

Colors of Aging: Cross-cultural Perception of Lifelogging Technologies in Older Age

Julia Offermann-van Heek^a, Wiktoria Wilkowska^b and Martina Ziefle^c

Human-Computer Interaction Center, RWTH Aachen University, Campus-Boulevard 57, 52074 Aachen, Germany

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Abstract: Within an aging society, characterized by increasing numbers of older people in need of assistance and care with a simultaneous shortage of professional caregivers, new ways and innovations have to be developed to facilitate life in older age. Assisting lifelogging technologies have the potential to support older and frail people, but also caregivers in their everyday lives. These assisting lifelogging technologies require the acceptance of future users to reach a sustainable adoption. As research has focused mostly on country-specific analyses so far, a cross-cultural and -national investigation of users' lifelogging technology acceptance in older age is necessary. Therefore, an online survey study ($N = 1123$) examined perceptions regarding aging, care, and lifelogging technology usage, focusing on the perspective of potential users originated from five different countries: Germany, Sweden, Canada, Italy, and Spain. The results revealed significant differences between the countries regarding attitudes towards aging and care as well as perceptions and acceptance of lifelogging technologies. The insights identify the cultural background of potential users as a relevant impacting parameter and should be considered when technologies are developed and tailored to the needs of specific user groups.

1 INTRODUCTION

The care sectors of today's society are tremendously challenged by increasing proportions of people in need of assistance and care caused by their age, (chronic) illnesses, or disabilities and a simultaneous shortage of (professional) care personnel (Greve, 2016; Fekete, 2019; Börsch-Supan et al., 2015). As a consequence of a significantly higher life expectancy including more and more people aged 75 years and older having specific needs regarding assistance and (intensive) care, higher numbers of professional and family caregivers are needed. In fact, the proportions of professional caregivers have decreased in the last years. At least in Germany, it is tried to compensate this described lack by outpatient nursing services or by care provided by family members (Roth and Reichert, 2019). In line with most older people's wish – to stay as independent and as long as possible within their own home – it is thereby tried to enable that older and frail people can stay within their familiar home environment (Blackman et al., 2016). Nevertheless, these efforts do not suffice in the course of

demographic change. Much more, it is required to think about new ways, concepts, and technologies in order to assist and support older people and people in need of care. Using assisting lifelogging technologies in older age represents one possible approach to support older people in their everyday life to enable a longer staying within their own home or to relieve the burdens of (professional) caregivers and family members. Thereby, assisting lifelogging technologies refer to diverse technological ways of recording the everyday life Selke (2014) reaching from wearable devices – motivating their users to a healthier lifestyle – to holistic ambient systems installed within the home environment, that are able to detect emergencies or remind their users for intake of medicine or appointments. In the last years, a broad variety of applications has been developed belonging to the field of ambient assisted living (AAL) and assisting lifelogging technologies (for an overview see Rashidi and Mihailidis (2012)). Besides their technical potential, the future user's acceptance of innovative technical solutions presents a prerequisite for a sustainable adoption and usage within the everyday life. Therefore, research has increasingly focused on diverse future users' perception and evaluation of assisting technologies in recent years (e.g., (Larizza et al., 2013;

^a <https://orcid.org/0000-0003-1870-2775>

^b <https://orcid.org/0000-0002-7163-3492>

^c <https://orcid.org/0000-0002-6105-4729>

König et al., 2017; Peek et al., 2014). Most of the studies in this field have in common that they focus on the perspectives of participants from one single country. Hence, there is hardly any knowledge about cross-cultural perspectives on using assisting lifelogging technologies in older age so far, and it is not known if and to what extent the participants' origins or cultural background is an impacting parameter. This is exactly why the present study ($N = 1123$) aimed at a cross-cultural and -national comparison of the perceptions of aging, care, technology-related benefits and barriers as well as acceptance of using assisting lifelogging in older age differing between participants from five countries: Sweden, Italy, Spain, Canada, and Germany. Hence, this paper investigated the influence of culture understood and defined as the participants' cultural origins.

2 STATE OF THE ART

The following section presents the theoretical background of the study, starting with the current state of acceptance of assisting lifelogging technologies. Afterwards, the individuality of users and its impact on the acceptance of assisting technologies are focused including demographic and health-related characteristics as well as culture (i.e. the cultural origins of the participants) as potential impacting parameter.

2.1 Lifelogging & Acceptance

In the last years, numerous technologies and innovative systems have been developed in the field of lifelogging and ambient assisted living. These technologies and systems cover an extremely broad range of functions for diverse groups of users with their specific needs and requirements (Rashidi and Mihailidis, 2012; Abtoy et al., 2018). The potential user groups are as diverse as the spectrum of the technologies and systems: for healthy people, lifelogging technologies provide the opportunity to analyze and track own behaviors, such as sports or nutrition, to improve and support a healthy life style, or to enhance well-being (e.g., Schoeppe et al., 2016; Middelweerd et al., 2014). For older and frail people, assisting lifelogging technologies have the potential to meet the care gap, by supporting them in retaining as independent as possible, staying active, and in particular by enhancing safety. The latter is realized using wearable and non-wearable, video- or sensor-based monitoring and fall detection systems, that enable alarms or emergency calls in case of emergencies and falls (e.g., Mubashir et al., 2013; Stone and

Skubic, 2014; Wu and Xue, 2008). Another relevant application area for older and frail people refers to prompting systems and memory aids: here, diverse concepts and systems aim at facilitating everyday life for older people in need of assistance and care and, in particular, for people with dementia and their caregivers, for example by reminding for intake of medicine or prompting for daily routines (e.g., Hosain et al., 2011; Mihailidis et al., 2007; Wu and Xue, 2008). Other application examples refer for instance to a barrier-free and independent communication for older people with friends, family, or caregivers using telemedicine, telecare, or videoconferencing services and technologies (van den Berg et al., 2012), or to wandering prevention tools (for people with dementia) (e.g., Vuong et al., 2011). Beyond all these useful opportunities and functions, the future users' perspective on, and acceptance of, those technologies are decisive for a long-term adoption and usage of assisting technologies in their everyday lives. Although the number of studies focusing on the user's perspective on innovative technologies in the area of ambient assisted living and assisting lifelogging technologies has increased in the last years, systematic evaluations and validations of new as well as already existing technologies are still needed (Peek et al., 2014; Calvaresi et al., 2017). So far, research has shown that assisting lifelogging technologies in older age are predominantly positively perceived by their potential users and in particular the potential to relief the everyday life of persons in need of care and their caregivers is acknowledged (Lorenzen-Huber et al., 2011; Wild et al., 2008; Lai et al., 2010): thereby, especially increased safety, independence, and autonomy for people in need of care are highlighted as benefits of applying assisting technologies in older age. These advantages are in particular acknowledged when safety-relevant functions, such as emergency alarms and fall detection, or relieving functions like (medical) reminders are enabled (e.g., Offermann-van Heek et al., 2019; Gall et al., 2016; Offermann-van Heek et al., 2019). Not surprisingly, some barriers and concerns stand opposite to the advantages and benefits of using assisting lifelogging technologies (Peek et al., 2014). Concerns with regard to privacy invasion when dealing with technology-related data (Mihailidis et al., 2008; Steggell et al., 2010; Lorenzen-Huber et al., 2011), feelings of being controlled by the technology as well as assumed high costs (Horton, 2008; Porter and Ganong, 2002) belong to the most relevant barriers of using assisting lifelogging technology. Besides benefit- and barrier-related aspects that impact the user's acceptance of assisting technology, research has shown that also the specific type of technology as

well as the respective context (e.g., necessity in terms of care needs (Offermann-van Heek et al., 2019)) are impacting parameters for the perceptions and acceptance of future users. With regard to the context of demographic change and usage of assisting technologies in older age, it is also relevant how the topics of aging and care themselves are perceived by (older) people in need of care. Here, research has shown that attitudes and handling of topics like aging and care have the potential to shape and influence the acceptance and adoption of assisting lifelogging technologies as well (Biermann et al., 2018).

2.2 Individuality of Users

In addition to technology-related characteristics as well as motives and concerns of using assisting lifelogging technology, individual characteristics of future users have the potential to impact the evaluation, perception, and acceptance of assisting technologies. Relevant findings related to these potential impacting user factors are described within the next sections.

2.2.1 Influence of Demographics

The most common user characteristics integrated in technology acceptance are certainly referred to the participants' age and gender. In the context of using assisting lifelogging technology in older age, research has shown that older people expressed more positive attitudes towards innovative technologies compared to younger people (e.g., Beringer et al., 2011; Offermann-van Heek et al., 2019): In more detail, the older participants showed higher agreements to potential advantages of using assisting technology, such as a longer staying at the own home or increased independence, while they showed lower perceptions of barriers. As an interesting result, they considered other concerns to be relevant compared to younger people, e.g., to be dependent on innovative technologies or to feel unable to control the technology. Research also revealed that the participants' gender can have an impact on the evaluation and acceptance of assisting technology (e.g., Offermann-van Heek et al., 2019), revealing men to show a higher acceptance of assisting lifelogging technologies, while the female participants expressed higher evaluations of barriers.

2.2.2 Influence of Health and Care

As other individual characteristics of users, the participants health status, potential care needs, and previous experiences with care have been identified in previous research. Previous research has shown that the participants' health status, such as existing chronic diseases

or disabilities of older people, have an influence on assessments as well as acceptance of assisting technologies (e.g., Chappell and Zimmer, 1999; Gentry, 2009; Wilkowska, 2015; Offermann-van Heek et al., 2019). In addition, further studies revealed that previous experiences with care (e.g., professional care experience Larizza et al. (2013); Offermann-van Heek et al. (2019) as well as private care experience (Lorenzen-Huber et al., 2011; Offermann-van Heek and Ziefle, 2019)) impact the perception and acceptance of assisting technology: For instance, professional caregivers showed in parts higher concerns and evaluations of barriers as well as a lower technology acceptance compared to lay persons.

2.2.3 Influence of Culture

The most studies regarding technology acceptance of assisting lifelogging technology have in common that they investigated the perceptions and acceptance of participants from one single country and cultural origin, although the cultural background is considered as an individual factor of users that could play a role as impacting parameter on technology acceptance (Sun and Zhang, 2006). Occasionally, some studies investigated the acceptance and perception of (assisting) technology depending on the cultural origin of the participants. For example, the research of Alagöz et al. (2011) and Wilkowska et al. (2012) revealed significant influences of the participants' cultural backgrounds on their acceptance of assisting eHealth technology – in addition to other user factors such as age and gender. In more detail, it was found that Turkish, Polish, and German participants differ in their evaluations of motives and barriers of using assisting technology, revealing that in particular barriers and concerns with regard to technology usage were assessed higher by the Turkish compared to the German and Polish participants. Although these results constitute the presumption that culture operationalized as cultural origin could be an impacting parameter for the acceptance of assisting lifelogging technology in older age, it is not known yet to what extent the contextual perception of care and aging, but also the perception of technology-related benefits and barriers, and acceptance are shaped by origin- and culture-dependent characteristics. Hence, an approach is needed that investigates lifelogging technology perception and acceptance in dependence of the participants' origins taking different countries into account. In order to enable cross-national and -cultural comparisons in Europe, it is necessary to systematically compare countries from different regions (e.g., Northern vs. Central vs. Southern Europe). In addition, it would be useful to integrate a non-EU country

in order to draw some first conclusions about Europe and continent spreading relationships between culture and lifelogging technology acceptance.

3 METHODOLOGICAL FRAMEWORK

The background for the current study presents the European research project PAAL (“Privacy Aware and Acceptable Lifelogging services for older and frail people”). Within PAAL, an interdisciplinary team of lawyers, diverse engineers, and communication scientists develop different assisting lifelogging services that are specifically tailored to the needs and requirements of older users. In order to reach a broad acceptance and to understand acceptance patterns from as diverse people as possible (younger vs. older people, “healthy” people vs. people in need of assistance and care, people from diverse countries), cross-national studies, surveys, and experiments are conducted. The specific research aim of the present study was to examine the potential influence of the participants’ cultural origins on their perceptions of aging and care as well as their evaluation, perception, and acceptance of using lifelogging technology in older age. In order to reach this aim, an online survey was conceptualized and people from five different countries were asked to participate in the survey. To reach participants from a broad range in Europe, Italy and Spain were chosen to represent Southern Europe, Sweden as example for Northern Europe, and Germany as example for Central Europe. As counterpart to the euro states, Canada was chosen as control group enabling a comparison beyond the European countries. The specific underlying research questions were the following:

- RQ1: Does the handling of care within families differ depending on the participants’ origins?
- RQ2: Do the attitudes towards aging and care differ depending on the participants’ origins?
- RQ3: Do the perceptions of technology-related benefits and barriers differ depending on the participants’ origins?
- RQ4: Does the acceptance of lifelogging technology in older age differ depending on the participants’ origins?

3.1 Concept of the Online Survey

Subsequent to the present study different qualitative as well as quantitative studies were conducted. These studies enabled to derive central guidelines for

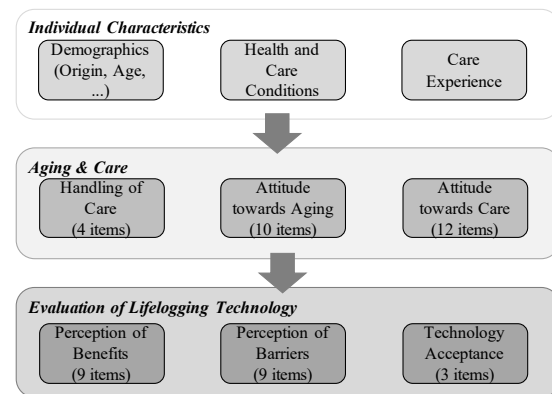


Figure 1: Structural overview of the survey’s parts and the investigated constructs.

a human-centered development of lifelogging technologies and provided a broad overview of impacting user factors Offermann-van Heek et al. (2019). As these studies did not integrate cross-cultural analyses, an online survey was developed based on the existing knowledge specifically aiming for an cross-cultural investigation of perceptions of aging and care as well as acceptance and perception of using lifelogging technologies in older age. In order to reach participants from different countries, the survey was made available in English, German, Italian, and Spanish. At the beginning, participants were able to choose the language, in which they desired to fill out the survey. Afterwards, they were welcomed and shortly introduced into the topic of an aging society and the development of lifelogging technology in order to facilitate life in older age. The main part of the survey consisted of three parts (see Figure 1). In the first part, the participants were asked for individual characteristics, starting with indicating demographic information, such as their origin, age, gender, highest educational level, or living situation. Subsequently, the participants indicated if they suffer from a chronic illness and/or if they are in need of assistance and care in their everyday life (answer options: yes/no). Further, the participants were asked, if they have previous experiences in care (answer options: yes/no) differing between professional experience, (private) passive, and private active experience. Here, passive experience meant that the participant has a person in her or his family circle, who is in need of assistance and care; whereby active care experience meant that the participant has already been the caregiver for a family member in need of care. Following these details, the participants were introduced into the topic of aging and care within the second part of the survey. Here, the participants initially assessed four items dealing with the handling of care of older family members

within their families. The items are presented in Figure 2 and the participants' evaluations based on a four-point scale reaching from "1 = I disagree" to "4 = I agree". Further, the participants evaluated their attitudes towards aging and care. For this purpose, they first assessed 10 items ($\alpha = .86$) referring to potential positive (e.g., /sayAging means to me... that I can still have a lot of fun in my life.) and negative aspects of aging (e.g., /sayAging means to me... to be less independent.). The evaluation of this and the next scales based on six-point Likert scales (reaching from /say1 = I totally disagree" to "6 = I totally agree). The attitude towards care was evaluated using 12 items ($\alpha = .74$) covering aspects like the desired living situation in older age (e.g., "I do not wish to be placed in a nursing home under any circumstances."), needs for autonomy and independence (e.g., "In my everyday life I would improvise to be able to do things myself."), and who should be the caregiver in case of care needs (e.g., "I'd be glad to have someone in my family to help me."). After these aging- and care-related aspects, the participants were introduced to the development of lifelogging technologies and their potential benefits and barriers within the third part of the survey. The participants should empathize with the situation that they are in need of care themselves and that assisting lifelogging technology has the potential to facilitate their everyday life by detecting emergencies such as falls or by reminding for daily routines (such as intake of medicine or adherence to schedules). In the following, the participants were asked to assess each nine potential benefits ($\alpha = .94$, e.g., "Increase in independence (autonomy)" or "Fast reactions in emergencies") and potential barriers ($\alpha = .89$, e.g., "Insights into personal health data for unauthorized persons" or "Replacing human care by technology") of using lifelogging technology in older age. Finally, the participants evaluated their acceptance and intention to use lifelogging technology using three items ($\alpha = .76$; e.g., "I do not want to use an assisting lifelogging system." or "I think an assisting lifelogging system is generally useful."). For all these evaluations, also six-point Likert scales were used. At the end of the survey, the participants had the opportunity to give feedback on the topic and the survey.

3.2 Data Acquisition, Preparation, and Analysis

In order to reach representative samples (in particular with regard to age) and participants from five different countries, the service of an independent market research institute was used. The respondents were invited to participate in the survey via email by the

market research institute. Further the market research institute was engaged to acquire respondents from the mentioned five countries, fulfilling previously defined age and gender quotas (i.e. equal distributions with regard to gender and age groups: 18-40 years, 41-65 years, 65+ years).

As only complete data sets could be used for detailed statistical analyses, incomplete data sets were excluded from the data base. In addition, participants with very short processing times (less than the median of the processing time -30%) were also excluded from the subsequent data analysis. As a further preparation for the data analysis, negative items were re-coded, all scales were tested for reliability, and overall scores were calculated.

For the statistical analysis of the influence of the participants' cultural origins on the perceptions of aging, care, benefits, barriers, and acceptance of lifelogging technologies, one-way between groups analyses of variance (ANOVA) were applied in order to analyze potential differences between Spanish, Italian, Canadian, Swedish, and German participants (partial eta squared (η^2) was calculated for effect sizes). If the homogeneity of variance was violated, Brown-Forsythe (BF) tests were applied in order to verify the equality of group variances. In order to identify specific differences between the countries, Tukey's post-hoc tests were applied. Significant group differences are presented using square brackets within the diagrams in addition to the respective significance level. To analyze potential relationships between the perceptions and acceptance, Pearson's product-moment correlation coefficients (r) were calculated for continuous variables. In the following, means (M) and standard deviations (SD) are reported for descriptive analyses and the level of statistical significance (p) was set at the conventional level of 5% ($*p < .05$; $**p < .01$).

3.3 Description of Participants

After the data cleansing (deleting incomplete data sets, speeders etc. ($n=568$; 33.6%)) a final sample of $N = 1123$ participants remained for further statistical analyses. As mentioned above, the participants were recruited by an online-panel of a market research institute and were paid for participating. The participants were on average 49.7 ($SD = 16.1$) years old ($min = 18$; $max = 99$) and the proportion of male (48% ; $n = 539$) and female (52% ; $n = 584$) participants was almost balanced. The educational level of the sample was rather high, as 49% ($n = 550$) of the sample reported to hold a university entrance qualification (or completed apprenticeship) and 44.9% ($n = 504$) a university degree. In contrast, only

Table 1: Overview of participants' characteristics depending on their (cultural) origins.

	Spain (<i>n</i> = 149)	Italy (<i>n</i> = 150)	Canada (<i>n</i> = 295)	Germany (<i>n</i> = 229)	Sweden (<i>n</i> = 300)	Difference
Age [M, (SD)]	49.6 (15.3)	49.3 (16.0)	50.7 (16.3)	49.5 (16.7)	49.2 (15.9)	n.s. (<i>p</i> = .827)
Gender (w, m)	47.0% (<i>n</i> =70) w 53.0% (<i>n</i> =79) m	62.0% (<i>n</i> =93) w 38.0% (<i>n</i> =57) m	50.8% (<i>n</i> =150) w 49.2% (<i>n</i> =145) m	49.3% (<i>n</i> =113) w 50.7% (<i>n</i> =116) m	52.7% (<i>n</i> =158) w 47.3% (<i>n</i> =142) m	n.s. (<i>p</i> = .078)
Education	3.9% (<i>n</i> =5) low 44.3% (<i>n</i> =66) middle 52.3% (<i>n</i> =78) high	1.3% (<i>n</i> =2) low 70.0% (<i>n</i> =105) middle 28.7% (<i>n</i> =43) high	1.0% (<i>n</i> =3) low 43.1% (<i>n</i> =127) middle 55.9% (<i>n</i> =165) high	17.9% (<i>n</i> =41) low 52.4% (<i>n</i> =120) middle 29.7% (<i>n</i> =68) high	6.0% (<i>n</i> =18) low 44.0% (<i>n</i> =132) middle 50.0% (<i>n</i> =150) high	F(4,980.1)=21.9 <i>p</i> < .001 (BF)
Living Situation	12.8% (<i>n</i> =19) alone 36.2% (<i>n</i> =54) 1 person 51.0% (<i>n</i> =76) family	11.3% (<i>n</i> =17) alone 22.0% (<i>n</i> =33) 1 person 66.7% (<i>n</i> =100) family	25.4% (<i>n</i> =75) alone 24.4% (<i>n</i> =72) 1 person 50.2% (<i>n</i> =148) family	32.8% (<i>n</i> =75) alone 38.0% (<i>n</i> =87) 1 person 29.3% (<i>n</i> =67) family	35.0% (<i>n</i> =105) alone 25.3% (<i>n</i> =76) 1 person 39.7% (<i>n</i> =119) family	F(4,1072.4)=18.4 <i>p</i> < .001 (BF)
Chronic Disease	32.2% (<i>n</i> = 48)	38.7% (<i>n</i> =58)	38.6% (<i>n</i> =114)	46.3% (<i>n</i> =106)	32.7% (<i>n</i> =98)	F(4,1018.5)=5.7 <i>p</i> < .001 (BF)
Care Needs	6.7% (<i>n</i> = 10)	13.3% (<i>n</i> =20)	9.2% (<i>n</i> =27)	6.6% (<i>n</i> = 15)	23.0% (<i>n</i> =69)	F(4,931.5)=12.5 <i>p</i> < .001 (BF)
Prof. Care Experience	31.5% (<i>n</i> = 47)	33.3% (<i>n</i> =50)	10.5% (<i>n</i> =31)	12.2% (<i>n</i> =28)	34.0% (<i>n</i> =102)	F(4,781.2)=19.3 <i>p</i> < .001 (BF)
Passive Care Experience	32.9% (<i>n</i> = 49)	58.7% (<i>n</i> =88)	19.7% (<i>n</i> =58)	32.3% (<i>n</i> =74)	30.0% (<i>n</i> =90)	F(4,891.1)=18.0 <i>p</i> < .001 (BF)
Active Care Experience	53.7% (<i>n</i> = 80)	61.3% (<i>n</i> =92)	34.6% (<i>n</i> =102)	25.8% (<i>n</i> =59)	45.3% (<i>n</i> =136)	F(4,938.5)=16.9 <i>p</i> < .001 (BF)

6.1% (*n* = 69) of the participants reported a lower educational level (i.e., completed secondary school). Regarding their living situation, the majority of the sample indicated to live together with their families (45.4% *n* = 510), while 28.7% (*n* = 322) reported to live together with another person and 25.9% (*n* = 291) live alone. According to the topic of the study (using assisting lifelogging technologies in older age), the participants were also asked for the indication of their health status, potential care needs, and previous experiences in care. Thereby, 37.8% (*n* = 424) of the participants reported to suffer from at least one chronic disease, while 12.6% (*n* = 141) indicated to depend on care and assistance in their everyday life. Further, 23% (*n* = 258) of the participants reported professional experience in care. Regarding private experience with care, 32% (*n* = 359) reported to have passive experience, which means that they currently have a person in need of care within their family circle. Even more participants (41.8%; *n* = 469) indicated to have an active experience in care (i.e., they have been the caregiver for a family member in need of care). As the study aimed for a cross-national and cross-cultural comparison, the participants came from five different countries: Canada (26.3%; *n* = 295), Sweden (26.7%; *n* = 300), Spain (13.3%; *n* = 149), Italy (13.4%; *n* = 150), and Germany (20.4%; *n* = 229). The participants' characteristics depending on the different countries are described within the next section.

3.4 Description of Cultures

All characteristics of the participants depending on their (cultural) origins are illustrated in Table 1, which shows that the five countries did not differ significantly with regard to the participants' age. The distributions of male and female respondents were slightly different, but not at a significant level. Looking at

the countries' average educational levels, post-hoc tests revealed that the participants from Italy and Germany differed both considerably from the participants from Sweden, Canada, and Spain by holding larger proportions of low (Germany) and middle education (Italy). With regard to their living situation, post-hoc tests showed that Spain as well as Italy differed each significantly from Germany and Sweden. Thereby, higher proportions of the Spanish and Italian participants lived together with their families and only very small proportions lived alone, compared to Germany and Sweden. Moving to health-related characteristics, the proportions of people suffering from a chronic disease was considerably higher in the German group compared to all other countries (post-hoc tests). In contrast, the proportion of people who indicated to depend on assistance and care in their everyday life was significantly higher in the Swedish participants compared to all other countries (post-hoc tests). In the area of previous experience in care, the German and the Canadian participants were characterized in post-hoc tests by significantly lower percentages of people having professional care experience each compared to Spain, Italy, and Sweden. Concerning passive private care experience, the Canadian group hold the considerably lowest experience compared to all other countries, while the proportion of people being passively experienced was significantly highest in the Italian group (compared to all other countries). Finally, the proportions of people having active care experience were also significantly different, revealing the highest proportions of experience for the Italian and Spanish participants, followed by Sweden and Canada. In contrast, the active care experience was lowest in the German group of participants.

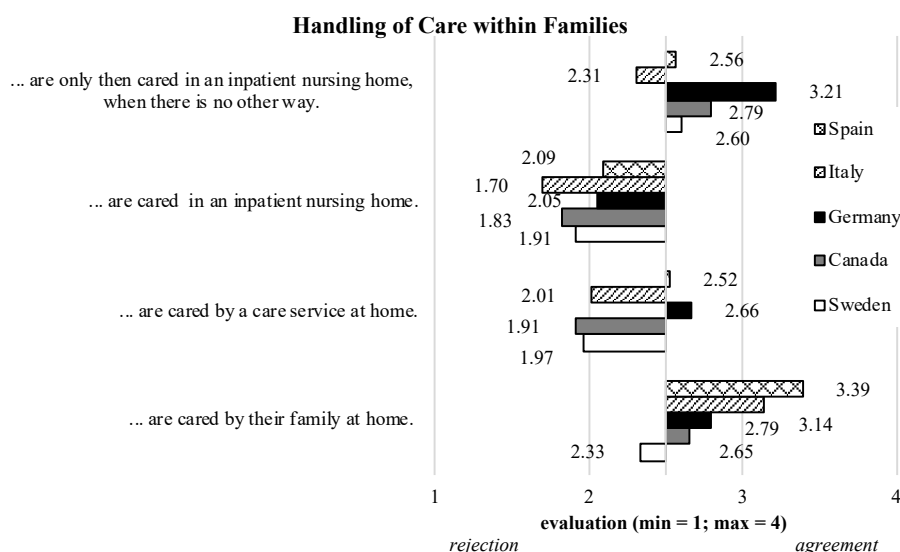


Figure 2: Evaluation of handling of care within families depending on the participants’ origins.

4 RESULTS

The following section represents the results of the study, starting with handling of care, and attitudes towards aging and care. Further, the results regarding the perception of benefits and barriers as well as the participants’ acceptance of lifelogging technology in older age are presented. In addition to the answering of the research questions related to the influence of the participants’ origins on the evaluations, overall relationships between the attitudes, perceptions, and acceptance are shown.

4.1 Handling of Care

In a first step (RQ1), handling of care within families was analyzed depending on the five countries in order to understand if life in older age and, in particular, aging and care are handled differently. The results are presented in Figure 2.

All four items related to the beginning “In my family it is usual that older family members in need of care...” were evaluated significantly differently by the participants. Thereby, the item “... are cared by their family at home” ($F(4, 1036.65) = 36.40; p < .01; \eta^2 = .11$) was clearly confirmed by the Spanish participants ($M = 3.39; SD = 0.82$), followed by the Italians ($M = 3.14; SD = 0.99$), whereas significantly lower agreements were found for the German ($M = 2.79; SD = 0.95$) and the Canadian ($M = 2.65; SD = 1.04$) participants. In contrast, caring older family members at home was slightly rejected

by the Swedish participants ($M = 2.33; SD = 1.11$).

The opportunity that older family members “... are cared by a care service at home” ($F(4, 845.25) = 26.75; p < .01; \eta^2 = .09$) was only marginally positively evaluated by the German ($M = 2.66; SD = 0.82$) and the Spanish participants ($M = 2.52; SD = 1.13$). However, it was rejected and significantly lower evaluated by the Italian ($M = 2.01; SD = 1.08$), Canadian ($M = 1.91; SD = 0.95$), and Swedish participants ($M = 1.97; SD = 1.04$).

All participants rejected that it is usual that older family members “... are cared in an inpatient nursing home”, but to a significantly different extent ($F(4, 822.02) = 4.89; p < .01; \eta^2 = .02$). Thereby, the Spanish ($M = 2.09; SD = 1.15$) and German participants ($M = 2.05; SD = 0.81$) showed a lower rejection than the Swedish ($M = 1.91; SD = 0.94$), Canadian ($M = 1.83; SD = 0.88$), and in particular the Italian participants ($M = 1.70; SD = 0.90$).

Finally, also the evaluation pattern of the last option “... are only then cared in an inpatient nursing home, when there is no other way” was characterized by significant differences ($F(4, 840.06) = 19.13; p < .01; \eta^2 = .07$). Here, the German participants showed the clearly highest agreement ($M = 3.21; SD = 0.87$), followed by the Canadians ($M = 2.79; SD = 1.04$). In contrast, the Swedish ($M = 2.60; SD = 1.11$) and the Spanish participants ($M = 2.56; SD = 1.18$) showed almost neutral evaluations, while a slight rejection was found for the Italian participants ($M = 2.31; SD = 1.22$).

4.2 Attitudes towards Aging & Care

In a next step (RQ2), the participants' attitudes towards aging and care were investigated. The overall results regarding the attitude towards aging are presented in Figure 3 and a significant difference was found ($F(4, 889.41) = 2.40; p < .01; \eta^2 = .01$). Thereby, the positive overall attitudes of the Swedish ($M = 4.13; SD = 0.84$), Spanish ($M = 4.12; SD = 0.95$), German ($M = 4.04; SD = 0.75$), and Canadian participants ($M = 4.01; SD = 0.84$) were rather similar. In contrast, the Italian participants' attitude ($M = 3.89; SD = 0.83$) towards aging was significantly less positive (compared to the Swedes).

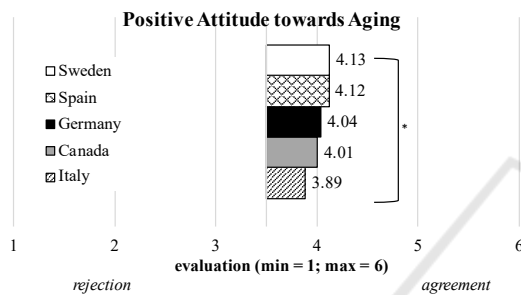


Figure 3: Perception of aging depending on the participants' origins.

Further, the results referring to the participants' attitude towards care are shown in Figure 4 and revealed also a significant difference ($F(4, 1122) = 4.75; p < .01; \eta^2 = .02$). Thereby, a positive attitude towards care included high needs for independence and autonomy as well as wishes for staying longer within the own home. The evaluations of all participants were positive, revealing significant differences between the Swedish holding a comparably lower ($M = 4.19; SD = 0.66$) and the Spanish ($M = 4.40; SD = 0.73$) as well as the German participants ($M = 4.37; SD = 0.61$) with a comparably more positive attitude towards care.

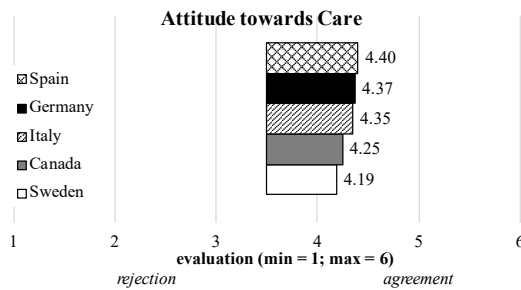


Figure 4: Perception of care depending on the participants' origins.

4.3 Perception of Benefits & Barriers

To identify potential differences regarding the evaluation and perception of lifelogging technology, also the perception of technology-related benefits and barriers was examined (RQ3). For this purpose, the participants evaluated each several benefits and barriers with regard to their agreement or rejection of the respective properties.

Starting with the perception of benefits, the overall results depending on the different countries are presented in Figure 5 and revealed significant differences between the countries ($F(4, 1122) = 13.58; p < .01; \eta^2 = .05$). The Spanish participants ($M = 4.96; SD = 0.80$) showed definitely the highest evaluation of benefits of using lifelogging technology, followed by the Italian participants ($M = 4.80; SD = 0.91$). The Canadian ($M = 4.59; SD = 0.76$) and the German participants ($M = 4.55; SD = 0.82$) showed also a positive evaluation, while the Swedish participants evaluated the benefits of using lifelogging technology least positive ($M = 4.40; SD = 0.88$). It can be taken from Figure 5 that significant differences ($p < .01$) were located between Spain on the one hand, and each Canada, Germany, and Sweden on the other hand. In addition, there were also significant differences between Italy on the one hand, and Germany ($p < .05$) and Sweden ($p < .01$) on the other hand. Finally, also the difference between the Canadian and the Swedish participants was on a significant level ($p < .05$).

Moving to the perception of barriers, the results are shown in Figure 6 and revealed also significant differences with regard to the participants' origins ($F(4, 847.4) = 11.15; p < .01; \eta^2 = .04$). Here, it was striking that the German ($M = 3.78; SD = 0.95$), Canadian ($M = 3.74; SD = 0.85$), and Swedish participants ($M = 3.68; SD = 0.91$) showed slight confirmations of the potential barriers of using lifelogging technology in older age, while the barriers were evaluated almost neutrally by the Spanish participants ($M = 3.49; SD = 1.01$). In contrast, the Italian participants ($M = 3.18; SD = 1.09$) showed the lowest eval-

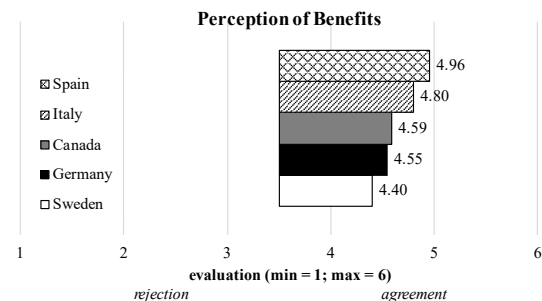


Figure 5: Perception of technology-related benefits depending on the participants' origins.

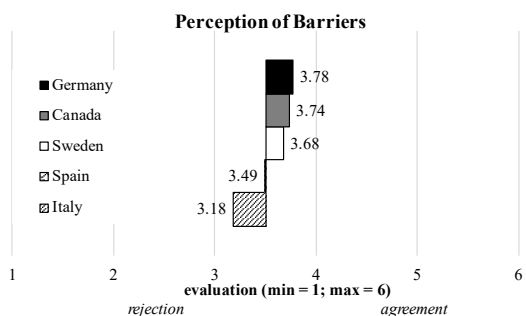


Figure 6: Perception of technology-related barriers depending on the participants' origins.

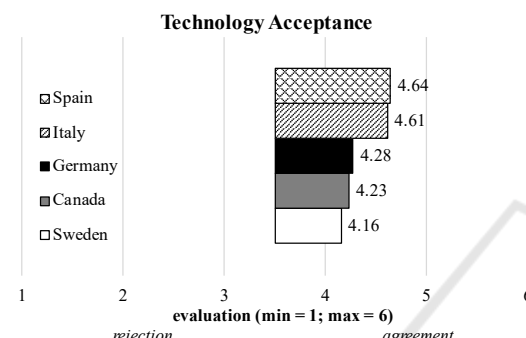


Figure 7: Acceptance of assistive lifelogging depending on the participants' origins.

uations, indicating a slight rejection of the potential barriers. With regard to the evaluation of barriers, all countries differed significantly from the Italian evaluations. Further, the difference between the German and the Spanish evaluations was on a significant level.

4.4 Acceptance of Assistive Lifelogging

The participants also evaluated their acceptance of using assistive lifelogging technology (RQ4, see Figure 7). The results revealed that participants of the five countries also significantly differed with regard to their acceptance and intention to use lifelogging technology in older age ($F(4, 921.16) = 10.91; p < .01; \eta^2 = .04$) and a diverse evaluation pattern was observed: the Spanish ($M = 4.64; SD = 0.96$) and Italian participants ($M = 4.61; SD = 0.99$) showed a clearly higher level of acceptance compared to the other three countries – Germany ($M = 4.28; SD = 0.95$), Canada ($M = 4.23; SD = 0.81$), and Sweden ($M = 4.16; SD = 1.01$), which revealed rather similar acceptance scores. The differences between the Spanish and the participants from Germany, Canada, and Sweden as well as the difference between the Italians and the participants from Germany, Canada, and Sweden were all on a significant level ($p < .01$).

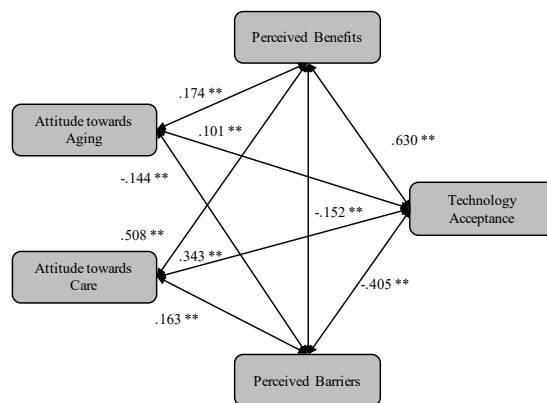


Figure 8: Relationships between the perceptions of aging, care, benefits and barriers as well as technology acceptance.

4.5 Related Perceptions & Acceptance

In a final step of the analysis, it was investigated if the participants' perceptions of aging and care, of benefits and barriers, and their acceptance of assisting lifelogging technology were related with each other. The results of a correlation analysis are shown in Figure 8. As expected, the perception of benefits was strongly positively related with the acceptance of assisting lifelogging technology ($r = .630; p < .01$), while a moderate negative correlation was found for perceived barriers and the participants' acceptance ($r = -.405; p < .01$). Thereby, the perception of benefits and barriers was only weakly related ($r = -.152; p < .01$).

As comparably new insights, the analysis revealed that a positive perception of aging was weakly positively related with the perception of technology-related benefits ($r = .174; p < .01$) and with the acceptance of lifelogging technology ($r = .101; p < .01$), while it was slightly negatively related with perceived barriers ($r = -.144; p < .01$). Considering the participants' attitudes towards care, the results showed a strong relationship with the perception of benefits ($r = .508; p < .01$), a moderate relationship with the acceptance of lifelogging technologies ($r = .343; p < .01$), and a weak correlation with the perception of barriers ($r = .163; p < .01$). The identified results suggest the necessity to analyze those connections and interrelations in more detail and in dependence of different cultural origins in future research.

5 DISCUSSION

The current study revealed that the perception of aging and care, but in particular also the evaluation

and acceptance of assisting lifelogging technologies in older age are influenced by the participants' (cultural) origins. This section discusses the results with regard to the underlying research questions, critically reflects the applied approach, and highlights the necessity of future work within the research field of assisting lifelogging technology acceptance.

5.1 Influence of Culture

Starting with RQ1, the study revealed new insights that the evaluation of handling of care differed significantly with regard to the investigated countries. In line with the previous research, which identified country- and culture-specific differences with regard to the respective health care systems as well as perceived access to care (Blendon et al., 2002; Osborn et al., 2016), the perception of care handling in this study also depends on the country and its respective political and socio-economic circumstances. In more detail, it was observed that caring for older family members within the family is more usual for the Southern Europe countries than for the more "Northern countries" Germany, Sweden, and Canada. Simultaneously, using the service of professional care providers at home seems to be more usual for Germany and Spain than for people in Italy, Sweden, and Canada. In addition, none of the countries confirmed that caring of older family members in inpatient nursing homes is usual, while this was most strongly evaluated to be only the last resort by the German participants. Further, the results generally revealed positive perceptions and also significant differences with regard to a culture-specific perception of aging and care (RQ2), however to a lesser extent (compared to RQ1, RQ3, and RQ4). In tendency, the results showed that the Swedish participants expressed a slightly higher positive perception of aging (compared to Italian respondents), while they simultaneously showed a less "positive" attitude towards care (compared to Spanish and German participants). Thereby, a positive attitude towards care referred to high needs for autonomy and independence. In comparison, the evaluation of technology-related benefits and barriers (RQ3) revealed novel and more distinct country-specific evaluation patterns. Summarizing the results, the Southern Europe countries showed clearly higher evaluations of benefits with a simultaneously lower evaluations of potential barriers of using assisting lifelogging technology compared to the rather "Northern" countries, i.e. Germany, Sweden, and Canada. The same pattern applied for the acceptance of using assisting lifelogging technologies in older age (RQ4): Here, Spain and Italy representing the southern part

of Europe indicated significantly higher acceptance scores than the other – rather northern – countries (Germany, Canada, Sweden). These culture-specific insights are definitely novel and show the relevance of adapting the technology development as well as communication and information about innovative technologies to the needs of the respective user groups. In line with this, the results confirmed that the acceptance of lifelogging technologies is related with the perception of aging and care, but in particular with the perceptions of benefits and barriers. Exactly at this point, communication and information strategies should consider the country- and culture-specific findings from this study. For example, the higher evaluations of barriers by the Swedish, German, and Canadian participants let assume that the communication and information about the handling of potential barriers of using assisting lifelogging technologies are of high relevance for these potential users. When perceived concerns are adequately addressed and their handling comprehensively explained (e.g., transparent regulations of data storage and data access Offermann-van Heek et al. (2019)), concerns could be diminished and the probability of a sustainable acceptance and adoption of assisting lifelogging technologies could thereby be increased.

5.2 Limitations and Future Work

Although the study revealed novel insights into cross-cultural perceptions of aging, care, and lifelogging technologies in older age, there are still some limitations with regard to the applied approach and necessary future work that should be considered for future research in the field. As a first limitation, it should be kept in mind that the country-specific samples differed with regard to individual characteristics of the participants (e.g., health status, care experience, etc.). For this study, it can therefore not be excluded that the differences between the countries were shaped by other user factors as well. Here, the results should be analyzed for interaction effects between culture and other user factors (e.g., care experience, care needs etc.) in a next step. As one example, the level of previous experience in using ICT applications could also be an interesting user factor, which probably influences the perception and acceptance of lifelogging technology. Other limitations of the present study refer to the applied online survey and the email-based invitation to participate in the survey. This procedure could have led to the fact that in tendency especially technologically advanced (older) people were reached. In order to include less technologically advanced (older) people likewise, future

studies should apply both, online and paper-based surveys. In addition, future investigations with regard to this study should focus on an analysis of the single benefits and barriers as well as decisions between these technology-related aspects to gain more detailed insights and possible explanations with regard to the divergent evaluation patterns. A further limitation regards the restricted number of countries which were integrated into the present study. Nevertheless, asking participants from four different European countries and an additional non-EU country enabled a first cross-national and cross-cultural investigation of differences and similarities within the perceptions of aging, care, and lifelogging technology usage in older age. The results showed that there were considerable differences between the investigated countries. Furthermore, future research should aim at integrating even more countries from diverse continents in the world, as it is assumed that in particular perceptions of aging and care differ enormously when also participants from developing countries are asked for their opinions and perspectives.

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