Everyone Is Always Aging: Glocalizing Digital Experiences by Considering the Oldest Cohort of Users

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By Allegra W. Smith

ABSTRACT

Purpose: Older adults (aged 65+) represent an under-explored group in technical communication, despite rapid population aging. Designing for older age cohorts holds potential for "glocalization"—integrating the local and the global—through attending to the needs of a specific user community while benefiting all users through interventions that prioritize usability, accessibility, and generational cultures.

Method: Using structured task analysis methods, I investigated the steps and decisions that six adults aged 75+ took to accomplish five increasingly difficult tasks.

Results: Though participants were easily able to access the Internet and find a news story online, they faced difficulties when attempting to modify the homepage on their browser, use mapping tools to determine the distance between two locations, and identify a government document answering a question about income taxes. These findings point to four key considerations when designing for older age cohorts: user customization and personalization, information literacy, deceptive patterns, and mismatched mental models stemming from gaps between declarative and procedural knowledge. Addressing these needs through targeted design, documentation, and education can help the oldest user group to realize their technological goals.

Conclusion: This very *localized* study of a specific group of users has *global* implications for research and practice. Designing experiences for the oldest adults provides critical opportunities for usability, because though they represent a specific user community, designing for them and alongside them actually benefits all users, because everyone is always aging. Thus, accounting for aging bodies and minds serves as an important form of glocalization for designers of communication.

KEYWORDS: Accessibility, Aging, Older adults, Task analysis, Usability

Practitioner's Takeaway

- Older adults (age 65+) represent an often ignored and underserved population of technology users.
- Although members of the oldest age cohort (age 75+) are typically able to access the Internet and interact with content online, they may face difficulties using mapping tools, searching for credible information, and changing device and browser settings to customize their experience.
- Gaps in information literacy, deceptive patterns built into interfaces, and incomplete mental models all pose threats to older adults' user experiences that can be addressed through technical communication interventions.
- Improving websites and interfaces for older adults benefits all users because everyone is always aging.

Allegra W. Smith

INTRODUCTION

The global population is aging at an unprecedented rate due to twin declining birth and death rates (U.S. Census Bureau International Programs, 2020). Population aging presents unique opportunities and challenges for technical communicators and user experience (UX) designers, as older adults have unique physical, cognitive, material, economic, and sociocultural needs that shape their interactions with interfaces and documentation. Older adults, typically classified as those aged 65 or older, represent as diverse a user group as any; in fact, this group is typically subdivided into age cohorts based on the life changes that older adults experience as they age (Ortman, Velkoff, & Hogan, 2014). The "young old" (age 65–74) have distinctly different experiences with computers and the Internet than the "old" (age 75–84) and the "oldest old" (age 85+), respectively. Although these experiences are often categorized by older adults' physical interactions with technology, shaped by the bodily processes of aging (e.g., low vision necessitating larger type sizes, essential tremors that make manipulating a touchpad difficult), the lives and technology usage of older adults are complex and mediated by a variety of human and nonhuman factors (Czaja et al., 2019).

The complexity of the aging experience creates many questions for technical communicators. How do older adults learn and use technologies differently from their younger counterparts? What experiences should we architect to meet the needs of aging users? How do we "future-proof" technology (Wilkinson & Gandhi, 2015) for current generations and generations to come?

In this article, I review the previous technical communication theory and research focusing on older adults as a distinct group of users. Then, I describe a study using structured task analysis methods with six older adult computer users aged 75+, followed by results and discussion. I conclude by analyzing patterns of user behaviors across the study participants, as well as pervasive problems they faced that could be alleviated through targeted design and documentation interventions. By detailing and interpreting the results of this very localized study of a specific group of users, I draw global implications for communication design practice and user advocacy. Ultimately, I argue that designing for old age serves as a form of *glocalization*, where the concerns of a particular or local group of users can inform practice for technology design and education more broadly.

LITERATURE REVIEW

In 2019, 54.1 million people, or more than one in every seven Americans, were over the age of 65; the percentage of Americans aged 65+ has quadrupled since 1900, and by 2040, there will be twice as many older Americans as there were in 2000 (Administration on Aging, 2021). Though older adults today have reported greater screen time than they did a decade ago (Livingston, 2019), this age cohort still lags greatly behind its younger counterparts in technology adoption (Smith, 2014), with users age 65+ feeling "digitally unprepared" or unconfident in their ability to use electronic devices for necessary activities (Anderson & Perrin, 2017).

Despite the country's shifting age demographics—and, consequently, the shifting demographics of technology users—technical communication research largely does not account for age as a component of identity and a factor that affects technology adoption and use. Technical communication's historic focus on user-centered design (Johnson, 1998; Redish, 2010; Salvo, 2001; Spinuzzi, 2005) and renewed emphasis on social justice and advocacy (Agboka, 2013; Jones, 2016; Rose, 2016; Walton et al., 2019) make addressing the needs of a growing older adult population a seemingly natural fit for designers. However, relatively few articles have been published in the field's flagship journals that focus on age—and old age in particular—as a defining variable or marker of difference. Across the five main journals in technical communication (*Journal of Business and Technical Communication*, *Journal of Technical Writing and Communication*, *Technical Communication*, *Technical Communication Quarterly*, and the *IEEE Transactions on Professional Communication*, respectively), only 12 full-length articles addressing older adults as a user group have been published in the past 30 years. I identified these articles by searching for the terms "older adult," "senior citizen," "middle age," "elderly," and "old age" in each journal's article titles, keywords, and abstracts. After identifying the published pieces that mentioned these terms, I removed those that gave only brief mentions to older adults (e.g., those that merely acknowledged the presence of older users, gave a cursory reference to another work that discussed age or aging, or mentioned older adults in a way that was not central to the subject of the publication), as well as book reviews or brief summaries of previous research (such as the "Recent and Relevant" section of *Technical Communication*).

Though one 2001 article in the *Journal of Technical Writing and Communication* explored documentation for older age cohorts (van Horen et al., 2001), it used the now outdated term "elderly" to frame older adults as suffering from "age deficiencies." Technical communication scholarship that recognized aging as a process that extends beyond biological functions began in 2004, with Lippincott's article, "Gray Matters: Where are the Technical Communicators in Research and Design for Aging Audiences?" This piece has functioned as both a rallying cry and a manifesto, where Lippincott emphasized the importance of integrating age into technical communication research and outlined four considerations for investigating aging in teaching, research, and practice. These considerations include:

- refining age as a "demographic variable" to understand the nuances and complexities that mark different age cohorts, as well as the other identity categories that mediate the aging experience;
- integrating age with other "variables of audience analysis" through including older adults in experience design;
- building an understanding of multidisciplinary aging research to better address the needs of older adults; and
- collaborating with interdisciplinary and international colleagues to conduct aging research that is inclusive and equitable (Lippincott, 2004, p. 157).

Lippincott's work followed a *Journal of Technical Writing and Communication* article that mapped the challenges faced by older adults in "accumulating technologies and literacies" (Crow, 2002). Notably, Crow provided a case study illustrating how the inequalities of a generational digital divide could be compounded and magnified by classed, raced, and gendered divides. Taken together, Lippincott's and Crow's articles formed the foundation for intersectional inquiry into age in technical communication, but they have not been followed by additional studies examining older adults' technology use *in situ* or case studies examining the interfaces commonly used by members of older age cohorts.

Little work on age or aging has been published in the field since Lippincott's call nearly twenty years ago. The February 2006 issue of *Technical Communication* provided two articles in this area. In a review of a report created for the AARP, usability specialists Chisnell, Redish, and Lee (2006) expounded upon "usability and design issues common to older users" by creating heuristics, personas, and tasks for website review and rating. They offered a four-point heuristic for classifying users (age, ability, aptitude, and attitude), as well as a thorough list of considerations for visual design, interaction design, and information architecture.

In the same issue, Van der Geest (2006) provided recommendations for participant recruitment, communication, and consent in the article "Conducting Usability Studies with Users Who Are Elderly or Have Disabilities." However, Van der Geest's juxtaposition of these two populations—like that of many human-computer interaction studies on older adults—conflated age with disability and framed older adult populations according to a deficit model. Although it is certainly important to consider the impacts that aging bodies have on technology use, declining motor and cognitive abilities are not the only factors that affect usage for older age cohorts. What's more, if we reduce older users to their impairments, we risk stereotyping them in ways that curtail design possibilities, as well as these users' full participation in digital life.

Van der Geest's colleagues from Twente University in The Netherlands—Loorbach, Karreman, and Steehouder (2007, 2009, 2013a, 2013b)—published four of the 12 available articles on older adults, typically using the term "seniors" to refer to their target user group. Their body of work has sought to build confidence, motivation, and usability for 60- to-70-year-old users when when interacting with instruction manuals. Schwender and Köhler's (2006) article "Introducing Seniors to New Media Technology" similarly focused on documentation for cell phones, concluding that "further data is needed to gain an accurate picture of the senior" (p. 464).

O'Hara's (2004) *Technical Communication Quarterly* article "Curb Cuts on the Information Highway" described "communication impairments" experienced by older users, before detailing accessibility initiatives aimed at closing the "digital divide" and concluding with analyses of three websites designed specifically for older populations: seniornet.org, aarp.org, and seniors-site.com. O'Hara's article is noteworthy in that it is the only one in this sample that described cultural influences that affect internet use by older adults; she identified ageism and "technophobia" (or luddism) as two key factors for communicators and marketers to consider. Previous technical communication literature on aging and older adults is limited in scope and application. The majority of the aforementioned articles were written more than 10 years ago, before the advent of Web 2.0; thus, they do not account for newer technologies like smartphones, social media, and virtual assistants, which have greatly impacted digital landscapes and cultures. Besides Loorbach, Karreman, and Steehouder (2013a, 2013b), the only publication in a mainline journal that focused on older adults in the second decade of the 21st century is Cleary and Flammia's (2012) article, "Preparing Technical Communication Students to Function as User Advocates in a Self-Service Society." Identifying older adults as one of "the three user groups most at risk for being left behind in the digital age" (p. 306), along with disabled persons and non-native speakers of English, Cleary and Flammia reviewed the literature on web usability for older adults from the previous decade and outlined tactics for exposing technical communication students to testing methods, design ethics, and cultural differences. Again, this piece offered an overview of previous research from fields adjacent to technical communication and called for advocacy for older adults but did not add new data or user stories to give contours and context to the best practices it provides.

Technical communicators have yet to fully investigate the user experiences of older adults or conduct studies localized to specific older adult communities, despite the opportunities that such communities pose to understand technology usage in context. Retirement or senior living communities remain apparently untouched by researchers as a resource for understanding the user behaviors of older populations.

WHAT DOES IT MEAN TO (G)LOCALIZE FOR AGE?

Older adults provide designers a unique opportunity for localized usability, given the complex facet of identity that sets them apart from other user populations: age. When we design for old age specifically, we advance usability in a way that focuses attention on a *local* population whose characteristics have *global* implications. Because all users are always aging—and the experience of aging is near-universal, though some may age quicker than others, due to a constellation of biological, economical, sociocultural, and regional factors—any intervention for technical communication or user experience design for older adults in fact benefits all users. This makes designing for old age a practice not just of localization, but of *glocalization*.

Glocalization refers to the blurring of boundaries between the global and the local that necessitates a cultural balance between the universal and the particular (Ritzer, 2003; Robertson, 1994). Inherent in glocalization is a recognition of power and agency, as Roudometof (2016) explained: recognizing that local communities or cultures exert power on a global stage, just as global forces exert power on them. A glocal framework provides the opportunity to name, theorize, measure, and work within these flows of agency. Such a merging of "globalization" and "localization" represents another under-explored concept in technical communication theory and practice (Breuch, 2015). The practice of glocalizing involves centering local conditions and knowledge that can be lost when considering the role of technology and communication on a global level, which can provide opportunities to investigate the interplay between these differing levels while balancing them during the design process (Sun, 2012, pp. 245–246).

Though glocalization has been occasionally cited in technical communication research as a tactic for adapting content for regional or national cultures, the notion of the glocal holds potential for extending beyond these geographic distinctions and into other cultures—such as the cultures of generations. Each generation holds its own cultural norms that impact technology use, and at any given moment of time, a generational cohort also is marked by certain physical and cognitive features of age. For example, though the Silent Generation, at 75–95 years old, currently has the lowest rate of smartphone adoption of any age cohort and may have trouble reading on a smartphone screen because of presbyopia (difficulty seeing up close); Generation Z, at 10–25 years old, may prefer smartphones over desktop devices and generally see well with minimal use of corrective lenses. Of course, eyesight is but one factor affecting adoption and use of smartphones across generations, and a study of older adults' smartphone use would need to investigate other physical and attitudinal elements, but the findings of such a study could later be applied to interventions that would not only enable older adults to use technology, but also facilitate the continued use of technology for younger adults as they age over time. Designing for old age, then, can be a form of glocalization, given its capacity for integrating particular or *local* user experiences (e.g., the digital goals and tasks of 70- and 80-somethings) with more universal or *global* concerns (e.g., how to create technology that addresses the needs of a broad range of age cohorts, how to guide users with a variety of experience levels when using a new product or interface, etc.).

This type of glocalization for age is different from existing theories like universal design, which seeks to comprehensively address disability to create better experiences for all users (Walters, 2010), in that it expands beyond disability in its treatment of older adults as a user group. Though states of bodily and cognitive decline are often foregrounded when considering older age cohorts, they do not represent the totality of the lives of older adults, nor are they the sole elements shaping these age cohorts' user experiences. The experience of aging with technology is shaped by physical, psychological, social, economic, and experiential aspects (Wilkinson & Gandhi, 2015), all of which should be considered when designing devices and interfaces for older adults. Thus, the findings and implications of this study provide one example of the types of information that could be used to glocalize for age, advocating for the needs of older adults and designing technologies that facilitate easy adoption and usage for users of all ages.

METHOD

This IRB-approved study took place in an independent living apartment facility located in a large retirement community in the southern United States. This particular facility was chosen because it housed members of older age cohorts (i.e., individuals aged 75–85 and 85+) who could still live independently, and thus could understand the risks inherent in user research and provide informed consent. I recruited six residents (a number that corresponds with the accepted sample size for usability test studies—see Barnum, 2002; Nielsen, 2012a) aged 78–91 to participate in the research, with the help of the apartment complex's manager and a resident liaison who occasionally assisted with technical support in the community. These community experts helped gather a sample of participants who represented a mix of ages, genders, and comfort levels with technology, whom I observed interacting with their computers and other devices in their apartments.

The research involved two phases: in the first, a naturalistic observation, participants demonstrated their typical daily computer use; and in the second, a structured task analysis, participants completed a series of increasingly difficult tasks with their computer and used "think aloud" protocol (Cooke, 2010; Nielsen, 2012b) to explain their processes. This article details the results of the structured task analysis and provides key implications for technical communicators and user experience professionals.

Task analysis methods date to the early 1980s, when the increased mechanization of industry and the military necessitated improvements in human-machine interaction (Militello & Hoffman, 2008). At the heart of task analysis is watching users as they work. Task analyses, as with most user research work, involve field studies or site visits with people who use a product or a service. The key to task analysis is learning about users by viewing them in action, to better understand how "any and all parts of a product—software, hardware, interface, documentation. . . help[s] people do things" (Hackos & Redish, 1998, p. 52). Many different kinds and levels of task analysis exist, including procedural analysis, which involves examining the steps that users take or the decisions that they make to accomplish a task (Hackos & Redish, 1998). This project involved procedural analysis because of the nature of the research question and the goals of data collection: to better understand the oldest age cohort's familiarity with certain digital activities, their thought process and mental models when attempting to accomplish certain objectives online, and the steps that they took when they encountered problems with their technology. As such, the six participants were asked to complete the following five tasks:

1. Access the Internet on your computer.
2. Set up a new homepage for your internet browser.
3. Find a news story of interest to you about world events.

4. Determine the distance between your home and the nearest Kohl's store.
5. Find a government document that answers the question, "how do I deduct medical expenses for transportation to and from doctor's appointments on my taxes?"

I did not assist the participants in completing the tasks, but instead asked guiding questions and reminded them to explain to me how they felt, and how they would go about solving the issue if they were posed with a similar problem in real life. This followed a "think aloud" protocol approach, where the participants were encouraged to verbalize their reactions or emotions throughout the procedure (Cooke, 2010; Nielsen, 2012b). This session identified "pain points" (troublesome problems) for members of this population attempting to complete tasks using computers and the Internet and generated rich qualitative feedback from participants while doing so.

Observations with each participant were video recorded, and a short exit interview was conducted to debrief participants and answer their questions about the experience. The video recordings were later transcribed, and participants were assigned pseudonyms to protect their anonymity. Because the participants lived independently (i.e., they did not live in an assisted living or nursing facility), they were not considered a vulnerable population by university IRB. To protect their personal data, I explained to participants before the observations that their computer screens would be recorded and advised them to neither view nor input sensitive data (e.g., financial or medical information, passwords) during the sessions; if they did reveal any personally identifiable or sensitive data, I notified and warned them, typically moving the camera away from the device so the information did not appear on the recording. Only the participants' screens were recorded; I did not record their keystrokes (to prevent the recording of passwords) or their faces (to protect their identities).

RESULTS

In Table 1, I provide a brief sketch of each participant in this study. In addition to the participants' pseudonyms and demographic information, I also list their typical online activities, as demonstrated in the ethnographic observations conducted with them prior to the structured task analyses. As shown in Table 1, participants used similar technology and completed similar online tasks, such as emailing others, accessing medical information, and reading news, to name a few.

Table 1. Participant demographics

Pseudonym	Gender	Age	Task analysis time	Devices used	Typical online activities
Daisy	Female	82	14:12	PC laptop	banking and financial planning; email (Gmail); news and current events; medical information; search (Google); shopping (Amazon)
Mabel	Female	91	17:57	PC desktop	email (Outlook Mail); printing; security (virus scanning); search (Google); shopping (Amazon); social networking (Facebook)
Walter	Male	82	17:47	PC desktop	ancestry and genealogy; email (AOL Mail); mailing lists and groups; medical information; search (Google); social networking (Facebook); sorting and navigating files; travel booking/planning; troubleshooting; word processing and correspondence
David	Male	90	31:16	Chrome desktop, Jitterbug smartphone	banking and investing; email; images; news; reference (dictionary, encyclopedia, etc.); religion and spirituality (Bible lookup, spiritual commentary, etc.); search; smartphone apps; sports; text messaging; virtual assistant; voice-to-text

Table 1. Participant demographics

Pseudonym	Gender	Age	Task analysis time	Devices used	Typical online activities
Agatha	Female	86	18:07	PC desktop, Nook eReader	calendar and scheduling; design programs; email (AOL Mail); e-reading and books; hobbies and leisure; social networking (Facebook); photo editing; printing; search (Bing); shopping; sorting and navigating files; travel booking/planning; video chatting (Skype); word processing and correspondence
Susan	Female	78	22:44	PC laptop, Kindle eReader, Amazon Echo speaker and Alexa virtual assistant, iPhone	apps; banking and investing; calendar and scheduling; cloud and information backup (Carbonite); email (AOL Mail); e-reading and books; hobbies and leisure; maps and navigation; music (Apple iTunes); news and current events; search (AOL and Google); security (LastPass password keeper); shopping (Amazon); virtual assistant
TOTAL			2:02:03		

Table 2. Task analysis performance summary

Name	T1	Time	T2	Time	T3	Time	T4	Time	T5	Time	Total time
Daisy	✓	0:26	X	0:02	✓	1:08	X	3:17	X	4:04	14:12
Mabel	✓	0:38	X	0:07	✓	3:18	X	0:22	X	2:45	17:57
Walter	✓	0:15	X	0:12	✓	1:44	X	2:44	~	2:41	17:47
David	✓	0:05	X	0:23	✓	1:09	✓	5:54	✓	8:02	31:16
Agatha	✓	0:11	X	0:05	✓	1:11	✓	8:43	✓	7:47	18:07
Susan	✓	0:23	~	3:30	✓	1:48	✓	2:34	✓	4:23	22:44

✓ Indicates that participant successfully completed the task
X Indicates that participant was unable to complete the task
~ Indicates that participant did not complete the task but likely would have been able to with additional time or resources that were not available at the time of data collection

A summary of the participants' experiences in the structured task analysis, including the time spent on each task and whether they were successful in accomplishing the goal of the task, is presented in Table 2.

As Table 2 indicates, each participant was successful at accessing the Internet on their computer and finding a news story of interest to them (Tasks 1 and 3), though they had mixed experiences with using online mapping tools and finding government sources that answered tax questions (Tasks 4 and 5). Nearly all participants could not or would not change the homepage on their internet browser (Task 2). The following sections describe the task performance results in greater detail.

Task Performance Successes

All six participants were easily able to turn on their computers and access the Internet (Task 1), and each indicated that they did so every day or nearly every day. Indeed, 73% of Americans over age 60 self-identify as internet users (Livingston, 2019). However, browser preferences varied across the group: 82-year-old Daisy used Mozilla Firefox, 91-year-old Mabel and 82-year-old Walter used Internet Explorer (which had been replaced by Microsoft Edge as the default Windows browser three years prior), 86-year-old Agatha and 90-year-old David used Google Chrome, and 78-year-old Susan began her session on AOL Desktop Gold before navigating to Google Chrome to work on later tasks. None of the participants articulated a particular preference or brand loyalty to the browser that they used, and most simply continued to use the browser that was either installed as default on their machine or set up by their more technologically savvy children or grandchildren.

Task 3, which focused on finding a news story online, appeared similarly easy for the participants, though each demonstrated different methods for finding and accessing news, as well as different user journeys after completing the task's stated objective. Based on my previous experiences with this population, I expected that participants would open their browsers to an internet search provider landing page (e.g., aol.com, my.xfinity.com, currently.att.yahoo.com, etc.) which they would then scan for an article of interest. Agatha and Susan both took this approach, watching the carousel on aol.com and scrolling through the headlines until finding a topic that caught their eye.

However, other participants did not have news content featured on their browser homepage or did not have a homepage set on their browser at all (see next section for the results of Task 2, which expands on this). Daisy typed a query for a specific topic of interest to her into a search bar, which led her to a series of Google search results. She clicked the first result, which linked to a December 2017 article from *The Guardian*. Walter took a similar approach to seek out information on a specific topic, but, instead of typing a query into a search engine, he navigated to his AOL homepage and clicked for a link to a story to seek out preliminary information before typing keywords about the topic into the search bar at the top of the page to get more details. He finished his journey by looking at a Wikipedia page on the topic, explaining that he preferred this source over traditional news networks (e.g., NBC, Fox, CNN) because he already had access to that content on television.

On the flip side, Mabel preferred more traditional media and did not appear to have much experience with online news content. She pondered the task for a few moments, before typing "daily news" into the Google Search bar and selecting a result that took her to the website of a regional newspaper. David similarly typed "world news" into his Google search bar and selected NBC News from the results.

Task Performance Breakdowns

Participants had the greatest difficulty with the task that asked them to change the homepage on their internet browser (Task 2). Some of this difficulty stemmed from terminology—multiple participants confessed to not knowing what a homepage and/or browser was. Others simply opted to skip the task because they thought that the process of changing their homepage would be too difficult or time-consuming. The only participant to attempt this task was 78-year-old Susan, who indicated that she did not know how to change her homepage on AOL, her preferred browser, but she could probably do it on Google Chrome instead. After accessing Chrome, she searched for information on how to change her homepage and found instructions for changing homepages on Microsoft Edge. Though she did not end up changing her homepage on any browser during the task analysis session, she indicated that she was confident she would be able to find an answer to the question if given enough time.

Though no participants were able to complete Task 2, the results for Tasks 4 and 5 were mixed, with half of the participants succeeding in each. Task 4, requiring the use of web mapping tools to determine the distance between the participants' homes and the nearest Kohl's store, stumped the oldest participant, Mabel, from the beginning; she admitted that she had "never done it" and had no idea how to use a computer to calculate distance or find directions. Walter and Daisy both tried to use Google to find information on how to get to Kohl's but encountered a potentially harmful mapping website that attempted to install malware on their PCs. (I warned them before they could click to download any plugins or files from the site and advised them to run a scan on their antivirus software after the session concluded, just to be safe.)

Of the three participants who succeeded in the task, each took a different route. Agatha wrote down the instructions for the task on a piece of paper next to her desk to guide her as she searched for directions on Bing Maps. Susan recognized that there were multiple methods for finding the distance between two points using technology, first asking her Amazon Echo smart speaker before navigating to MapQuest on her computer. Like Mabel, David had not used a computer to calculate the distance between two points before, but resolved to complete the task by typing a query into Google: "How would I use the computer to find the distance from [retirement community name] to Kohl's department store?" This eventually led him to Kohl's website, where he entered his zip code to find the nearest store, which the site estimated was approximately 3.6 miles away.

The fifth and final task posed greater difficulties for the participants because of its complex nature (finding a document to answer a specific tax question about medical deductions that came from a government source) and their lack of previous experience seeking information of this nature online. Though Susan combed TurboTax for a link to a government document with the guidelines for itemizing deductions, Agatha and David both tried multiple search strings (i.e., "how do I deduct medi [*sic*]," "what form would I use to calculate mileage for tax completion, "IRS medical expenses," "how do I deduct medical mileage") before eventually finding the United States' IRS official publication on the deduction of medical and dental expenses, Topic 502.

Walter, who would typically call his tax consultant to answer questions about deductions and credits, searched for TurboTax and immediately clicked the live chat "ask a question now" option on the homepage for the tax preparation service. He indicated that he would type in his question and hit "start chat" to ask a representative for an answer. Although not a government document, this would have likely resulted in him finding an accurate answer to the question being asked in the task. Walter's willingness to text with a representative (instead of insisting on speaking with a person over the phone) is also noteworthy here, as the older adult participants in this study typically expressed strong preferences for speaking on the phone, rather than corresponding through instant message. Daisy and Mabel failed to complete the fifth task because of difficulty identifying legitimate government sources, as well as opaque or outright deceptive information design of websites and apps, also known as "deceptive patterns" (Brignull, 2022) that misled them into clicking on useless—or worse, dangerous—links. The third subsection of the discussion of the study results provides an explanation of these patterns.

DISCUSSION

These older adults' experiences completing online search, mapping, and device customization tasks reveal key themes and implications for documentation, education, technology design, and culture. The following sections outline considerations for technical communication researchers and designers seeking to advocate for older adult users and localize experiences with these age cohorts in mind.

Customization and Personalization

Participants not completing Task 2 successfully is not necessarily due to a lack of knowledge but rather a lack of inclination to modify the default settings on one's computer. Some participants lacked appropriate vocabulary to name a browser homepage or explain what one is, but with explanation, they could understand the concepts. For example, other than Susan, all participants indicated little desire to change their browser homepage and indicated that they were either satisfied with their landing page experience or had not at all considered the possibility of changing it.

Though the potential benefits of customization of technology for older adults are well documented in the biomedical and healthcare domain (Freund et al., 2017; Kappen et al., 2020; Mannheim et al., 2019), the preferences of the participants of the present study seem to indicate that members of the oldest age cohort feel hesitant to modify the basic settings of their devices. This result may stem from a fear of using the device "incorrectly" or breaking it—a fear that was prevalent across the participant pool and stemmed both from previous negative experiences with technology and ageist assumptions that they would somehow misuse the technology because of bodily or cognitive deficiency.

However, also noteworthy is a lack of identification with one's technology across these older adults, regardless of their age or ability level. Throughout the research process, participants voiced fears of becoming too attached to or dependent on their technology, and these fears were reflected through the language that they used to describe their devices. As a millennial researcher, I tended to use possessive determiners (e.g., your, his, my) to refer to devices when speaking with these participants (e.g., "how do you do that with *your* laptop," "when I am using *my* smartphone, I click this"). Conversely, participants tended to use indefinite articles (e.g., the, a, that), even when referring to the devices that they privately owned (e.g., "I use *the* iPhone to check my stocks;" "when reading news on *a* computer, I prefer CNN"). These linguistic differences reflect a clear generational divide, where older adults are separating themselves from their devices through the words that they use to disassociate themselves from their technology (either deliberately or unconsciously). The older adults participating in this study did not see their technology as extensions of themselves and did not wish to be identified by it; hence, they rarely customized it. Participants noted that they had not considered changing settings on their browser, or that they were not aware that they could modify their homepage, magnify the text, or install ad blockers to customize their browsing experience.

These fears of technological dependence can pose significant barriers, not only to technology designers seeking to design or market products to older age cohorts, but also to older adults themselves as they seek to participate in digital life. Studies that investigate users' values and motivations behind computing can further pinpoint the causes of these generational differences, so that designers can move towards solutions for an age-diverse user population.

Information Literacy

The importance of critical understanding of how to locate, evaluate, and apply information both on and offline is well documented in theory and research across disciplines. Because of a lack of formal training in information literacy, older adults can be especially vulnerable to misinformation and disinformation, fake news, scams, fraud, and other digital privacy and security breaches. Indeed, avoiding such scams and fraud represents a top priority for AARP, the largest special interest group for older adults in the US: as of February 2022, the AARP Fraud Resource Center tracked 70 different types of scams, from fake QR codes to ransomware.

Beyond the immediate financial or data security danger posed by scams, older users also face deeper information literacy problems when attempting to differentiate between legitimate content and misinformation or deliberate disinformation—or even just trying to pick the best search result for their query out of a list of suggestions, as the participants in this study experienced. Most frequently, these types of issues surfaced when a participant interacted with sponsored content (e.g., paid placements or advertisements) or sought an authoritative answer to a question online. For instance, though Walter included "IRS" in his search query for Task 5, he still clicked through to a result for a paid income tax preparer service, rather than a government document. Moreover, though he identified Wikipedia as a preferred source of information because it was frequently updated, he was unaware that the site was unmoderated and its entries often written by non-experts.

Addressing these gaps in information literacy for older adults necessitates a multi-pronged approach. Though younger age cohorts likely receive extensive K–12 instruction on technology use and digital literacy, adults aged 65+ are less likely to have formal training on basic internet use, let alone on retrieving specialized information using advanced search strategies, identifying and understanding targeted advertisements, and safeguarding their personal data. Technical communicators are well positioned to design educational content in the form of help guides, infographics, and instructional videos to build older adults' critical information literacy.

Deceptive Patterns

Though specialized training in information literacy can help older adults identify and validate legitimate sources of information, additional work is also needed in communication design and information architecture to both promote authoritative content and discourage misleading or predatory practices. Design elements or tricks that deceive users into taking actions that may harm them, their data, and/or their security are increasingly common; UX designers initially referred to them as "dark patterns" (Gray et al., 2018; Trice & Potts, 2018) but later shifted to the phrase "deceptive patterns" as an anti-racist alternative (Brignull, 2022; Intuit Content, 2022). Two specific deceptive patterns emerged during the final two tasks in this study: forced action through installing a plugin that could lead to a breach in user privacy and a disguised ad pattern leading to what I describe as a "sponsored content loop."

In their analysis of deceptive patterns identified by UX practitioners, Gray et al. (2018) framed *forced action* as "any situation in which users are required to perform a specific action to access (or continue to access) specific functionality" (p. 8). Although Gray et al. provided examples of forced action that involve users sharing more information about themselves that they might typically give, or even agree to selling information across platforms, a more insidious version emerged for three of the participants in the present study as they attempted to use mapping tools for Task 4. An online mapping website, mapsanddirections.com, would not display results for Walter's, Agatha's, or Daisy's search queries unless they installed multiple plugins on their computers, including a maps widget and a "search encryption and privacy" extension. Though Walter and Agatha immediately understood that the site could install malware on their machines (and consequently closed their browser windows when confronted with the pop-up), Daisy clicked "allow" on the install dialogue without questioning. Daisy's difficulty identifying this threat to her device security and personal data exemplifies the potential risks posed by forced action to older adults, who may not have been taught to read and reflect before clicking a button that could install malicious software or compromise sensitive data.

Gray et al. (2018) briefly noted disguised advertisements as another deceptive pattern that "deals more directly with form than function" (p. 7), but when these advertisements appear to be legitimate results from a search provider, they can impede the function of the search engine as well. It can be especially difficult for older adults to separate an advertisement from a true search result on Google because of the lack of clear visual differentiation between these types of content: an advertisement may have "Ad" written next to its URL in black type or circled in green, both of which can be easy to gloss over when a user is scanning the page or hard to identify if that user has low vision or limited color perception (both of which occur more frequently as people age). Sometimes, these advertisements simply link to results on a less prominent search engine for the same query that the user has just typed in. This paid placement tactic seeks to funnel traffic to these sites but can lead to daisy-chain advertisements when the next search engine too provides a series of ads as the top results for the query, which links to another search engine's results. When working on Task 5, Daisy fell into this "sponsored content loop," with Google's top result for her query about deductions for medical expenses directing her to the same query at Information Vine (another search provider), which then directed her to results at Ask.com, which then directed her to results at Metacrawler.com. The sponsored content loop represents a deceptive pattern that can lead to frustration for users, believing that their inability to find answers to their questions is their fault, when the blame falls squarely on the designers of the interface.

Mental Models and Knowledge Gaps

Users construct mental models, or beliefs and ideas about how an interface works, based on both real and imagined experiences (Nielsen, 2010). Building an understanding of users' mental models is essential for architecting experiences that meet their needs and that they will interact with (see Rosenfeld et al., 2015, pp. 40–51). Mismatches between designers' and users' models can lead to friction for users when the functionality or steps to operate features are unclear—this is one of the key tenets of user-centered design and user research practice. The experiences of the older adults in this study sample shed light on a different type of mental model mismatch: where users' mental models are incomplete, incorrect, or even entirely nonexistent.

Participants' journeys through the browser homepage, mapping, and government document tasks demonstrate consistent and persistent gaps between their ability to do things and their understanding of how those things worked or what they were called. Even those who were able to finish most of the tasks often struggled to describe how they were successful: they just did it. This gap illustrates a divide between *declarative* and *procedural* knowledge. Declarative knowledge involves facts and things, whereas procedural knowledge is the knowledge of how to do something or perform an activity. For example, Susan noted during her session that she regularly synced her laptop's data to the cloud using Carbonite, a backup program, but admitted that she did not fully understand what the cloud was or how it worked. Although she recognized that cloud computing and storage were important concepts, she lacked the mental model or vocabulary to describe or conceptualize them.

Susan's ability to back up her data without understanding where it was backed up to represents *procedural* understanding, rather than *declarative.* Procedural knowledge is often noted as "automatic" or unconscious in nature, with users performing activities without necessarily recognizing that they know *how* to do something or explain it. Declarative knowledge, conversely, is conscious and explicit (Soliman, 2018; ten Berge & van Hezewijk, 1999). During the task analyses, multiple participants attested that they did not know what a homepage was, despite having interacted with their homepage on their internet browser on a daily or weekly basis. Their computer and internet start-up process, as well as their typical daily activities (usually checking email and/or social media, looking at homepage news and stories, etc.) had become almost mechanical—to the point where they had to "stop and think" about their routine when asked to demonstrate their typical usage.

These results demonstrate that declarative knowledge does not necessarily have to precede procedural knowledge, but the interplay between the two can further enrich the ability to complete computer-based tasks and participate in digital life. The automated nature of procedural knowledge became apparent when I used technical terminology or asked participants to explain how they went about completing tasks. Moreover, employing strategic metaphors or comparisons (e.g., "fast internet is like an expensive sports car, whereas a slow connection is like an old clunker;" "this website protects your data with two-factor authentication, like a store asking for your ID before they run your credit card") helped to build users' declarative understanding of how interfaces worked or why they were the way they were or bring their tacit knowledge to the surface. Developing a robust understanding of the principles and mechanisms underpinning these interfaces can in turn improve usage for all.

CONCLUSION

The study presented in this article sheds light on the interface design features that help and hinder the fastest growing segment of the population: older adults. Though the results of this study are localized to a particular community of the "oldest old," they hold broader, more global implications for research and practice. As practitioners have noted, a five-participant sample size is an effective number for most user testing and heuristic evaluation studies, revealing 80% of the usability issues with an interface (Rubin & Chisnell, 2008). Furthermore, interventions made to improve the experiences of septua- and octogenarians (aged 70–80 and 80+, respectively) are ultimately investments in everyone's technological future, as all users are always, already aging. In this way, designing for old age and addressing these issues of personalization, information literacy, deceptive patterns, and mental models provides the ultimate opportunity for glocalization: considering local conditions to design for global change.

However, aging is not an experience that is the same for all people in all places; thus, the findings of this research are limited *global* perspectives, given the privileged standpoint of the study participants. These users belonged to a resource-rich retirement community and, as such, their experiences represent a best-case scenario of technology access and support. Moreover, they belong to the oldest cohort of technology users; though their experiences are likely not the same as those of their younger counterparts (e.g., users aged 65–75), studying their journeys and interactions can ultimately inform design that benefits the generations behind them (a practice that should become standard in our field). This type of generational design practice could seek to study the user experiences of generations "up the line" to construct technology that ages with users "down the line." Finally, technology access and use differ across geographic and cultural contexts, so caution should be exercised when applying these results to older adults in other regions and nations. Again, glocalization provides an excellent opportunity for balancing between the universalities of age and the local contexts of individual communities and cultures.

As these limitations and the review of previous work on age and technical communication demonstrate, our field has much work ahead to expand knowledge of older adult users. Future studies in this area can investigate older adults' experiences with specific types of interfaces, such as telehealth apps or online shopping. Moreover, as with any population of users, older adults' digital lives are not merely task-oriented, but rather involve a myriad of activities mediated by social interactions, cultural legacies, and access to economic and technological capital. Thus, further studies should probe the user stories and journeys of older adults from a variety of communities, and further advocacy should support their usage and the design of interfaces that match their needs. To make computing truly sustainable and "future-proof" it (Wilkinson & Gandhi, 2015) for generations to come, technical communicators and UX designers should look to today's oldest users to understand the intersections between aging and technology.

ABOUT THE AUTHOR

Dr. Allegra W. Smith is an assistant professor of professional writing at Jacksonville State University, where she coordinates the English Internship Program. She teaches, researches, and mentors in the design of communication, online writing instruction, and user experience. Her dissertation, *Digital Age: A Study of Older Adults' User Experiences with Technology*, was honored by *Computers and Composition* with the 2021–22 Hugh Burns Dissertation Award. Dr. Smith can be reached at awsmith@jsu.edu.

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