study do not lie solely on the older adults' point of view, but conveys the insights from the everyday lives of the warm experts. Although warm experts in the research data are not usually older adults themselves, they provide an important mediating view on the daily lives of the older adults using digital technology that has not been rigorously addressed in previous studies.

We argue that the relationship between aging and the various modes of digital technology use cannot be described in linear terms. There is a continuum, or a spectrum (e.g. Lenhart and Horrigan, 2003; Loos, 2012) of digital technology use among older adults, ranging from active and independent to more limited use. These divergent ways of engaging with digital technology also involve supported modes of use that reflect the role of warm experts. In addition, there are multiple non-technical forces at play here, ranging from life transitions (e.g. Ganito, 2018; Kuoppamäki, 2018), personal health status, and attitudes/emotions (e.g. Mitzner et al., 2010; Wyatt et al., 2005) to economic incentives, which all affect the personal choices made by older technology users. Moreover, as an opposite to the rise of digitally skilled and active older adults, a new category emerges from our research data. This category suggests that there is a growing number of older adults who are used to, and on this premise would like to continue using digital technologies, but who are restricted from new technologies due to health conditions in later life.

The article begins with a short overview of recent studies on warm experts in the context of aging societies. We draw theoretical insights from social system studies (e.g. Luhmann, 1995; Meyer et al., 2008), which provide conceptual tools to make sense of the sustained need for warm experts. Thereafter, we describe our research material and methods. The outcomes of our thematic analyses are presented in two sections. The first results chapter identifies various forms of support required by senior users (75+) of digital technology. In the second result chapter, which builds upon the previous description on the various forms of support, we examine the ways younger family members, who often serve as warm experts to their grandparents, act as mediators in adopting and maintaining ICT in later life. The article is concluded by explaining how the heterogeneous uses of ICT, often supported by warm experts, appear as a response to the challenges faced by older adults in rapidly developing digital societies.

Warm experts in an aging and digitalizing society

Since the publication of Bakardjieva's (2005) book *Internet Society: The Internet in Everyday Life*, the technological landscape has changed considerably and general awareness of aging population structures has increased (Taipale, 2019: 60). At first sight, it looks as if both technological advancements and the passing of time have reduced the demand for warm experts. There are, for example, a decreasing number of "digital immigrants" (Loos, 2012; Prensky, 2001), who have only adopted technology at a later point in life and who should be convinced to start using ordinary ICTs such as mobile phones and the Internet, or social media (Olsson and Viscovi, 2018). Friemel (2016) describes this phenomenon by arguing that the age divide has "grown old"; the major differences in ICT usage rates can now be found between the "old" and "the oldest old," of whom the latter also increasingly have age-related cognitive and motoric limitations influencing technology use (Loos and Romano Bergstrom, 2014). Studies from the Netherlands indicate that older adults (aged 65+) still differ from younger cohorts in that they are more likely to only use a desktop and/or a laptop to access the Internet (Van Deursen and Van Dijk, 2019). In general, they also seem to benefit less from the positive outcomes of the Internet use than middle aged and young adults (Van

Deursen and Helsper, 2015). Nevertheless, previous studies also show that older adults have gained more self-confidence in ICT use, and they report higher digital skills than before (e.g. Khvorostianov, 2016; Van Deursen and Van Dijk, 2015).

While the exteriors of ICT devices have become stripped-down and increasingly sleek, indicating effortless adoption and ease of use, the insides of the same devices are now characterized by a higher degree of complexity (Fortunati and Taipale, 2017; Taipale et al., 2018). This increased internal complexity results from an ever-growing number of functionalities embedded in ICT devices. The smart phone is an exemplar of this development. To maneuver all the features of a smart phone, one must handle multi-layered menu structures and diverse navigation elements, which also differ between operating systems and their multiple versions (Petrovčič et al., 2018; Ziefle and Bay, 2005).

Everybody tackles with problems related to digital technology from time to time regardless of their age. However, internal complexity hampers usage especially among those who have little or no prior experience of using ICTs and who are more dependent on the help of warm experts. Older ICT users are a special group in this respect since older age cohorts involve a higher variation in technology adoption rates, usage, and skills than younger age cohorts (e.g. Friemel, 2016; Loos, 2018; Neves and Amaro, 2012; Östlund et al., 2015). Studies also suggest that the size of social support networks is subject to change with age. Although the size of these networks typically shrinks as people age, a smaller network size does not inevitably affect the amount of support received (Petrovčič et al., 2015; Van Tilburg et al., 2002). In the context of families, typically only one or two family members are named as warm experts (Taipale, 2019), and it is their availability that matters when assistance in ICT adoption or use is needed. Among the older cohorts, there is more variation, or so-called aged heterogeneity, in people's physical and cognitive abilities (Nelson and Dannefer, 1992; Stone et al., 2017), but also in the rates and ways of using ICTs (e.g. Loos, 2018; Neves and Amaro, 2012; Taipale and Hänninen, 2018). The former certainly affects the latter, making it more difficult especially for the oldest old to independently deal with the complexities of ICT.

In this article, we argue that the gradually increased complexity of digital technologies, software, and applications (Fortunati and Taipale, 2017; Kallinikos, 2005) sustains the need for motivation and technical support provided by warm experts. According to Luhmann's (1995) communicative theory, the ultimate goal of a socio-technical system is to reduce the complexity of its environment by creating order out of "chaos." According to this view, ICTs are means to create order in the chaotic world of information and communication surrounding us. In everyday life, ICT users face and experience socio-technical systems, mainly while using digital technology, which are subject to a continuous change: new devices and applications are introduced to the system on a regular basis, while older ones become redundant. New ICT devices, applications, and services are also extensively interconnected, which adds to the complexity of the system. The core of Luhmann's (1995) communicative theory focuses on the interaction between individuals and social systems. As systems try to control their environment, they become more complex and eventually require progressively more skills and knowledge from the people interacting with them. When this knowledge is limited or insufficient, individuals can do nothing but trust the system (Meyer et al., 2008).

Older adults and their families in Finland

When digital everyday life becomes too complex to navigate and manage, it is often the family that people turn to in order to receive help (Taipale, 2019). A great challenge is posed by the shrinking size of families in Finland as there are fewer and fewer family members at one's disposal who can potentially provide assistance. While in 1990, the average size of a Finnish family was three persons, by 2017 it had dropped to 2.8. In 2017, 78% of Finns lived in household consisting of at least two persons, while as many as 22% lived alone (Statistics Finland, 2018). In the 2000s, the share of Finns living alone has increased 1–3% every year (Statistics Finland, 2017). The increase in the shares of small families and sole-dwellers stems from a higher share of young adults living alone and from a high priority of the "aging in place" policy that encourages older people to stay at home as long as possible (Anttonen and Karsio, 2016).

It is also worth noticing that extended families are geographically highly distributed in Finland (Taipale, 2019). Children leave their parental homes early in their lives and set up their own homes. Despite this, they often feel that they are part of a larger family. According to Taipale (2019), geographical distances between members of extended families are on average longer in Finland than in some other European countries, such as Slovenia or Italy. While in Slovenia, the closeness of younger family members was associated with regular intra-family ICT support and training, in Finland families' own warm experts were often hard to reach. Due to the limited availability of warm experts, asking for help in technology-related issues can be deferred, or assistance is sought through phones calls, which is typically considered complicated. Other recent studies from Finland underline that the need for help with regard to digital technology is intertwined with other daily chores (Nordlund et al., 2019). Thus, the work carried out by warm experts, such as purchasing, installing, and configuring devices and software, as well as teaching and mentoring family members who need help, closely resembles other household chores (Tolmie et al., 2007). Finally, in view of the aging of population and the rapid digitalization of social and health care services, studies indicate that the need for assistance in technology use may even grow in the near future (e.g. Koiranen et al., 2016).

Research methods and analysis

The Extended Group Interview (EGI) (Hänninen et al., 2018) method was developed in order to study ICT use in geographically distributed extended families. As a qualitative research method EGI draws from recent methodological ambitions to refine group interview in qualitative research. The attribute "extended" before "group interview" refers to (1) the possibility of complementing interviews with observations, (2) extending group interviews into a series of interviews to investigate family members' differentiated daily agendas and (3) the option to perform interviews through phone or any mode of video conferencing, such as Skype, if a family member is not otherwise available. (For a more detailed description, see Hänninen et al., 2018; Taipale, 2019, appendix.)

In our thematic analysis, we first paid attention to the various forms of ICT support that older adults actually need and that are beneficial for their use of digital technology.

Building upon this knowledge, we then analyzed the themes that clarified why such help and support from families' warm experts was necessary. Regarding research ethics, the study was based on informed consent obtained from the key informants (Miller and Bell, 2002). All key informants and their family members were informed about the purpose of the research and the ways in which its results would be reported. In the following results sections, pseudonyms are used to guarantee anonymity of all study participants.

Research material

As the key informants and their siblings typically acted as warm experts in their families (Taipale, 2019), the research material emphasizes the younger family members' views on why older adults need assistance in technology use. The voice of the older adults is present in the reports indirectly through the observations and interviews conducted by the key informants. The reports were drawn by 22 *key informants*, who were university students majoring in social sciences and communication studies at the University of Jyväskylä, Finland. The key informants were recruited through student mailing lists, and all students who responded were included in the study. The students were given an assignment to observe their ICT-related intra-family communication, and then to interview at least five family members who use ICT. The research material represents the views of three generations since the key informants were instructed to interview at least one of their parents and one grandparent, if possible, and to reflect on their own ICT use as well.[1] ICT was defined as digital communication tools and applications that are used to stay in contact and communicate with family members including various devices and applications. The research material was collected and reported between December 2014 and March 2015.[2]

The key informants interviewed and observed 111 family members, or *interviewees*. Although the majority (19 out of 22) of our key informants were women, the gender distribution of the interviewees was more balanced (61 female: 50 male). The research material represents the views of three generations since the key informants were instructed to interview at least one of their parents and one grandparent, if possible, and to reflect on their own ICT use as well. The interviewees who were born before 1940s, were less likely to have used technology in their working lives, and hence, more likely to need assistance in ICT use. Focusing on the older users (75+) also made it possible to identify the intergenerational roles (grandmothers and grandfathers of the key informants who acted as warm experts in their families) of the interviewees in the family context.

Based on their interviews and observations, the key informants wrote a total of three field reports in which they were asked to describe, (1) what ICT tools and applications were used to stay in touch with family members, (2) how the key informants considered their ICT skills in relation to one another, and finally, (3) how ICT affected the roles within their family. Key informants also gathered background information on each interviewee including gender, age, relationship with the key informant and whether the key informant and informant shared a household. Geographical distance was documented if the key informant and the informant were not members of the same household (Hänninen et al., 2018). The research reports include in total over 29,000 words.

Students were suitable key informants as they had good knowledge about ICT skills within their families. Furthermore, as the students were part of the families they observed and interviewed, they were able to gain information that might not have been accessible to an outside interviewer regarding, for example, their role as a warm expert to their parents and grandparents. EGI enabled us to gain a better view on families and their relationships with various ICTs, and to shed light on the mediating role of warm experts' especially in the context of aging and older adults.

In comparison with, for example, traditional group interview conducted by a researcher, EGI gave room for the key informants to contemplate on the ICT use of their families during both observation and the actual interviews in collaboration with their older family members but also later on when they wrote their reports. The reports depict numerous occasions on which the family members disagreed with one another, indicating that the environment in which the interviews took place was considered safe enough for everyone to express their opinions regardless of age or gender. While studying one's own family especially in the role of a warm expert contributing to the technology use of the older adults (and often children too) provides valuable access to information on family members, existing preconceptions can follow key informants through their fieldwork and find their way into the reports. However, in ethnographic terms, the process of interpretation is by necessity always invested with various biases, as human perception in general is subjective by nature (Clifford, 1986; Geertz, 1973; Marcus, 1998). The reports drawn by the key informants did not produce "objective facts" but rather impartial truths, which are further interpreted by the researchers during the analysis in order to detect and make visible potential biases (Hänninen, 2012; Hänninen et al., 2018).

Results

The heterogeneous aspects of digital technology use among older adults

Adopting new devices and software or solving daily problems related to digital technology use is, in fact, an integral part of the continuously evolving digital society itself, which affects all technology users regardless of their age, gender, or social background (Taipale, 2019). We argue that the relationship between older people and digital technology is heterogeneous, and thus, exhibits a greater variation in comparison with other age groups (e.g. Loos, 2018; Neves and Amaro, 2012; Petrovčič et al., 2015; Taipale and Hänninen, 2018).

There are older adults in our research data displaying fluent skills in digital technology, while others did not engage in the digital world at all or relied on the assistance of warm experts. However, not all older adults on the outskirts of the digital world are the same: there are older adults who explicitly reject the possibility of being part of the digital world altogether, arguing that they simply do not have any interest in or use for ICTs. At the same time, others are genuinely, although cautiously, interested in participating in the digital world but, due to a lack of a warm expert, struggle with new devices and apps and can thus be left behind. It is also common that older adults' disinterest toward the digital world is intertwined with confusion, distrust, fear of embarrassment, or lack of

help from a warm expert in the face of digital technology (also for example, Quan-Haase et al., 2016; Schreurs et al., 2017). There can also be lack of knowledge on the ways digital technology actually works and what it could actually do for older adults in order to serve their daily needs and interests.

In active and independent use of digital technology, ICTs are an integral part of older adults' everyday lives. ICTs help them in their daily chores and keeping in touch with their relatives and friends, and provide them with an overall sense of safety, as Laura describes the use of digital technology by her grandmother, aged 89:

> [. . .] my grandmother feels that ICTs have helped her to communicate better with people. She can call my grandfather from the bus and tell him to put the coffee on. In emergencies it is easier to reach everybody, and she can call her grandchildren anytime.

Being active refers here to a positive and self-reliant attitude toward digital technology. New devices, apps, and updates are actively adopted and used by older adults, and the occasional problems in using digital technology are more a question of temporary malfunctions or counter-intuitive interfaces than a lack of skills. Being an active and independent user of digital technology does not require full autonomy in the face of digital technology but, rather, a sense of ease and self-confidence in front of ever more complex technological system. Digital technology has become a new standard for active, independent users and integrated as an essential part of their everyday lives (also Wilska and Kuoppamäki, 2017), as Leo describes it:

> My grandmother, aged 85, is a good example of how senior people can benefit from new ICTs. My grandmother calls her daughter (who is over sixty years old) in Skype every day to exchange their happenings. The daily Skype call has become a staple in their social interaction, and any malfunction in Skype is regarded as an unpleasant disruption to the convenience and comfort provided by the service. My grandmother also emails her neighbour on a daily basis just to check that everything is okay.

In relation to active and independent use, it is not uncommon that either the active or the independent element of the category is slightly less developed than the other. In practice, this means that there are older adults who are relatively independent users of technology but who do not, for various reasons, find digital technology particularly engaging, or their interest is limited. They have the necessary skills to manage the things they choose to do or are required to do "digitally" in their everyday lives, and they keep up with their routines without any additional interest in the digital world. Thus, it is possible to be independent and self-reliant when using digital technology without actually being very active or curious about it. As Fernández-Ardèvol's (2013) study shows warm experts may then be benefited in learning some specific, innovative communicative practices, such as the use of deliberate missed calls.

However, there are numerous examples in the research data indicating that the reverse also applies: regardless of the particular activity, older adults' daily use of digital technology can, in fact, be more supported than independent. These supported modes of use range from continuous support and co-use with warm experts to proxy use, where warm

experts step in and carry out the daily digital chores on behalf of older persons (e.g. Sourbati, 2009). In the category of *continuous support*, warm experts, who are usually younger family members, basically offer all the necessary advice and help older adults need to become acquainted or cope with digital technology. Earlier studies have also noted that the role of a co-habiting partner is important for continued and intense use the Internet in later life (Barrantes Cáceres and Cozzubo Chaparro, 2019).

Hanna's grandmother, aged 78, finds it difficult to follow and to remember all the advice she is given and requires repetition in order to handle ICTs such as a mobile phone. Hanna's grandfather, aged 79, however, is better at receiving advice, which is possibly due to the fact that he combines new things with his previous knowledge and is eager to learn new skills. Hanna's grandparents display two very different perspectives on ICTs, which also affect the ways in which Hanna tackles their different needs as a warm expert.

Continuously supported use is an exceedingly broad category in the context of the digital technology use of older adults, reflecting the overall need of assistance of especially warm experts in the context of digital technology. It entails a range of "digital household chores" (Taipale, 2019) from buying new mobile phones and computers to installing them, downloading and updating software, managing security issues, introducing and downloading new apps, and taking broken phones, computers, and digital cameras to the local repair service. Warm experts also deal with digital technology on a seemingly mundane, daily level by solving problems and answering technology-related questions. However, the similarities between active and independent, active but only partially independent, and continuously supported use are very clear: all three categories emphasize the importance of warm experts as facilitators of older adults' digital life.

The *co-use* of digital technologies has a close affinity with the continuously supported use of digital technology, but in the former category, both activity and independence are more limited (e.g. Colombo et al., 2014). What is characteristic of co-use is that it provides older adults with an opportunity to come to terms with the digital world in general and to see firsthand what ICTs actually do and what one can do with them. In addition, there is also a strong element of sociality and "doing things together" embedded in co-use, as Frida describes her family life with her grandparents:

> When I was staying abroad for a year, we used to Skype regularly with my mother, father, and sister. Sometimes, when one of my grandmothers was visiting them, they all Skyped together. Both of my grandmothers (aged 76 and 74) found this [Skyping] a new and exotic thing because they had no previous experience of technological devices or video calls.

The idea of "doing things together" involves two main aspects in the context of warm experts. First, it describes situations where the social aspects of technology use act as a glue between older adults and warm experts, who are often family members and friends. Solving problems, learning new skills, or, as in Frida's case, getting to know new ways of using digital technology takes place in very informal contexts and is frequently accompanied with other everyday life agendas than just tackling with digital technology (Nordlund et al., 2019). Not all co-use is, however, as equal as the idea of

"doing things together" might suggest. The second aspect regarding co-use emphasizes the significance of warm experts as facilitators for older adults especially when digital technology has proven to be too difficult for them to adopt. In these kinds of cases, the element of "doing things together" can still be there, but the actual digital skills required in a given situation are provided mostly by the warm expert.

Co-use can very easily turn into *proxy use* (e.g. Dolničar et al., 2018; Dutton et al., 2005; Selwyn, 2006), where the warm expert assumes the daily digital chores of an older adult and basically acts on behalf of them. For example, Nina describes proxy use in her family as follows:

> My grandpa's (aged 85) grandson, my cousin Max, pays the bills on behalf of our grandfather, and his other grandson, Paul, who is an engineer, bought him a computer. At first, our grandpa was actively involved in new technology, but as it started to develop towards the contemporary state of things he just couldn't follow [. . .].

Proxy use can also manifest itself though a phenomenon we call *digital piggybacking*, where a senior person, in our research data the grandmother of the family, is an active Facebook user, whereas her husband, the grandfather, has never been involved in social media (on mothers' central role, see also for example, Ureta, 2008). However, as most of the communication regarding their extended family life takes place on Facebook and other social media, the grandfather has adopted the habit of asking his relatives questions and sending them short messages through his wife, who thus acts as a proxy between her husband and the rest of the family (see also for example, Selwyn, 2006). It is also note-worthy that by conveying messages between her husband and other family members, the grandmother has become not only a proxy but also a warm expert in relation to her husband.

It is also not unusual that older adults with good digital skills that support their success in everyday life lose their grip on digital technology due to health issues, for example, as happened to Laura's grandmother:

> My grandmother, aged 78 had a computer for a few years before her heart surgery last year. The surgery and the medical examinations before and after the surgery as well as physiotherapy and other procedures messed up her normal everyday life. When everything was okay, my grandmother could make a Skype call to her grandchildren living abroad by herself and read the blog of one of her grandchildren. If my memory serves right, she even sent me an email once. Now she feels that she can't even remember how to use Skype.

The continuum from the active, independent use of digital technology to various forms of supported use and finally proxy use, where someone else, usually the warm expert, acts on behalf of the older person in the digital world, can at first seem like a linear progression moving toward the inevitable stage of giving up digital technology altogether. There are, however, many shades to this "gray divide," ranging from active current users and active former users to former users becoming active users again (Fernández-Ardèvol et al., 2017). This is evident especially in the light of the new category emerging from the research data, which we call *no longer in use*.

Making sense of the role of warm experts in older adults' diverse forms of ICT usage

In the previous section, we concluded based on our analysis and other relevant studies on the digital technology use in later life that older adults are, in fact, a very heterogeneous group in regard to ICT use (e.g. Quan-Haase et al., 2018). Drawing from this observation, the range of the different roles warm experts play in their lives turns out to be equally wide. In practice, this means that active, independent users require different kinds of support in comparison with older adults who rely on continuous support, co-use, or proxy use. There are also particular idiosyncrasies included in the category of "no longer in use," which we will discuss toward the end of this section.

At this point, it is important to note that there is a difference between the specific types of ICT use in the context of older adults and being an actual representative of a given category of use in this analysis. Based on our research data, we argue that it is only rarely, and mostly in association with proxy use, that these two analytical concepts align with each other. The majority of the older adults who took part in this research exhibited elements of several categories of use simultaneously.

In the context of the active, independent use of digital technology, it could seem that older adults do not need warm experts at all. However, according to our research data, this is not entirely true. The active, independent use of digital technology does not entail full autonomy regarding ICTs but, rather, emphasizes the older adults' overall attitude toward the digital aspects of their daily lives. Regardless of the level of activity, everybody needs assistance with ICTs every now and then (see also Taipale, 2019). Nobody can master everything in the digital world, and at the same time, problems can occur unexpectedly even to those with good digital skills. This need for help applies not only to older people, but all ICT users, who tackle with the complexities of new ICTs regardless of their age..

The digital world draws from constant transformation: new devices and updates constitute an ongoing stream of novelties to be learned and adopted by users. The innovation cycles of new ICTs are considerably short, and the internal complexity of ever more multifunctional and interconnected devices and applications continues to grow, as suggested by social system theories (Luhmann, 1995; Meyer et al., 2008). Without good digital skills, motivation, and/or well-informed warm experts, it is easy to be left behind. This also applies to the multitude of interfaces provided by ICT companies, as many of them can turn out to be less than intuitive for users, which underlines the role of warm experts as facilitators between ICTs and the older adults trying to use them.

Despite their good technology skills, active and independent users, too, benefit from the occasional help of warm experts, who assist them with unexpected problems or motivate them by offering advice on new devices and applications. In regard to digital technology, the social element of sharing knowledge is manifested very clearly in the informal assistance among fellow users. The motivational elements, which reflect the multiple aspects of being a warm expert, are important especially when an older person is managing their "digital life" independently by sharing experiences, solving problems, and trying out new applications and hardware in social interaction with a warm expert. It also

underlines the fact that older people can, and indeed do, act as warm experts themselves (Selwyn et al., 2016).

In terms of continuously supported use, the significance of warm experts is based on the same overall rationale as in the context of active and independent ICT use. In both cases, warm experts provide the necessary assistance and motivation, and support the continuity of digital technology use in the daily lives of older adults. However, there are also age-related characteristics to continuously supported use that go beyond digital practices, but highlight the obvious differences between these two categories. Difficulties can manifest themselves with, for example memory issues or poor eyesight, which may require a considerable amount of repetition. In their study, Peng et al. (2018) showed that poor health condition is a particularly strong barrier to the use of ICTs among older adults, who would most likely benefit from the support of warm experts in their family. It is an even stronger determinant for technology non-use than older adults' membership in a pre-digital generation.

As has been already established in our analysis, continuously supported use is one of the most common and variable trends of ICT use among older adults. As a concept, continuous support quite literally suggests that older adults who require assistance with digital technology could not take part in the digital world at all, or their participation would be limited, without continuous help from warm experts. This is an important observation as it states the obvious: one can no longer merely rely on mastering, say, the use of a smart phone, or a tablet in order to be part of the contemporary digital world. Instead, the content of the digital realm today introduces requirements of its own. ICT has already moved from devices to a service-based approach where the user must not only tackle the complexities of a given device but is also expected to define one's personal presence in the online world.

According to our research data, the growing complexity that takes place inside ICT devices is one of the main reasons why older adults experience difficulties in coping with ICTs today. Choosing one application over another is not enough because there is a growing number of must-have applications that "everybody uses" regardless of their suitability for older people (Wilska and Kuoppamäki, 2017). An increasingly complex system of digital technology and applications has thus immersed itself into an integral part of everyday life. Although it serves everyday needs in many beneficial ways, it can also act as a source of exclusion.

There are a great number of older adults, exhibited especially in the categories of co-use, proxy use, and no longer in use, who do not directly engage with ICTs at all—not even if it would be necessary in order to maintain one's autonomy in digital society. In connection with co-use, older adults engage with digital technology through warm experts. It is characteristic to this category that the older adults cannot or do not want to use ICT by themselves at all. Hence, the level of support here is relatively high in comparison with active, independent use. In the case of proxy use, the element of independence is weak since warm experts act on behalf of the older adults and not with them as in connection with co-use.

Learning new ICT skills improves the level of digital independence and, consequently, the ability to deal with the complexities of ICTs among older people. The development

of skills does not, however, guarantee a linear progression (Taipale et al., 2018; Quan-Haase et al., 2018). First, having good digital skills do not mean that everybody would be proficient in all aspects of ICTs at the same time. Instead, skills vary sporadically depending on the available devices, personal interests, economic resources, and the socio-digital environment (e.g. what ICTs are used by other people, including warm experts, around older persons). This is also why we discuss categories of use rather than user categories (cf. Quan-Haase et al., 2018). Second, due to age-related health conditions and transitions in later life, all categories of use discussed earlier reflect the overall heterogeneity of old age and are subject to change (e.g. Hargittai and Dobransky, 2017). For example, age-related impairments or illness can dramatically affect the digital abilities of certain older adults, but leave others unaffected. Even a person with a sound skill set can abruptly be pushed away from active, independent use toward the category of no longer in use. This kind of transition does not of course have to be permanent, but it can be, and this is why senior people may benefit from flexible support adjusted to their everyday lives.

Conclusion

In this article, we first studied the heterogeneous aspects of older adults' ICT use in Finland from the warm experts' point of view. We brought together and discussed various forms of support, previously addressed separately in various studies, in which warm experts are involved in the digital everyday life of older adults, ranging from small acts of motivation and giving practical advice to actual co-use and proxy use of ICTs. In terms of digital skills and the need for warm experts' support, the heterogeneity also extends to the everyday lives of the interviewees on an individual level: although an older adult may be expert in using one device or application, he or she may need support in the use of another. We also showed that older adults serve as warm experts to one another, which underlines their active role as technology users.

In response to our second research question, why warm experts play such a pivotal role in the processes of adopting and using ICT, we argued, drawing from social system theories (Lash, 2003; Luhmann, 1995; Meyer et al., 2008), that the sustained need for warm experts results from the increased internal complexity of everyday ICTs and their deepening integration into complex networks of personal technologies (Fortunati and Taipale, 2017). The far-reaching tentacles of the socio-technological system of ICT devices, software, and applications create a need for continued motivation and technical support, and this development is quite independent of the technical advances in the domain of ICT usability. To cope with this complexity, older adults—and to a varying degree also younger age cohorts—take advantage of the above-presented variants of ICT use facilitated by warm experts, not forgetting older users' ability to also employ many ICTs unaided and to learn new skills from their peers. Hence, we conclude that the heterogeneity of ICT use among older adults manifests itself more as a practical response to the complexity of the constantly changing ICT landscape than as an indication of older adults' low digital skills or unwillingness to keep up with technical advancements.

Limitations and implications for future research

The study was carried out using a particular data collection method EGI through which older adults' voice was filtered by the younger family members who, almost as a rule, also served as the key informants in their extended families. While the views of the younger key informants may be slightly overemphasized at the expense of the older family members, the great advantage of the method was that we gained a vivid picture of older adult–warm expert relationships. Future research should further investigate if personal interviews with older adults can produce an even more fine-tuned picture of their heterogeneous ICT use and the ways in which they combine independent and supported use of digital technology. As the complexity of ICTs tends to develop inside devices, additional research is also required on whether the need for warm experts arises more from software- than hardware-related issues. Older adults are used to and content with many kinds of technologies, but what is new to them is the internal logic of digital devices (Fortunati, 2017). To conclude, based on recent similar studies on warm experts from Sweden (Olsson et al., 2019; Olsson and Viscovi, 2018), we believe that the results of the study lend themselves to various cultural contexts in other countries with certain constraints. Differences in the concept of family and in the housing arrangements of extended families are likely to affect the extent to and frequency in which warm experts can provide personal help and assistance.

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Notes

1. One of the interviewees in the research material was 74 years old. This is because her digital use was discussed in the reports with another interviewee, who was over 75 years and her accounts could not be detached from the overall report.
2. Among the 111 family members, there were 24 persons that were over 75 years old. The fieldwork was led by Sakari Taipale. All research material has been gathered by Finnish key informants from their Finnish family members. The research data have been analyzed by Riitta Hänninen and Raija Luostari. The English citations were translated by Riitta Hänninen.

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