



UNDERSTANDING THE COGNITIVE BURDEN OF DIGITAL INTERACTIONS FOR USERS AGED 60 AND OLDER

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Abstract

Globally, approximately 13% of the population was over the age of 65 in 2020—a figure projected to rise to nearly 24% by 2100. In some countries, such as Japan and Italy, over 30% of the population is already over the age of 65. (*Alvarez, 2023*) As digital platforms become increasingly central to daily life, this accelerating demographic shift highlights a growing generational gap in digital fluency—posing a significant barrier to full societal inclusion and participation for older adults. This divide not only hampers progress toward complete digitization but also contributes to the social exclusion of older adults.

Motivated by firsthand experiences as a UX designer and personal observations of older family members struggling with digital interfaces, this study investigates why a generation skilled in other technical fields faces such challenges with modern digital products. Employing a mixed-methods approach—including a literature review and in-depth interviews, the research seeks to uncover the key factors contributing to cognitive overload among older users. It examines how heightened caution and reluctance to engage with digital tools affect technology adoption, how the unintentional exclusion of older users in the design process leads to unnecessarily complex interfaces and explores practical strategies to foster greater digital inclusivity.

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Keywords

Digital inclusion, cognitive load, older adults, user experience (UX) design, grey digital divide, technology adoption, age-friendly design, human-computer interaction (HCI), accessible design, digital literacy, usability testing, inclusive technology, design for aging, intergenerational technology gap, empathy-driven design, digital accessibility, senior users, user-centered design, barriers to technology use, age and technology.

Introduction

The pace of digital advancement continues to accelerate, with new and more intelligent frameworks being introduced almost daily, often replacing previously established ones. These evolving systems are designed not only to challenge younger, tech-savvy users but also to keep digital experiences fresh and engaging. As a result, familiar patterns are quickly replaced, and users are constantly encouraged to adapt to novel and innovative design solutions. While the learning curve associated with these changes can sometimes be steep, many users embrace it, valuing the uniqueness and modern appeal of these new digital experiences.

However, not all users share this enthusiasm. A significant portion of the population, particularly older adults, finds the constant evolution of digital platforms overwhelming. For them, what may be a slight learning curve for others becomes a substantial barrier. Rather than enhancing usability, frequent design changes and complex interfaces can render digital products virtually unusable, leading to disengagement and digital exclusion.

Research Problem

In the pursuit of innovation, digital products often overlook the needs of older users, resulting in experiences that are unintuitive and cognitively demanding. This research seeks to understand the key factors that contribute to the heightened cognitive burden experienced by individuals aged 60 and above when interacting with digital platforms. It investigates how rapidly evolving interfaces, lack of representation in design decisions, and increased complexity contribute to digital disengagement among older adults, ultimately widening the "grey digital divide."

Research Questions

- What are the main elements that contribute to cognitive burden in digital interactions for users aged 60+?
- How do older users' cautious behaviors and perceptions affect their engagement with digital products?
- In what ways does excluding older users in the design process lead to overly complex interfaces?

- What design strategies can reduce cognitive load and improve inclusivity?

Methodology

This journey begins by situating the research within the context of today's rapidly evolving digital landscape, where functionality often takes precedence over accessibility. Drawing from my own professional experience as a UX designer and the lived realities of older adults in my community, the inquiry is shaped by both personal observation and studying systemic patterns of exclusion. The groundwork will be laid through a literature review focused on the "grey digital divide," cognitive load theory, and inclusive design practices.

The next phase involves engaging directly with the lived experiences of individuals aged 60 and older through in-depth interviews. These conversations will not only explore the barriers faced in digital interactions but will also serve as a space for empathy, listening, and the co-construction of meaning around digital discomfort.

Throughout the process, this research remains open to shifts and insights that emerge from the participants themselves. It is not only an investigation into cognitive barriers but also an exploration of how inclusive design can foster dignity, ease, and agency in digital spaces for older adults.

Literature Review

The term "Grey Digital Divide" refers to the gap between young and old in areas when it comes to having access to modern technology like computers and the internet. In this divide, age plays a big role. Older people often face challenges like perception, feeling left out, and difficulties accessing the internet (*Millward*). This divide is not limited to physical access to devices like smartphones, computers, or internet connectivity. Rather, it also involves a complex interplay of factors such as digital literacy, economic resources, educational attainment, age, and the presence or absence of support networks. Having access to a device is not equivalent to being digitally included; meaningful participation in the digital world requires users to have the skills, confidence, and context-specific knowledge necessary to navigate increasingly complex online systems.

As people get older, they're less likely to have internet access, not having internet access doesn't just create the grey digital divide but also contributes to social exclusion (*Huxhold, Hees, & Webster, 2020*). Some older people can't do basic things online, like booking appointments or buying tickets (*Mubarak & Suomi, Elderly Forgotten? Digital Exclusion in the Information Age and the Rising Grey Digital Divide., 2022*). This means a portion of the population is left out of important services and activities.

This divide is especially pronounced in rural and inner-city areas, which experience different but overlapping forms of disadvantage. In rural regions, users may lack basic infrastructure such as high-speed broadband or stable mobile networks. The absence of service providers and weak technical infrastructure creates significant barriers to entry for potential users. In inner-city environments, while infrastructure may exist, economic hardships and social inequalities, such as systemic racism or historically marginalized communities—can still result in digital exclusion. Both settings often struggle with high rates of poverty, low levels of formal education, and limited access to technology training, all of which significantly hinder the ability of individuals to benefit from the digital landscape.

Older adults, in particular, represent one of the most consistently excluded groups in the digital era. According to (*Choi, Kim, Chipalo, & Lee, 2020*), older adults, people with disabilities, those

with lower levels of income or education, and certain ethnic minorities, such as Hispanic communities in the United States—are disproportionately affected by the digital divide. Despite the overall rise in internet adoption rates across the general population, older adults consistently lag behind, especially those aged 80 and above. In these older age groups, the prevalence of internet use declines significantly. Their wariness towards digital application stemmed from a perception of excessive complexity, coupled with difficulties in understanding the product flows (Chee, 2024).

The reasons behind this are multifaceted. Age-related physical and cognitive changes, such as diminished eyesight, reduced hand-eye coordination, slower information processing, and challenges with memory, can be impediments to accessing digital technologies. These physical challenges are often accompanied by emotional barriers, such as anxiety, fear of making mistakes, and a general lack of confidence in navigating digital platforms. For many older users, technology is not intuitive; rather, it is overwhelming or even alienating. Moreover, financial constraints may prevent older adults from affording devices or reliable internet connections, especially those living on fixed incomes or pensions.

Beyond individual barriers, the structural issue of ageism plays a critical role in perpetuating the grey digital divide. Ageism, defined as discrimination or prejudice based on a person's age, can take both internalized (self-directed) and external (other-directed) forms. Self-directed ageism refers to the internal acceptance of negative societal messages about aging, such as the belief that older individuals are inherently bad with technology, incapable of learning, or too set in their ways to adapt (Levy, 2009). This internalized narrative can significantly reduce motivation and self-efficacy, discouraging older adults from engaging with digital tools even when access and opportunity are present. On the other hand, other-directed ageism manifests through external forces, such as stereotypes reinforced by media, policies, and design decisions that treat older users as fringe or incapable audiences (Ayalon & Tesch-Römer, 2017). For example, the widespread portrayal of seniors as technologically inept can further discourage them from trying, out of fear of embarrassment or failure.

An additional dimension of this problem is the gendered nature of ageism, where older women often face compounded disadvantages. Research by (McGann, et al., 2016) has shown that older

women are more likely than older men to be perceived negatively in the context of aging, and societal expectations around women's technological proficiency tend to be lower. These stereotypes can result in older women experiencing greater anxiety, less encouragement, and fewer opportunities to engage with digital tools. They may be more hesitant to seek help or enroll in training programs due to perceived stigma, further deepening their exclusion.

In conclusion, the grey digital divide is not merely a matter of unequal access to hardware or connectivity. It is a multifaceted and systemic issue that intersects with social class, geography, age, health, gender, and deeply embedded societal attitudes. Addressing this divide requires more than just increasing broadband coverage or distributing devices—it calls for inclusive design practices, intergenerational support systems, targeted training programs, and a critical shift in how society views aging in the digital era. Without addressing the underlying social and psychological barriers, efforts toward digital inclusion will continue to fall short for one of the world's fastest-growing demographic groups.

Finding process

During the preliminary stages of research, several recurring challenges faced by older adults in their interactions with digital platforms were observed and documented. These challenges often involved routine digital tasks that individuals with regular internet access and moderate digital literacy typically perform with ease. For elderly users, however, even seemingly simple actions can become significant hurdles. Among the difficulties noted were tasks such as composing and sending an email to the correct recipient, which often involved confusion around user interface elements, address fields, or attachment handling. Another commonly reported challenge was logging into official government portals—a task that typically requires navigating multi-step authentication processes, remembering or retrieving passwords, and interpreting complex instructions. These early findings highlight how digital interfaces, when not designed with inclusivity in mind, can unintentionally create barriers to essential services and everyday communication for aging populations.

Recruitment process

The recruitment of participants for this research was conducted in accordance with the guidelines set by the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, (TCPS) to ensure transparency, informed consent, and respect for participant rights. Initial outreach was carried out via email, targeting individuals who fit the study's demographic criteria. These emails briefly introduced the purpose of the research, particularly older adults experiencing challenges with digital platforms, and invited recipients to participate.

Upon expressing interest, potential participants were provided with additional information about the nature and scope of the study. They were then asked to select a preferred time slot for the interview session. Prior to the commencement of each session, participants were read a summary of their rights as outlined by the ethics protocol, including the voluntary nature of their participation, the confidentiality of their responses, and their right to withdraw at any point. Once informed consent was confirmed, the interview sessions proceeded as scheduled.

Participant

The participant involved in this research was a 71-year-old active member of the Rainbow Seniors group in Canada. Selected in alignment with the inclusion criteria and ethical guidelines approved by the Research Ethics Board, the participant represents a segment of the aging population that regularly engages with digital technologies. They reported frequent use of digital devices, including an iPhone and an iPad, for everyday activities. While no explicit preference between iOS and Android operating systems was mentioned, the participant's device usage appeared to be influenced by recommendations from trusted sources rather than personal bias or technical familiarity. Their experience offered valuable insights into the cognitive and usability challenges encountered by older adults when interacting with digital platforms.

Insights

The participant expressed frustration when encountering commonly used technical terms like “smartphone” and “app.” This highlighted a significant gap in understanding even the most basic digital vocabulary, terms that are often taken for granted. However, it also became clear that with clear and patient explanations, participants were able to grasp the purpose and function of these technologies.

Digital interfaces are still a relatively new concept for this generation, often evoking feelings of hesitation and uncertainty. This apprehension was particularly evident in the context of online banking. One participant shared, *“I feel confident when sending emails or texts, but not when I’m doing my online banking because I still don’t trust banking or any confidential information online.”*

This reveals a broader lack of trust in digital platforms for sensitive tasks, underscoring the need for improved digital literacy, clear communication, and trust-building measures when introducing digital services to older or less tech-savvy users.

The same participant elaborated on this mistrust, tying it to broader concerns about data security and institutional transparency:

“Because of the numerous security breaches that keep happening. Like, I just had to... get in touch with City Hall 311 to get information. In order to get information, I have to give them my information. I trust that when I dial 311, I'm getting the city, but you never know. So basically, they're hiding behind.”

This quote illustrates the lingering sense of vulnerability users feel when engaging with digital services, even those provided by trusted institutions. The need to exchange personal information in order to receive basic services creates discomfort, especially in a climate where data breaches and digital scams are increasingly common. This highlights a critical challenge: building trust through transparency, clear communication, and reassurances about data safety, particularly for users who are still adjusting to digital environments.

The prevalence of scams and the vulnerability of the elderly is another concern affecting the use of digital interfaces.

Another key issue highlighted was the lack of clear system feedback. For older users, not receiving immediate or noticeable confirmation that an action was completed can lead to confusion and frustration. As one participant explained:

“Then it got to the end where it said submit, and I'm pressing on submit and nothing is happening.”

This emphasizes the importance of intuitive feedback mechanisms—such as visual cues, haptic responses, or confirmation messages—that reassure users their actions have been registered. Without this, users are left uncertain about whether the system is working, which can lead to repeated inputs, anxiety, or abandonment of the task altogether.

A particularly striking example of this came from participant who said:

“I have no idea what is a browser. I don't even know what a browser is. I know when it tells me open your, open the link or in, and it gives me three choices. Safari being one of the choices. I choose Safari. Is that a browser?”

This quote reveals the disconnect between digital language and user understanding. While the participant interacts with a browser regularly, they're unaware of what the term “browser”

actually means. This reflects a broader issue, many users are following patterns based on trial and error, not comprehension. Interfaces often assume a base level of digital fluency that not all users have, especially older adults or those newer to technology.

Using clearer language, providing contextual explanations, and implementing supportive onboarding experiences can significantly help bridge the digital literacy gap, especially for older adults or individuals less familiar with technology. When users encounter unfamiliar terms or ambiguous icons without guidance, it often leads to confusion, hesitation, and a sense of intimidation. This is particularly important for populations who didn't grow up with digital devices and now face a steep learning curve just to perform basic tasks.

One participant shared:

"I see all these little symbols. Now I know the microphone. I know the video camera. But it also helps to explain what these things are. Because it's like learning a new language when you're using these devices."

This quote powerfully illustrates the reality many users face: while visual icons can be helpful, they're not always intuitive. For someone unfamiliar with digital conventions, interpreting these symbols often feels like deciphering a foreign language. A microphone or camera icon might be recognizable, but what about less obvious symbols? Without accompanying labels, tooltips, or onboarding prompts, users are left to guess, relying on trial and error.

For younger or more experienced users, this guessing game may be part of the learning process. But for older adults with limited exposure to technology, this ambiguity can increase cognitive load, resulting in frustration and even fear of making mistakes. In these cases, unclear interfaces don't just slow down task completion, they actively discourage engagement.

To create more inclusive digital experiences, designers need to go beyond minimalism and iconography. A balance must be struck between clean design and accessible communication. Adding text labels, simple walkthroughs, and contextual hints not only aids comprehension but also builds user confidence, empowering users to explore, learn, and engage with digital tools without feeling lost or overwhelmed.

Another powerful insight emerged around the emotional barriers that users face when interacting with digital interfaces, especially when support is provided remotely. For many older adults or individuals less confident in using technology, even seemingly simple actions like opening a form can become daunting.

“The person was trying to help me to fill out a form online and they said to me, ‘Well, go to the form.’ And I’m saying, ‘Well, how do I go to the form?... I’m afraid if I touch anything on the screen, you will disappear.’”

This quote illustrates a critical intersection between usability and emotional security. The fear of “breaking something” or “losing” a support person is real and valid. In this case, the participant was not only unsure about how to access the form, but was also worried that a single tap could end the remote assistance session—leaving them stranded.

Such fears often go unaddressed in interface design, yet they have a significant impact on user behavior and confidence. While tech-savvy individuals might navigate between tabs or apps without a second thought, users with limited experience often lack the mental model needed to feel in control of what’s happening on screen. This creates a fragile user experience where every click feels risky.

To support these users better, designers must consider how to reinforce a sense of safety and control. This can include:

- Providing clearer step-by-step guidance during remote support sessions
- Designing interfaces with visible progress markers and orientation cues
- Including gentle prompts that reassure users their current task won’t disrupt a call or support channel

Ultimately, good design should not only guide users *where* to go but also reassure them that they won’t lose their way or their support along the journey.

Based on the insights, a table was created for the design.

| Category | Identified Issue | Insight / Quote | Explanation | Design Recommendation |
|----------------------------|--|--|---|---|
| Digital Terminology | Difficulty understanding basic digital terms like "browser," "app," etc. | "I don't even know what a browser is... I choose Safari. Is that a browser?" | Assumed baseline digital literacy creates a gap in understanding. Users follow steps blindly without knowing what actions mean. | Use plain, descriptive language in instructions. Add definitions or tooltips for key terms. Offer onboarding walkthroughs using common, relatable examples. |

| | | | | |
|--|---|---|--|--|
| Trust and Security Concerns | Mistrust of digital platforms, especially for sensitive activities like banking | "I still don't trust banking or any confidential information online. You never know who's behind it. Basically, they're hiding behind." | Security breaches and scams lead to fear and avoidance of online platforms, even government sites. | Include trust signals (padlocks, secure messages), offer privacy explanations, and simplify secure login processes. Provide alternatives like in-person or hybrid support. |
| Emotional Safety | Fear of "breaking something" or losing access to help while using digital platforms | "I'm afraid if I touch anything on the screen, you will disappear." | Anxiety about interacting with unfamiliar systems alone causes hesitation and avoidance. | Use persistent, visible help options (chat buttons, phone call continuity). Offer task confirmation prompts and "safe to exit" reassurance. |
| System Feedback | Interfaces lack clear, immediate feedback when an action is taken | "It said submit, and I'm pressing on submit and nothing is happening." | Absence of visual or audio feedback increases confusion and task repetition. | Provide strong feedback (e.g., buttons changing color, animations, confirmation messages). Incorporate haptic feedback on mobile. |
| Icon Ambiguity | Icons are not universally understood without accompanying text | "I see all these little symbols... it helps to explain what these things are." | Icons are interpreted differently by older users and are often mistaken or ignored if unfamiliar. | Pair all icons with clear text labels. Use recognizable imagery. Provide hover explanations or onboarding to introduce icon meanings. |
| Cognitive Overload | Complex interfaces lead to confusion, especially during multitasking | "How do I go to the form?" while fearing that switching screens would break connection | Users don't have a mental model for task flows or tab management, leading to anxiety. | Break tasks into linear steps. Use progress indicators. Avoid split screens or multitasking assumptions. |
| Overreliance on Trial & Error | Users resort to guessing due to lack of guidance | Multiple quotes suggest that participants "stumbled" through | This increases frustration and leads to task abandonment if no positive | Include microlearning modules, highlight successful completions, and reduce "dead ends" in interaction flows. |

| | | processes by trial | reinforcement is received. | |
|-----------------------------|--|--|--|---|
| Interface Complexity | Frequent layout changes, inconsistent patterns, and cluttered interfaces | Observed in interviews and literature review | Inconsistencies cause disorientation; older adults rely on pattern recognition and familiarity | Adhere to Jakob's Law—follow common design conventions. Offer simplified "senior" mode that prioritizes clarity and minimalism. |

Recommendations

The concept of a “one-size-fits-all” design approach is reaching its limitations in the context of inclusive digital experiences. While younger users often appreciate visually complex and dynamic interfaces, sometimes even perceiving a level of challenge or social value in mastering them—the same does not hold true for older adults. For elderly users, cognitive simplicity and familiarity are crucial in reducing barriers to digital interaction. In this regard, Jakob’s Law, which suggests that users prefer interfaces that follow familiar patterns based on their prior experiences, becomes particularly relevant. Designing for this demographic requires prioritizing ease of use and minimizing cognitive load through intuitive and predictable task flows.

Rather than striving for uniqueness at the cost of usability, digital interfaces aimed at older users should focus on clarity, consistency, and simplification. For example, while icons are widely used as visual shortcuts to communicate functionality, their effectiveness relies heavily on whether users understand their meanings. Therefore, designers must ensure that icons are not only universally recognizable but also rooted in a visual language familiar to older generations. This could be achieved by leveraging icon libraries that reflect design conventions understood by senior users.

Furthermore, digital products typically collect demographic data, such as date of birth, during account creation. This information presents an opportunity to dynamically tailor user interfaces based on age-related needs. For instance, users above a certain age threshold could be presented with a simplified interface by default, prioritizing clarity over aesthetics, while retaining the option to switch to a more advanced layout if desired. This approach avoids categorizing users rigidly while still addressing the unique needs of older adults.

Additionally, incorporating contextual pop-up guides that explain steps in each task flow can significantly reduce dependency on external assistance. These in-app support elements can empower elderly users to complete tasks independently by offering real-time guidance, thereby improving overall confidence and engagement.

In summary, designing for older users requires a shift in focus from visual novelty to empathetic usability. By integrating familiarity, simplification, and personalized experiences into digital

products, designers can create more inclusive interfaces that truly accommodate the diverse capabilities and preferences of aging populations.

Limitation

While this research provides an important starting point for understanding the cognitive challenges older adults face when interacting with digital products, it is important to recognize its limitations. The study was primarily based on a literature review and insights gathered from a single interview with an older participant. Although the literature provided a strong theoretical foundation and the interview offered valuable first-hand perspective, the absence of broader qualitative data collection such as multiple interviews or focus groups limits the depth and generalizability of the findings.

The inclusion of only one participant means that the study cannot claim to represent the full range of experiences, behaviors, and preferences of the target demographic. Older adults are a diverse group, varying in terms of technological exposure, health conditions, cultural background, and personal attitudes toward digital products. Engaging more participants would have allowed for the identification of common patterns and contrasting perspectives, providing a more comprehensive understanding of the cognitive burdens experienced across different contexts.

Furthermore, the research was conducted within a specific geographical and cultural setting, Canada, which may shape how older users interact with technology due to regional policies, infrastructure, and accessibility differences. As such, the findings may not be applicable to older populations in other countries or with different sociotechnical environments.

The study also did not include usability testing or direct observation of digital interactions. This data would have enriched the analysis by capturing behavioral insights and real-time challenges faced by older users. This limitation points to an opportunity for future research that combining observational data with participant feedback for a more holistic view.

Despite these constraints, this research highlights important considerations and opens the door for future studies to build on its findings with more participants, a broader methodological approach, and cross-cultural perspectives.

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