

When to say bye: a qualitative study of older adults' discontinuation of technology use after the pandemic

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The COVID-19 pandemic has prompted many older adults to adopt communication technologies as a means of maintaining connections with their loved ones, accessing healthcare services, and engaging in various daily activities. Yet, as the pandemic eases and restrictions are lifted, many older adults gradually discontinue their use of technology. This article addresses the questions of how the intentions of technology discontinuation develop, and how older adults experience the process. A total of 10 phenomenological interviews were conducted, examining transformations and experiences in technology discontinuation among older adults. Five themes regarding the discontinuation of communication technology were identified, including life transformation, interaction disillusionment, semantic transformation, environment shifts, and reconnection. The study highlights the complex and multifaceted nature of communication technology discontinuation among older adults and emphasizes the importance of designers, developers, and researchers understanding and addressing the challenges faced by older adults in sustaining technology use. It concludes by discussing the implications of designing sustainable and inclusive technologies and corresponding use contexts for older adults.

Keywords: *discontinued technology use; older adults; qualitative study; pandemic*

1 Introduction

During the COVID-19 pandemic, older adults have increasingly adopted communication technologies (Sin et al., 2021). These technology, also known as information and communication technology, refers to all equipment and programs that are used to process and communicate information, including smartphones, video, smart speakers, web conferencing tools, computers, and online chatting or shopping platforms (Silverstone & Haddon, 1996). According to a 2021 report from the AARP, 44% of adults aged 50 and above used video conferencing to connect with family and friends, 31% used social media more frequently, and 22% used mobile apps for health-related purposes (Kakulla, 2021). The utilization of these technologies enabled older adults to stay informed about the pandemic situation (Lund & Ma, 2022), combat loneliness and social distancing by staying in touch with loved ones (Elimelech et al., 2022), maintain good physical health through exercising in the comfort of their



homes (Drazich et al., 2023), and access healthcare services without temporal or physical constraints (Goldberg et al., 2022).

Considering the benefits of technology use, a significant body of literature has emerged examining how and whether older adults utilize technology for various purposes during the pandemic (Chen et al., 2021; Sin et al., 2021; Lund & Ma, 2022). Additionally, studies have identified various influential factors that contribute to the acceptance of specific technologies during the pandemic (Benge et al., 2022; Balki et al., 2022; Parlapani et al., 2021), and explored the process through which older adults gradually accept technology in domestic environments (Sixsmith et al., 2022; Ankuda et al., 2022; Iancu & Iancu, 2022). These studies have provided valuable insights into the acceptance of technology among older adults, highlighting the importance of capturing the entire spectrum of the digital technology acceptance cycle, including continued or discontinued use and the quality of users' experiences over a long period (Nadal et al., 2020; Karapanos et al., 2010).

As the pandemic eases and restrictions have been lifted recently, some older adults have made a deliberate choice to disengage from or minimize reliance on these technological tools in their daily lives. Their discontinuation of technology use, which refers to the intentional and permanent cessation or pausing of the use of communication technology, has been observed in the most recent literature. For instance, Zapletal and colleagues (2023) found that many older adults, regardless of whether they had become regular users or not, were not interested in continuing to use digital technology post-pandemic. Similar findings have also been observed in other studies that older adults abandon some technologies used during the pandemic (Xie et al., 2020; Haase et al., 2021). The question then arises about when and how the decision of discontinuing the use of communication technologies among some older adults develops when the pandemic resolves. Only a few studies have investigated the discontinued use of communication technologies among older adults when the pandemic resolves. These limited studies primarily focus on comparing older adults' adoption rate of a specific technology before and after the pandemic (Kung, Steptoe, 2023), the impact of pandemic on older adults' technology use (Zapletal et al., 2023; Xie et al., 2020; Haase et al., 2021), and examining the influential factors related to technology discontinuation (Diehl et al., 2022; Ramírez-Correa et al., 2023). The circumstances, under which older adults decide to discontinue their use of communication technology, and their experiences with the discontinuation process are still underexplored. Yet, without understanding the circumstances behind technology discontinuation, it becomes difficult to provide appropriate support and interventions for older adults who may need assistance in adapting to digital technologies, and can potentially lead to increased social isolation among older adults. Besides, as communication technologies provide access to a wide range of services such as online shopping, telehealth, and virtual social activities, the lack of an understanding of technology discontinuation may pose challenges to service providers to offer high-quality services for older adults. That is, a comprehensive understanding of the circumstances surrounding technology discontinuation among older adults is crucial for developing targeted interventions, addressing social isolation, and providing high-quality services.

This study aims to explore the use of communication technology among older adults after the pandemic, with a focus on theorizing the processes and experiences related to technology discontinuation. By investigating the experience related to stopping technology use among older adults, we hope to shed light on the complex and multifaceted nature of technology discontinuation,

and provide empirical insights into older adults' stories of breaking up with a technology they usually use. This would be of help to inform the design of future technologies that better meet the needs and preferences of this demographic, and help policymakers, researchers and service providers develop targeted interventions and support systems to facilitate successful technology transitions for older adults.

Our findings make three contributions to the field of design for sustainable behaviour in technology interactions. First, five themes of technology discontinuation among older adults were identified, providing empirical insights into the emerging body of literature about the use of technology among older adults. Besides, the study revealed that it is important to recognize that the discontinued use of technology does not necessarily result from a negative user experience, as a positive user experience may boost older adults' confidence in technology use and thus opens up new opportunities to embed other types of technology in their daily activities. Third, by highlighting the importance of understanding older adults' decisions of stopping using technology, we proposed a set of design implications for creating sustainable and inclusive technologies and corresponding use contexts for older adults.

2 Method

2.1 Participant recruitment

Our qualitative study started by identifying older adults who had discontinued their use of communication technology. One senior community in Shanghai was selected for participant recruitment. During the pandemic, managers in this senior community encouraged and guided older adults to use smartphones to contact their friends or families, access health resources, and buy daily necessities online. Some residents who had no phones received laptops, iPads or phones for remote communication. Hence, more than 80% of the residents had communication technology.

We first contacted the senior community managers and explained the study purpose. Study flyers were then distributed to their residents to invite them to an information session. At the information session, we provided an overview of the study and collected written consent from interested participants. The Computer Proficiency Questionnaire (CPQ-12) was then used to for participants to self-assess their technology experience level (Boot et al., 2015; Zhang et al., 2017).

As a result, a total of 10 older adults were recruited for our study (Table 1). Participants ranged in age from 68 to 82 years old, consisting of five males and five females. Participants had varying levels of experience with technology use, with some reporting high levels of comfort and proficiency and others reporting little experience.

Table 1. The detailed information of participants

	Age	Gender	Technology Experience Level	Used Technology
1	72	Female	High	Laptop
2	75	Male	Low	Smartphone
3	68	Female	Moderate	Smart speaker
4	80	Male	High	iPad

5	72	Female	Low	Camera monitoring system
6	82	Male	Low	Laptop
7	69	Female	High	iPad
8	73	Male	Moderate	Tablet
9	74	Female	Low	Mobile shopping App
10	79	Male	High	Phone

2.2 Data collection

This study conducted phenomenological interviews to attain the participants' experiences during the technology discontinuation process (Groenewal, 2004). Phenomenological interview is a qualitative research method widely used in social sciences to explore and understand individuals' subjective experiences of a particular phenomenon. It also receives significant attention in the field of design recently. By exploring the unique perspectives of individuals, researchers can gain rich and descriptive data about the essence of the phenomenon and how it is understood and lived by different individuals. In our case, we aim to unravel the details of the processes and experiences related to technology discontinuation among older adults. Hence, this form of interview was chosen to attain deep insights into this personal, not always easy to verbalize process of technology discontinuation.

During the interview, we engaged in a dialogue with the participants, allowing them to freely express their thoughts, feelings, and perceptions. We utilized open-ended questions to encourage the participant to reflect deeply on their experiences and provide detailed descriptions. The questions were developed encompassing the contextualization, clarification, and apprehension of older adults' practices and experiences related to the discontinuation of technology use (Table 2).

Table 2. Interview schedule

Focus Area	Examples of questions and probes
Contextualizing the technology discontinuation	<ul style="list-style-type: none"> - Tell me more about your day. How did you use the technology during the pandemic? - How is your day now? What has been changed after using and not using the technology? - How do your friends or relatives think of the discontinuation?
Clarifying the technology discontinuation	<ul style="list-style-type: none"> - In your own words, could you please describe the relationship between you and the technology? - How was the relationship change over time? - Has there been an occasion that something you expected to happen by using the technology didn't happen? I'd love to know more. - Could you please give me an example that drives your discontinuation?
Apprehending the technology discontinuation	<ul style="list-style-type: none"> - How well do you think that you had been supported by using the technology during the pandemic? - How do you feel about your discontinuation of the technology? - If you experience the pandemic again, how would you do with regard to (dis)continuing to use the technology?

To stimulate the expression of emotions and experiences undergone during the process, we applied the photo-elicitation technique (Zaltman, 1997). Respondents were asked to bring 3 photos or pictures

illustrating their technology use experience and their feelings during the technology discontinuation process. The pictures were used either at the beginning to stimulate stories about the participants' decisions of technology discontinuation, or in the course of the interview. Some respondents used the pictures to express their feelings. If the pictures were not mentioned by the respondent, the interviewer asked for their deeper symbolic meaning, in order to stimulate additional narratives. At the end of the interview the researchers also asked for a picture that is most representative of the participants' decisions of technology discontinuation, again to eventually evoke additional memories or feelings of the discontinuation process (Zaltman, 1997). Considering the pandemic, we also provided alternative modes of participation, such as online interviews, for participants who were unable to attend in-person data collection. Data were collected from October 2022 to March 2023.

2.3 Data analysis

The interview transcripts were imported into Nvivo software. We conducted qualitative data analysis using a thematic analysis approach to identify key themes related to older adults' experience of technology discontinuation. We coded the qualitative data using NVivo software, and used a constant comparison to identify patterns and discrepancies in the data. We analyzed the data to identify the circumstances, under which older adults decide to discontinue their use of communication technology, and related user experiences throughout the discontinuation process, based on which five themes were identified (Table 3).

Table 3. An overview of the themes regarding older adults' discontinuation of technology use after the pandemic

Themes	Sub-themes	Examples of extracted texts segments
Life transformation	Returning to pre-pandemic life	- resumed social life - no need to do online shopping
	Exploring alternative technologies	- piqued interest in other technology - emerged new technical tools
Interaction disillusionment	Unmet expectations	- not as easy-to-use as expected - thought the technology could be helpful before using it
	Insufficient functionality	- oversimplified functions - some functions that are not useful
	Humiliation	- embarrassing experiences with technology use - ageism in technology design
Semantic transformation	Brand alienation	- poor management during the pandemic - unsympathetic ways they responded to the customers
	The torn memory	- negative emotion attached to a specific technology - poor memories attached to a specific technology
Environmental shifts	Changing daily patterns	- phasing out the technology use - no requirement to do COVID test
	Changing social patterns	- preference in contact friends in person - preference in face-to-face social activities
Reconnection	Purposeful reintroduction	- reuse a specific technology for emotional comfort - recognize the value of a technology
	Function appropriation	- adjust the ways of using a specific technology - appropriate the use of technology to align with specific contexts

2.4 Ethical considerations

We obtained ethical approval from the ethical committee at our university prior to conducting the study (Code 153662I). All participants provided informed consent, and we ensured the confidentiality and anonymity of the participants by assigning unique identifiers to their data.

3 Results

According to the analysis, older adults' experiences during the technology discontinuation process varied, as five themes were identified, including life transformation, interaction disillusionment, semantic transformation, environment shifts, and reconnection.

3.1 Life transformation

This theme shows that the discontinued use of technology does not necessarily result from a negative user experience. The return to pre-pandemic social life and the desire to explore alternative technologies illustrate how technology is just one part of older adults' lives and is not the only means of achieving social connection or satisfaction.

3.1.1 Returning to pre-pandemic life

As the pandemic eases and restrictions are lifted, older adults experience a transformation in their social lives. They are able to meet their friends and family in person and engage in activities that they were previously unable to do. This return to pre-pandemic social life can lead to a decreased reliance on technology for communication and social interaction. Participants expressed a sense of pleasure in being able to meet their friends face-to-face and engage in offline activities. For example, one participant stated,

“My life underwent a transformation when the pandemic eased. I resumed my social life, which now involves meeting my old friends in person and going shopping offline. I have given the phone to a neighbor who is interested in using it.”

The participant has made a conscious decision to discontinue the use of the phone, possibly due to a lack of interest or a preference for face-to-face interactions. This highlights the importance of in-person interactions and the limitations of technology in providing the same level of satisfaction and connection for some older adults.

3.1.2 Exploring alternative technologies

Older adults who are confident in their use of technology may choose to explore new and different technologies as a means of staying engaged and curious. This exploration can lead to the discontinuation of previous technologies, as participants seek to experiment with and learn about different types of technology. Participants expressed a positive attitude towards technology in general, but also a desire to try new things and see what else is available. For example, one participant stated,

“I never thought I would be interested in using an iPad, but during the pandemic, I realized how much it could help me stay connected with my loved ones...I now feel confident in using technology. I can't say that I dislike iPads or other similar devices, my interest in technology has been piqued, and I'd love to try other technologies. I'm considering buying a GoPro now. These are all excellent technologies, and there's nothing negative to say about the iPad. I simply want

to explore what I can do with different technologies. That's how I feel about it and that is why I stop using it."

This quotes above emphasized older adults' intentions of continued learning and curiosity in technology, and how this can lead to the discontinuation of previous technologies in favor of new ones after the pandemic.

3.2 Interaction disillusionment

This theme highlights the various challenges that older adults face while using technology, leading to the discontinuation of technology use. Failed expectations, insufficient functionality, and humiliations make technology use unappealing for older adults.

3.2.1 Unmet expectations

Older adults may have high expectations for technology, which can lead to disappointment if the technology does not meet their needs. As the following quote illustrates:

"I got a tablet from my son, and he said that it would be helpful for keeping in touch with my family who lives far away. However, I found that I rarely used it, as I preferred to talk on the phone, which was more natural and easy for me. I had expected it to be useful, but it just wasn't for me. The (strong expectation) vanished...I thus stopped using the tablet after trying it for a while."

The participant had high expectations for the tablet but found it did not meet his needs or preferences for communication. Instead, he preferred talking on the usually used phone, which felt more natural and easy for him. The quote indicates that the device did not meet the older adult's expectations and technology use habits, and thus, discontinuation was the ultimate outcome.

3.2.2 Insufficient functionality

Older adults may find that technology does not have enough functionality to meet their needs during the pandemic, which can be frustrating and lead to discontinuation. For example, one participant stated:

"My smartphone broke out during the pandemic and was under repair. I got this phone from the community. Using this phone during the pandemic was fine, cause I need a tool to talk with my family. But its functionality was too simplified... I am a healthy person who happens to be old. I am not a silly person who can only click one button. I am also interested in using Tiktok, posting photos online and so on especially during the boring pandemic. I would prefer a smartphone that can use multimedia software."

The ageism that the participant felt in the oversimplified design was highlighted as he mentioned he was "not a silly person". The older adult further expressed interest in using smartphones and being able to use social media apps like Tiktok. The quote indicates that the smartphone did not meet the older adult's needs, regardless of the functional or psychological aspects. The lack of functionality led to discontinuation of the phone.

3.2.3 Humiliation

Some older adults had embarrassing experiences with technology which had challenged them during the pandemic. As the following example showed:

"I tried to use the App to make an appointment for a PCR test, I need to make it as soon as possible because I had already arrived at the testing point. The nurse was friendly but told me I could only do the test after making an appointment online. But what could I do? (the App) did not work, no matter how many times I tried. I stood there for at least 20 minutes. I was the mock of the people...Anyhow, I was humiliated and embarrassed with it."

The quote above highlights an older adult's experience with an app for making an appointment for a PCR test. The app did not work, which resulted in the older adult being unable to make an appointment, leading to humiliation and embarrassment, indicating that the technology posed significant challenges and led to discontinuation.

3.3 Semantic transformation

The third theme identified in the study relates to the negative experiences and emotions associated with technology use, which lead older adults to discontinue its use. Specifically, this theme highlights how the meanings attached to a specific technology, particularly related to the negative experience in a specific brand and the torn memories associated with a specific technology, can lead to the decision to discontinue its use.

3.3.1 Brand alienation

To adapt to the sudden surge in demand for online services, many grocery companies established their mobile shopping Apps. Yet, older adults may find themselves unable to navigate the technology required to place orders or schedule deliveries. This lack of support and guidance from businesses has left older adults' lasting negative impression of a brand, making them discontinue to use these mobile shopping Apps after the pandemic.

"I was a big fan of [Brand A]. Its goods are more expensive than the other groceries, but I feel it offers fresher food and provided better services. Yet, the online service totally failed me during the pandemic. The website was so confusing. I couldn't find what I needed, and there was no one to help me. Although I was using the App during the pandemic, but that was because I had to use it...It made me doubt whether they indeed cared about their customers. I was also skeptical whether the quality of their goods was as good as they advertised. How could I continue going shopping in their shops with these doubts, not mentioning using the App."

Furthermore, the unsympathetic ways in which some companies responded to their customers' concerns during the pandemic have also contributed to the refusal among older adults to continue using related technology after the pandemic. Instead of providing empathetic and patient assistance, some businesses adopted a dismissive approach, leaving older adults feeling frustrated and unsupported. In the following example, the participant had initially been attracted to the brand because of the promised home maintenance service, which would have been particularly beneficial for someone in their old age. However, when reaching out for assistance, they encountered numerous obstacles and dismissive responses from the customer service hotline.

"During the pandemic, I purchased a laptop with the understanding that home maintenance service was included. As an elderly person, this was a great benefit for me. However, when I contacted the customer service hotline for assistance, they seemed reluctant to provide on-door services and came up with numerous excuses. It felt as though they preferred to

discourage me rather than find a potential solution. When I inquired about offline repair shops, they instructed me to locate one using a map app on my own. This experience has greatly discouraged me from continuing to use the laptop, and I have decided that any product from this brand will never make it onto my shopping list."

The two participants' experiences above exemplify how a lack of proper support and unsympathetic responses can severely impact technology adoption among older adults. Different from the other cases where older adults were focused on a specific device or program, participants in the cases made their decision to discontinue using products from this brand altogether.

3.3.2 The torn memory

Our interview data also highlights the emotional attachment that older adults may develop with technology, particularly if they share heartbreaking experiences and memories associated with it. One participant had fond memories of using the laptop with her partner during the pandemic, and this shared experience created a strong emotional bond with the technology. However, after her partner's passing, the participant found it difficult to continue using the laptop as it was a painful reminder of her loss. The following quote emphasizes the emotional significance of technology and the role it can play in older adults' lives, both positively and negatively.

"I need to learn to let go of everything that reminded me of him, including the laptop. We had a great time using it together to watch TV shows and read the news. During the pandemic, we entertained each other by learning how to use a laptop at our age, which we compared to fish learning to fly. But now, I have to separate myself from this laptop for good, to move on and leave the past behind. The memories are too strong. Even though I used to adore it, I have decided not to use it anymore. So, I have made up my mind to never use it again."

3.4 Environmental shifts

This theme discusses how changing patterns in daily and social practices can lead to the discontinuation of technology use among older adults. Unlike the previous themes, participants here showed a more open attitude towards reusing technology in the future if their needs and contexts change again.

3.4.1 Changing daily patterns

Many participants highlighted the changing usage patterns of technology during and after the pandemic. One participant discussed how she initially used an iPad for various purposes but gradually became less attached to it as the pandemic context changed:

"I did not abruptly stop using the iPad. Initially, I continued to use some apps to order food, make video calls to my sick friends, or stay updated on the news. However, gradually, we grew apart. The environments changed, and I no longer felt as attached to it as I did during the pandemic. Perhaps, I may use it again in the future if the need arises, but I hope that it won't be due to quarantine (laughs)."

The quote suggests that technology usage patterns are closely linked to the context in which they are used. As the context changed, so did the participant's needs and preferences. The participant also said that she may use the iPad again in the future if there is a need, but she hoped that need won't be

related to quarantine. This suggests that technology re-adoption may also be influenced by past experiences associated with the device.

3.4.2 Changing social patterns

Similarly, changing social patterns also led to a decrease in technology use among participants. One participant discussed the emotional significance of a smart speaker, which provided a sense of comfort and connection during the pandemic. Yet, this emotional attachment may have decreased in accordance with the changing contexts, contributing to the participant's decreased willingness to use the device after the pandemic:

"My daughter gifted me a smart speaker and set it up so that she could talk to me through it. During the pandemic, she used it to remind me to take my pills and to offer comforting words. Hearing her voice and my grandson's voice through the device was the highlight of my day. However, now that the pandemic is easing, we don't use it as often for conversation. Nevertheless, I am grateful for the comfort and convenience the device brought me during the pandemic."

3.5 Reconnection

This theme unravels participants' willingness to reintroduce technology use in their daily lives after discontinuing it. Interestingly, the findings suggest that facing the same device or program, participants were more purposeful and cautious in their use of technology upon reconnection.

3.5.1 Purposeful reintroduction

This following quote highlights how participants may purposefully reintroduce technology use into their lives depending on their current circumstances and priorities.

"during the pandemic, as I had more leisure time, I rekindled my relationship with my tablet and started using it again to read books and watch movies. It was a nice experience to rediscover its usefulness in a more relaxed way. As things started getting back to normal, I got busy again and left my tablet untouched. However, I recently consider to resume using it to watch movies again, as I missed the peace of mind it brought me during the pandemic."

The example demonstrates the tablet's dual functions: as a tool for entertainment and relaxation, and as a device that can potentially be put aside when societal expectations and productivity demands rise. During the pandemic, the participant found solace in the tablet, utilizing it for activities like reading and watching movies. This demonstrates the tablet's ability to provide mental escape and entertainment during challenging times. However, as life returned to normal, the participant decided to abandon the tablet. This decision could be attributed to societal pressure to prioritize productivity over personal well-being. It implies that leisure activities facilitated by technology might be perceived as less important compared to work and societal obligations. Nevertheless, the participant eventually reintroduced the tablet into his life. This signifies a shift in perspective, where personal well-being is acknowledged as essential. It demonstrates the recognition of a technology's value and an individual's value priorities may determine the discontinuation and reconnection of a specific technology.

3.5.2 Function appropriation

The following quotes exemplify the discontinuation of technology use and the subsequent reconnection through function appropriation.

“I fell down on the ground before, so just in case it happens again during the pandemic, my son put (a camera monitor system) in the living room. Frankly I didn't notice it before, so I was really shocked when I know they had used it to see me every day...Of course, I would put it aside...But then I realize the camera could be suitable for another purpose. My door does not have a peephole, so I ask my son to put the camera outside the door. Once someone is knocking the door, I could know who he or she is.”

The initial installation of the camera monitor system in the living room served a specific purpose - to monitor for potential accidents during the pandemic. However, when the participant discovered that she was being watched without her knowledge, she decided to discontinue its use due to the breach of privacy and discomfort it caused. Despite putting the camera aside, the participant later recognized the opportunity for a different function - enhancing security at the door by using the camera to identify visitors. This demonstrates how discontinuing the technology's original use led to a reconnection through function appropriation. Rather than abandoning the camera altogether, the participant found a new purpose that suited her needs - knowing who is knocking at the door. This process of function appropriation showcases the adaptability of individuals when faced with technology-related challenges. It highlights how discontinuing the use of a particular technology doesn't necessarily mean it becomes obsolete or useless. Instead, it opens up possibilities for repurposing and finding alternative functions that can be beneficial and relevant in different contexts.

The journey from initial installation to discontinuation and then reconnection through function appropriation also underscores the importance of ethical considerations and respect for privacy. The discomfort caused by the unauthorized monitoring emphasized the need for consent and communication when using surveillance technology. The subsequent repurposing of the camera demonstrated a responsible approach to its use, redirecting its capabilities towards a non-intrusive and security-enhancing purpose.

4 Discussion

The present study explored the experiences of older adults during the discontinuation process of technology use. Our findings suggest that the discontinuation of technology is a complex process and depends on various factors. The participants' experiences were categorized into five themes, including life transformation, interaction disillusionment, semantic transformation, environment shifts, and reconnection.

4.1 The summary of key findings

The first theme, life transformation, shows that technology is only one part of older adults' lives, and its discontinuation does not necessarily result from a negative user experience. In our case, some older adults may discontinue technology use due to the return to pre-pandemic social life and the desire to explore alternative technologies. The participants expressed a sense of pleasure in meeting their friends face-to-face and engaging in offline activities, highlighting the importance of in-person interactions and the limitations of technology in providing the same level of satisfaction and connection. The findings are consistent with existing literature which indicate the benefits and challenges in association with using telepsychiatry (Martínez-Alcalá et al., 2018). Besides, our results show that positive experiences with technology can actually boost older adults' confidence in using technology, which in turn may encourage them to explore and adopt other types of technology in

their daily lives. The finding is important because it challenges the commonly held assumption that older adults are less likely to adopt the technology due to negative attitudes and beliefs about technology (Astell et al., 2020; Mitzner et al., 2019; Czaha & Lee, 2009). We thus call for more studies about the positive experiences underlying the technology discontinuation among older adults.

The second theme, interaction disillusionment, sheds light on the challenges that older adults face while using technology. Unmet expectations, insufficient functionality, and humiliations make the use of technology unappealing for older adults, leading to discontinuation. The findings support the current studies (Xie et al., 2020; Chang et al., 2022), highlighting the importance of considering the unique needs and preferences of older adults when designing technology. It is important to note that designing technology for older adults is not a one-size-fits-all solution, as they are a diverse group with varying levels of experience, skills, and preferences. In our cases, both oversimplified phone functions and overly complex PCR-test programs led to technology discontinuation among older adults. The underlying reasons the disillusioning interaction are not only related to physical limitations or cognitive changes among older adults, but also societal and emotional factors such as negative feelings about the ageism integrated in technology design. Therefore, the correlation between individual features and their preferred technology design characteristics are worthwhile to have further exploration.

The third theme, semantic transformation, explores the negative emotions and experiences attached to technology use. Brand alienation, negative memories, and emotional attachments can significantly influence older adults' decisions to discontinue using specific technologies. That is, older adults' experiences with technology are not just influenced by the design of the technology itself, but also by the related services and the meanings individual attached. Our findings shed light to the current debate about whether technology is a neutral tool or not. In our cases, although different technologies are developed with objective functions, they were attached by different meanings due to older adults' personal values and perceptions. Hence, to support older adults in their technology use, the focus should extend beyond the design of technology itself, and turn to the practices through which older adults perceive their experiences. This may be related to, for instance, the design of services such as assisting older adults in becoming familiar with technology, facilitating convenience in technology maintenance and upgrades, and shaping older adults' positive use experience.

The fourth theme, environmental shifts, delves into how changing daily and social patterns can lead to technology discontinuation among older adults even if they hold positive attitudes towards technology use. Specifically, the participant who initially used an iPad for various purposes during the pandemic highlighted how the usage gradually decreased as the pandemic context changed. Similarly, the participant who experienced emotional significance with a smart speaker during the pandemic demonstrated how changing social patterns can influence technology discontinuation. Our findings reveal that as older adults' daily contexts evolve, so do their technology needs and preferences. This highlights the importance of considering technology as more than just a standalone product, but rather an integral part of the physical and social environment in which it is used (Shang et al., 2021).

Finally, the fifth theme, reconnection, highlights how older adults may reintroduce technology after discontinuation, often driven by changes in their needs or priorities. Older adults may decide to reintroduce technology into their lives purposefully, depending on their current circumstances and value priorities. In addition, the concept of function appropriation plays a key role in this reconnection, as it allows older adults to repurpose technology for new and relevant functions that align with their

current needs and preferences. That is, technology use or termination is not a one-time decision but a continuous process that can change over time among some older adults. This aligns with the concept of "technology reinvention," where users continually reshape their interactions with technology over time (Nevo et al., 2016). Besides, in this study, while some older participants discontinued their use of a specific technology forever, some reuse a technology after a pause. The findings suggest there is a distinction between the termination and detachment of technology use among older adults. As this study focuses mainly on the circumstances under which older adults' decisions about technology discontinuation, the specific differences between the termination and detachment of technology use among older adults should be further examined. Consequently, we call on more studies about the different levels of technology discontinuation among older adults.

Looking into the five themes and related findings, the study presents a complex and multifaceted relationship between older adults and technology use during and after the pandemic. For example, the second theme of interaction disillusionment in the study highlights how unmet expectations, insufficient functionality, and humiliations can make the use of technology unappealing for older adults, leading to discontinuation. This suggests that technology design, functionality, and usability play a significant role in shaping older adults' attitudes and behaviors towards technology. Additionally, the first theme of life transformation in the study highlights how changes in older adults' life circumstances can also lead to technology discontinuation. This suggests that older adults' experiences, practices, and values also play a significant role in shaping their decisions to use or discontinue technology. Besides, the fourth theme of environmental shifts further emphasizes that while older adults may have positive attitudes towards technology use, changing daily and social patterns can lead to discontinuation of technology use. This emphasizes that the broader context in which technology is used, including the physical and social environment, matters when considering the technology discontinuation among older adults. That is, as the pandemic eases, older adults' daily contexts evolve, so do their technology needs and preferences. In the case, there is a mutual shaping between older adults and their used technology, as older adults' experiences, practices, and values shape their interactions with technology, while technology design, functionality, and usability shape older adults' attitudes and behaviors towards technology. These findings align with Oudshoorn's work (2005) that highlights that users are not passive recipients of technology but actively shape and appropriate technology to meet their needs and preferences. A future study could explore the mutual shaping between older adults and technology use in more depth by examining the specific factors that influence technology adoption and discontinuation among older adults.

4.2 Design implications

4.2.1 Increase technology compatibility and connection with other technologies

Despite the fact that a positive experience in technology use may contribute to the adoption of technology, our findings show that it may also be associated with the discontinued use of technology among older adults. After being familiar with technology, older adults may become confident in technology use, and thereby turn to try other digital devices, leaving the existing technology aside. In this case, we believe the shifts between different digital devices may result from poor compatibility and disconnections across different technologies. Hence, to ensure the sustained use of certain technology, designers could carefully consider the potential connections of existing technologies with others, based on which increase the technology compatibility.

4.2.2 Prioritize emotional bond over positive/negative experiences

The life transformation theme of the present study showed that positive experiences with technology can boost older adults' confidence in using technology, leading to the adoption of new technologies. The interaction disillusionment theme also highlighted the challenges that older adults face while using technology, leading to its discontinuation. Hence, positive and negative experiences with technology can both lead to technology discontinuation in our case. Rather than considering the binary aspects of user experience, designers could consider strengthening a strong emotional bond between older adults and technology by supporting older adults' autonomy, self-efficacy, and control. For example, incorporating personalized features, such as customization options or recommendations based on previous use, or providing options for older adults to opt-in or opt-out of certain features or functions, can make technology more engaging for older adults.

4.2.3 Design for flexibility and customization

The interaction disillusionment and semantic transformation themes showed that older adults may discontinue technology use due to failed expectations, insufficient functionality, technological challenges, and negative emotions. Older adults have diverse needs, preferences, and expectations when using technology. Rather than creating one-size-fits-all "age-friendly" technology, designers should focus on customizable and adaptable solutions. Providing multiple options for personalization, such as font size adjustments, color contrasts, and interface layouts, can cater to different physical, cognitive, and sensory abilities of older adults.

4.2.4 Recognize the importance of in-person interaction

While technology can facilitate communication and connection, it may not always provide the same level of satisfaction as in-person interaction. The life transformation theme reveals that many older adults may prefer in-person interactions to online chatting. In the case, designers should recognize the importance of in-person interaction and ensure that technology does not replace or isolate older adults from these experiences. For example, incorporating features that encourage in-person activities or facilitate social connection, such as event planning or group messaging, can enhance the social benefits of technology.

4.2.5 Broaden contexts where technology could be used

The environment shifts theme showed that older adults' physical and social environments play a significant role in technology discontinuation. Designers should account for environmental factors when designing technology for older adults, such as changes in daily routines, living arrangements, and social networks. Designers could consider how technology can adapt to these changes, such as by providing flexible and customizable features to enable the use of technology in broader contexts and to meet users' changing needs.

4.2.6 Support temporary discontinuation

Older adults may discontinue technology use temporarily due to some changes in life circumstances or environmental factors. Yet, these older adults may remain emotionally attached to the technology even if they have discontinued its use. Under this circumstance, older adults have a high possibility of re-using in this technology. Rather than avoiding the discontinued use of certain technology, we believe supporting temporary discontinuation might be more suitable for older adults who decide to take a break. For example, incorporating features that allow for easy data transfer and synchronization between devices can minimize the barriers to re-engagement. Additionally, providing clear

instructions and support for temporarily stop and restarting technology use can increase the likelihood of re-engagement.

4.2.7 Facilitate Reconnection

The reconnection theme showed that older adults may discontinue technology use temporarily and then reconnect with it later. Designers could facilitate reconnection by designing technology that is easy to re-engage with and maintain over time. For example, designers can provide reminders and notifications to prompt users to re-engage with technology, and design technology with features that can be easily updated and upgraded.

4.3 Limitations

One limitation of the study lies in the use of phenomenological interviews as the primary data collection method. While these interviews allow for an in-depth exploration of participants' lived experiences and perceptions, they are inherently subjective and reliant on the participants' ability to articulate their thoughts and feelings accurately. To ensure that there was clear communication between the interviewers and the participant, we constantly reviewed and summarized the participant's words during each interview, and did follow-up meetings to triangulate the findings.

Another limitation is that the study included a relatively small group of older adults, which could limit the generalizability of the findings to a broader population of older individuals. Additionally, the study's sample might have predominantly consisted of older adults who were more interested in our project, potentially skewing the results towards more positive or negative perspectives. Having recognized the potential bias and limitations inherent in the study's sample, we made efforts to ensure a more diverse and representative group of participants. We considered variations in technological literacy and demographic factors to gain a broader understanding of technology discontinuation experiences among older adults.

Additionally, considering the continuity of technology experiences across different life stages, we believe that including the pre-pandemic experiences in explorations would contribute to a comprehensive understanding of technology discontinuation among older adults. Yet, studying the full spectrum of pre-pandemic, pandemic, and post-pandemic experiences might have required a significantly larger and more complex research design, including prolonged data collection over several years to capture meaningful changes over time. Due to the time and energy limits, in this study, we chose to conduct the present study with a limited time scope, focusing on the immediate changes and challenges faced by older adults during and after the pandemic. Future research, building on the foundation laid by this study, could further explore pre-pandemic experiences among older adults to gain a more comprehensive understanding of their technology usage behaviors and preferences throughout different life stages and contexts.

5 Conclusion

This study explored older adults' experiences during the technology discontinuation process, shedding light on the complex relationship between older adults and technology use. The identified themes of "life transformation," "interaction disillusionment," "semantic transformation," "environmental shifts," and "reconnection" provided valuable insights into the reasons behind technology discontinuation among older adults. Contrary to common assumptions, positive experiences with

technology may also lead to discontinuation, as older adults explore alternative technologies or prioritize in-person interactions. Design implications include the need for technology compatibility, personalized features, multiple options for customization, and recognition of the importance of in-person interaction. By considering these insights, designers can create more inclusive and sustainable technologies that cater to the diverse needs and preferences of older adults, ultimately enhancing their overall technology experience and quality of life.

Our findings conclude that the discontinuation process of technology among older adults is a complex and multifaceted phenomenon that requires a deeper understanding of the social, psychological, and technological factors that contribute to discontinued use. By addressing these factors, designers, developers, and researchers can develop more age-specific and inclusive technologies that better accommodate the needs, preferences, and emotional experiences of older adults. This, in turn, can foster sustained technology use and improve the overall quality of life for this demographic.

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