Cognitive Changes and Life Transitions of Older Adults and Their Relationship with Technology Use

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Context	Experience	Needs	Barriers and challenges
Isolation	Long periods with little social contact	Daily opportunities for conversation and group activities	Fewer daily chances to interact with peers
Retirement	Loss of mentally demanding work routines	Challenging tasks such as puzzles or part-time work to stay mentally active	Reduced intellectual stimulation after leaving the workplace
Technology use	Opportunities for staying mentally active through online classes, games, and presentations, alongside frustration and slow relearning	Interfaces that match pace, allow learning, and offer guidance at different skill levels	Complex steps, forgotten details, and overwhelming instructions

Fig. 1. Our work explores what experiences, needs, and barriers older adults face. We found that isolation, retirement, and technology use shape older adults' experiences and awareness of cognitive performance.

Cognitive performance often declines with age, yet older adults can maintain abilities through sustained participation in socially, physically, and mentally engaging activities. Awareness of cognitive changes supports active aging by influencing how older adults interpret their abilities, adopt compensatory strategies, and adapt during major life transitions (*e.g.*, retirement). Understanding how older adults navigate cognitive changes and make decisions around life events can potentially guide the design of tools that meet their needs. Our study explores how older adults describe experiences, needs, and barriers related to cognitive performance in later life. We conducted semi-structured interviews with 15 older adults, ages 62-85, recruited from online and independent living communities. Findings show that participants linked everyday activities such as gardening and socializing to cognitive performance, framing them as indicators of staying active. Transitions like retirement or moving shaped access to those activities by removing some opportunities and creating others. Technology created both supports and barriers: tools enabled participation, but also replaced opportunities for developing cognitive skills. We discuss technology design implications that sustain access to social interaction and cognitive activities, and support older adults in active aging.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**; • **Social and professional topics → Seniors**.

Additional Key Words and Phrases: Older adults, Aging, Cognitive performance

1 Introduction

As people live longer [2], they experience subtle cognitive changes, such as slower processing speed, reduced working memory, and diminished attention [12, 20]. Changes often reduce performance on complex, cognitively demanding activities of daily living, such as driving, making financial decisions, and remembering to take medication [53]. Making mistakes can be costly. Hence, maintaining cognitive performance continues to be an important part of active aging. Active aging involves older adults staying engaged in social, physical, and cognitive activities, and participating in society according to their needs, desires and capacities [1, 55]. Many older adults are motivated to stay active in later life, and participate in activities to remain cognitively and socially engaged [29]. Moreover, technology—such as smartphones and internet access—can open opportunities to remain active and support participation [24]. Despite extensive evidence on age-related cognitive changes (or *Cognitive Aging* [12]), little research has explored older adults' needs for continued engagement and the barriers that limit active aging practices, such as exercising cognitive skills.

Our study focuses on older adults' awareness of cognitive changes because it functions as a tool for self-assessment since it affects whether older adults feel they are aging well and motivates how they cope and compensate, such as using reminders [5, 16, 34]. Specifically, we explore their *experiences* with age-related cognitive changes, the *needs* that arise from these experiences, and the barriers that prevent those needs from being met. By focusing on age-related changes, our study provides insight into how tools can be designed to support access to activities and sustain engagement in later life. Our research question is: "*What experiences, needs, and barriers do older adults face with age-related cognitive changes?*"

We answer this question through semi-structured interviews with 15 older adults recruited from independent living communities and online communities to understand how they approach and make sense of their cognitive performance. We found that participants were aware of cognitive changes and maintain their abilities through *social* and *compensatory* mechanisms. Participants linked their cognitive performance to everyday activities that ranged from social interactions to reading, games, and physical activities. Furthermore, we found that life transitions such as retirement and moving into senior communities created or limited cognitive and social activities. During transitions, participants reported needing social contact, reassurance from peers, and activities to support social and cognitive engagement. However, they experienced barriers that limited such engagement. Isolation before moving into a senior community often led to fewer opportunities to interact or engage and retirement removed the work routines that provided cognitive challenges. Additionally, technology enabled staying more engaged in activities, such as presentations and games, but also limited access to practice cognitive skills. We discuss design opportunities that build on older adults' experiences, such as comparing themselves with peers, and technology's role as both a support and a barrier of engagement. In summary, we contribute an empirical study that identifies how older adults describe their experiences of cognitive change in daily activities and transitions, highlighting specific needs and barriers that arise in contexts such as retirement and relocation. Our study shows how older adults link technology use to their awareness of cognitive change, describing both its role in enabling engagement and in limiting opportunities to exercise cognitive skills.

2 Related Work

In this section, we focus on the design opportunities and barriers that affect access to continued engagement for older adults.

2.1 Active aging: Daily cognitive activities need more support

Active aging for older adults refers to participating and being engaged in social, physical, and cognitive activities [55]. General perceptions of aging often frame older adults as frail, dependent, and unable to be productive [52]. However, many older adults take the initiative to engage in activities that are important to them [35, 58] and benefit from working their memory, reasoning, and executive control by learning new skills or doing leisure activities [22, 29, 53]. Many describe such activities as more challenging with age, since they demand more focus, time, and energy [22]. Hence, the perceived effort or costs may make them less likely to engage in activities most strongly linked to maintaining cognitive performance [20, 22].

Technologies can support active aging by enabling older adults to keep learning, stay socially connected, and pursue mentally stimulating hobbies in later life [48]. For example, engaging in intellectually challenging activities, such as taking online courses or using educational apps, can help older adults preserve and even improve cognitive abilities [48].

Similarly, communication technologies support the well-being of older adults by sustaining social relationships and reducing isolation [47]. For instance, social networking and video-calling tools enable older adults to regularly interact with family, friends, and communities beyond geographic barriers [10]. Overall, staying socially engaged through communication technologies can help older people maintain a sense of connection and purpose and can improve their cognitive function as well [27].

Designing technologies for active aging has mainly focused on health and physical engagement [37]. Cognitive aspects have received less attention. Supporting older adults also requires considering other aspects of aging like cognitive performance, which has received less attention. Additionally, older adults might have wide differences in life stages and living situations, such as retirement [17]. How do older adults connect everyday activities to cognitive performance, and how can technology support these experiences as part of active aging? Our study explores older adults' experiences of cognitive changes in later life by focusing on daily activities that they believe relate to their cognitive performance.

2.2 Designing technology for older adults

Designing technology for older adults often requires considering how age-related changes affect their interaction with digital systems [14]. For instance, working memory—which is the ability to hold information for a short time to support learning, communication, and problem solving [13]—can make it more challenging for older adults to learn how to use a new app [64]. Additionally, changes in attention also affect technology use. Older adults have found it difficult to switch focus between the center of the screen and peripheral elements such as navigation menus [64]. They may also struggle to navigate and concentrate on relevant information when mobile UIs and websites contain extensive textual or visual content [14, 64]. Such examples show that cognitive changes that are not accommodated for in technology design create additional barriers to using technology and accessing services like communicating with others [14].

Technology can be *redesigned* to better suit older adults' capabilities and reduce the barriers of technology use by mitigating age-related differences. For instance, older adults can perform tasks as effectively as younger adults by reducing unnecessary complexity, such as narrowing search space or simplifying options [64]. Additionally, one study found that older users move cursors more slowly and have difficulty with small targets. However, when older adults used a fully augmented pointing system, it reduced the time to reach targets by over 50 percent compared to the default mouse interface used by younger adults [62]. Additionally, older adults often have strong motivation to stay cognitively challenged as they age, yet perceived changes in ability and the rapid pace of software changes reduce confidence and limit engagement with technology [19].

These results highlight that barriers to technology use are consequences of mismatched design rather than cognitive or physical changes with aging [24]. Many designs create barriers rather than supporting engagement in activities that older adults see as cognitively stimulating, such as learning and gaming [24]. Therefore, design shapes whether older adults can continue engaging in cognitively stimulating activities that sustain performance or whether those opportunities are lost. What remains underexplored is how older adults' experiences of difficulty, adaptation, and reliance on tools express their beliefs about cognitive changes, and how technology design can respond to those beliefs. Prior work has identified usability problems and stigma [7, 30, 49], but few efforts have studied how older adults interpret their use of technology as a reflection of cognitive abilities and active aging.

3 Background: Older Adults and Cognitive Aging

Older adults commonly experience cognitive changes with age (also known as *Cognitive Aging*), such as reduced memory, attention, or processing speed. Cognitive abilities can be preserved or even improved [12, 20, 32]. Lifestyle and behavior strongly influence cognitive performance over time. Staying socially engaged results in better cognitive performance than less engaged peers [25]. In one study, older adults performed better on cognitive assessments on days when they had more frequent conversations with peers [67]. In contrast, loneliness and social isolation raise the risk of decline [67]. Physical activities such as walking linked to better cognitive outcomes [56]. Leisure activities, such as engaging in hobbies and learning provides opportunities for older adults to exercise the brain and sustain cognitive abilities [29]. Digital engagement offers similar benefits. Using technology for learning, games, or communication provides intellectual challenges that keep older adults engaged [23, 24]. Similar activities, such as online classes and group activities, have helped older adults stay socially connected and mentally engaged during periods of isolation [66]. These activities can help maintain cognitive performance, which are important for daily functioning. Together, participation in social, physical, and digital activities supports better cognitive performance in later life.

Living arrangements and major life transitions can also affect cognitive performance. Older adults who live alone, especially after losing a partner, face higher risks of cognitive decline than those who live with a spouse or partner [65]. Smaller support networks and reduced social interaction contribute to this risk. Retirement also changes engagement by removing work routines that provided daily structure and mental challenge [40]. Verbal memory tends to decline more quickly after retirement compared to when people were working [9, 63]. At the same time, retirement can create new opportunities. With more free time, older adults may pursue hobbies or take part in social activities that support cognition [40, 63]. Moving to new settings (*e.g.,* senior communities) has a similar effect. Older adults who maintain new social contacts beyond family (*e.g.,* joining book clubs) gain access to different perspectives and activities that keep them cognitively and socially active [38]. Such experiences are linked to building cognitive reserve, which is the brain's ability to maintain cognitive function despite age-related changes [38, 50]. Overall, aging is an ongoing process of various life stages and changing capabilities that requires different needs that contribute to active aging [33, 57].

4 Methods

To understand older adults' experiences with cognitive aging, the research team conducted a semi-structured interview study and analyzed the data through inductive thematic analysis [51]. Our interview study was designed to answer the research question "*What experiences, needs, and barriers do older adults face with age-related cognitive changes?*"

4.1 Participants

Participants were recruited through online communities (*e.g.,* Reddit) and independent senior living communities in the broader city area near a large public research university. Most participants (N=13) were recruited through coordinating with senior living event organizers. Event organizers assisted at senior living communities by posting flyers in common areas and sending memos to residents with the study description and eligibility criteria. Inclusion criteria required participants to be at least 60 years of age, live in the United States, and to self-report no diagnosed cognitive impairments. We specifically sought participants aged 60 and older to draw upon a broad range of experiences, including those who are still working and other who are retired.

Characteristic	Participant Responses
Age	62–87 years (Mean = 77.9 years, SD = 8.3 years, Median = 83 years)
Race or ethnicity	White/Caucasian (N=12); Asian (N=2); Black or African American (N=1)
Education	Master's degree or higher (10); Bachelor's degree (3); Associate degree (2)
Occupation	Retired (N=12)
	Working (N=3):
	Part-time Data Analyst (N=1)
	Licensed Psychologist (N=1)
	Self-employed: Independent writer (N=1)
Household composition	Lives Independently (N=11)
	Spouse/Partner (N=3)
	Spouse/Partner and Children (N=1)
Devices used daily	Smartphone (N=15)
	Computer or Laptop (N=9)
	Tablet (N=1)
	Smartwatch (N=1)
Gender	Female (N=9); Male (N=6)

Table 1. Participant demographics.

Participants provided informed consent by email for interviews conducted via Zoom and in person for interviews conducted face-to-face. Each participant received a $30 Amazon, Walmart, or Target gift card as per their preference, delivered electronically by email or physically handed to them (or the event organizer) after the interview.

We conducted 16 semi-structured interviews with older adults. One interview was excluded from analysis because the video/audio recorder unexpectedly stopped at the start of the interview; therefore, the interview was not recorded. Our final interview dataset included 15 interviews, of whom the majority were female (N=9) and the remaining were male (N=6). Participants ranged in age from 62 to 85 years (Mean = 77.9 years, SD = 8.25 years, Median = 83 years). Most participants were retired (N=12), while others continued working either full-time (N=1), part-time (N=1), or self-employed (N=1). Educational backgrounds included associate degrees (N=2), bachelor's degrees (N=3), and postgraduate degrees (N=10). In terms of living, most participants lived independently in senior communities (N=11), resided in senior living communities with spouse (N=3), or independently at home with their spouse and children (N=1). Table 1 provides a summary of participant demographics.

4.2 Procedure

Interviews were conducted either in-person or online and lasted approximately 45 minutes (Mean = 43 minutes, Min = 25 minutes, Max = 70 minutes). In-person sessions took place in private rooms at senior living facilities; online sessions were held over Zoom. To reduce barriers, participants had received the options to participate in-person in a private room at their senior facility or on the university campus, or remotely via Zoom. The informed consent process began with participants reviewing the consent form in-person or digitally via email. After clarifying questions, all participants provided informed consent. All interviews were video or audio recorded with informed consent.

All interviews were conducted by the first author. Participants were asked about daily activities, awareness of cognitive changes, strategies for adapting, and experiences with technology during life transitions such as retirement. Semi-structured interviews enabled the interviewer to investigate deeper into areas that participants emphasized as meaningful in their lives, while maintaining the interview's overall focus on participants' experiences with cognitive changes [4]. This approach acknowledged the heterogeneity of experiences with technology and cognitive changes among older adults [64]. As participants gained rapport with the first author, they shared how personal experiences shaped their beliefs around cognitive performance; the first author then expanded on those experiences. The interview guide included the following questions:

- What does cognitive performance mean to you?
- What aspect(s) of your cognitive performance are you most interested in?
- Can you walk me through a typical day and share anything you think might relate to your cognitive performance?

4.3 Data Analysis

The qualitative analysis followed an inductive thematic approach [51] and involved three main stages: familiarization with the data, coding, and generating themes. The first author transcribed the recordings using Otter.ai[1] and manually checked each transcript to ensure accuracy. This step included correction of transcript errors and removal of filler words (*e.g.,* "like", "um") to improve readability.

4.3.1 Data familiarization. To gain familiarity with the data, the first and second authors reviewed the transcripts and recordings. This process shaped initial ideas and highlighted possible patterns before the coding started [51]. Before coding the full dataset, both the first and second authors independently coded the same initial subset of four transcripts using ATLAS.ti[2]. The first and second authors cross-checked the subset to compare how each author coded the transcripts and to identify any points of disagreement. The authors then discussed their reasoning and any differences in interpretation to build a shared approach before moving on to the full dataset. When interpretations differed, the first and second authors resolved differences by discussing why they interpreted passages differently.

4.3.2 Data coding. The objectives of coding participants' responses were three fold: to categorize activities that older adults believe support their cognitive performance; to specify what experiences and challenges older adults' face in active aging; and to specify older adults' needs that support active aging. The coding process followed an inductive approach and was carried out in two phases. In the first phase, the dataset was divided between the first and second authors, and each author independently coded their assigned transcripts. This approach provided different perspectives and reduced the influence of individual bias [42]. The authors read each transcript closely and applied descriptive codes to segments of text that addressed the research question. In the second phase, both authors independently went through the entire dataset again. The aim of this phase was to check for completeness and consistency in applying the codes developed during the first phase. This second phase also allowed the authors to identify any overlooked sections and confirm that the dataset had been coded thoroughly in relation to the research question.

4.3.3 Generating themes. After completing the two coding phases, the codes were transferred to Miro[3], a collaborative digital canvas to support the process of developing themes. The first and second authors worked collaboratively to group related codes in Miro and organize them into broader themes. Emerging themes were discussed between the first and

[1]https://otter.ai
[2]https://atlasti.com
[3]https://miro.com

second author to ensure consistency. Overlapping codes were combined, and themes were arranged hierarchically. The third author reviewed the code groupings and provided feedback. This collaborative approach refined interpretations of existing themes [42].

5 Results

We present findings related to our research question on how older adults described their experiences, needs, and barriers in remaining active in later life. Various topics emerged from the interviews, such as life transitions, living arrangements, and technology that participants deemed relevant to active aging. The findings are organized into four sections. First, we show how participants described everyday activities that relate to their cognitive performance. Second, we show how they managed their abilities through social and compensatory strategies. Third, we highlight how awareness of cognitive change was connected to major life contexts, such as relocation and retirement. Finally, we describe how technology functioned as both an enabler and a barrier for cognitive engagement.

5.1 Everyday activities that support cognitive engagement

Participants repeatedly emphasized that everyday activities provided stimulation that they believed supported their cognitive performance (Table 2). Participants often linked group activities in their communities with maintaining cognitive performance and staying active and engaged. They described puzzles or games as both social and cognitively beneficial:

> *"I'm happy being in here [senior community]. It's secure, and I have friends, and there's always there's so much to do here. If you did everything that's on the list, you'd be busy all day. So we do put puzzles together, which is good. And we play bingo. There are other things we do that keep our minds working. I think that's how I interpret them."* (P14)

Community settings often created more opportunities for social interaction that were accessible at any time. For example, P8 noted how going into shared spaces allowed interaction with the staff member at the front desk of the senior living community:

> *"I can walk out at 10:30 at night and speak to the little kid that's at the desk"* (P8)

Learning new skills was also mentioned to improve memory:

> *"I think learning is very important, because I'm learning the piano. I also I saw on the internet that said finger movement can keep and increase your memory. So I think if I learn or join some piano learning lessons will increase the movement. I will be benefit from that. So I do that to learn piano and the goal is to improve, to increase my finger movement, also to learn some knowledge how to pitch."* (P10)

Together, these accounts show that participants framed activities, interactions, and learning as essential to staying cognitively active.

5.2 Mechanisms used for reflecting on cognitive performance

Participants often described how they stay aware of their cognitive performance in daily life through social context and compensatory tools.

5.2.1 Interpreting cognitive changes through social interaction. Older adults often reflected on their abilities in relation to those around them. Social interactions provided reassurance, comparison, and validation that helped participants

Type of Activity	Examples	# Participants
Lifestyle/Leisure	Cooking, chores, gardening, travel, daily planning	10 {P3,P5-P11,P14,P15}
Social Engagement	Socializing with friends, phone calls, family chats	9 {P1,P2,P6-P9,P11,P13,P14}
Reading & Writing	Newspapers, books, articles, research, journaling, scripture reading and note-taking	8 {P1,P5-P8,P10,P11,P15,P16}
Exercise/Physical	Walking, Pilates, yoga	7 {P5-P11}
Games & Puzzles	Mahjong, Scrabble, Solitaire, Sudoku, Bingo, crosswords	6 {P2,P9,P12-P15}
Technology Use	Texting, Instagram, Zoom book clubs, presentations, YouTube, TV, lectures, spiritual talks	6 {P1,P2,P3,P7,P8,P10}
Creative / Skills	Woodworking, piano learning	2 {P10, P15}

Table 2. Examples of activities reported by participants that they believe support cognitive performance and help them stay active.

interpret cognitive changes in ways that reduced worry or supported the importance of staying active. These strategies highlight how awareness of cognitive changes was connected to shared community life.

Participants described relying on reassurance from peers who emphasized that cognitive changes were "normal" in later life. Such validation reduced pressure to seek explanations on their own and supported acceptance of age-related changes, providing a collective way for interpreting their experience. Participant P1 describes how they rely on the reassurance of older peers who normalize these experiences as part of aging and retirement. They reflected on their cognitive performance with an attitude of accepting or coping with cognitive changes:

> *"I'm aware of it [cognitive changes] as they happen. I'm not needing to start doing some research online to find out what's going on. I've just been told by more than several residents here who are 5 and 10 and 15 years older than me 'It's okay, that happens. Welcome to life in full retirement.' So I've only accepted what they have to say, not really worried, because the pressure's not on me to find out what's going on. I do respect their response that has a lot to do with just the whole body, mind slowing down."* (P1)

Many participants evaluated their abilities by observing peers in their community. Seeing others with more advanced decline prompted them to reflect on their performance:

> *"Observing so many people here with cognitive [decline] it makes you really aware. Thank God. Right now I'm not losing it, but if I am starting to lose it, I'm in a safe place and I would want people to support me. And guide me around that. I think that's what it is, just observing."* (P7)

Participant P11 described the *experience* of how family history of Parkinson's and Alzheimer's disease, combined with the observation of others with advanced cognitive decline, led to the fear of losing independence. They mentioned that this fear motivated them to follow medical advice to delay further decline:

> *"My husband just died a year ago from Parkinson's after a long time, and my father-in-law died of Alzheimer's. So I'm keenly aware that I have a lot of fear about losing my ability to function independently. So I was concerned about it. That's why I went to the doctor, because I don't want to decline to the point where I've lost touch with where I am, because I've seen people like that. It's very disconcerting. There are people here [senior community] who are on that track, and it's sad, it's so sad, and they feel isolated and cut off, and that makes me sad for them, so I don't want that, so I'm doing what she [doctor] said to do to slow that process down."* (P11)

Participants emphasized that being busy with activities helped maintain cognitive performance. Some participants used this mechanism to contrast their active lifestyle with others.

> *"I think if you keep busy, you're a lot more alert. Your abilities are better. Generally there are some people here that don't do anything all day. Maybe they'll go down to a performance or something, but, and they just don't seem connected to what's available. This place has a lot of activities and it's good. It keeps you engaged. You have to use your brain quite a bit. So all those things I do every day are related to cognitive functions."* (P15)

5.2.2 Relying on external supports for memory. Participants relied on external tools and habits to manage daily life when they noticed changes in memory. They used notes and checklists to remember things they might forget. These tools helped them stay on track with tasks and notice any lapses.

Several participants used written notes, calendars, or lists to ensure they did not forget tasks or medications. Participant P11 described tracking sleep and medication because they fear forgetting about them:

> *"I kept a track record of my sleep, what time I went to bed, what time I got up, how many times I got up, things like that. For the sleep therapist, I tracked my medicines, because I'm afraid of forgetting one. And so I write them down."* (P11)

P2 describes how they use checklists when they notice they are overlooking tasks. They describe the checklist as a *crutch*, which implies dependency, and also as a *tool*, which implies a strategy to compensate for decline. They explicitly connect this strategy to their engineering background, where checklists were routine. In later life, the purpose of checklists has shifted. What used to be professional practice for them has become a personal tool that helps them avoid forgetting.

> *" In some ways, when I start overlooking things, I respond to that by using checklists. I'm an engineer. Checklists have always been part of my job and my profession. So you make a little checklist to make sure you don't overlook things. Now every Monday, I do five things around the house, and I have little checklist to make sure I don't forget something. And it becomes a, I want to say a crutch, but maybe it is. It's just a tool to make sure I don't overlook something I had intended to do. And there are other tricks to the trade I'm sure you can use to avoid unfortunate events due to decline in cognition, whatever they might be."* (P2)

Participant P14 described their *experience* involved difficulty sustaining cognitively demanding activities like reading and math. They mentioned using checkbooks on their computer for record-keeping. Technology compensated for the arithmetic and record-keeping that the participant no longer performed themselves.

> *"I can't read anymore. I mean, I can read the words, and I don't know if there's some place I could go or something I could do that would help me get that back. But I don't know how, when I was younger, I don't know how I got through school. When I look at books now, and try to read. How did I ever do this and get through school? And if it's [reading] too challenging for me, I just quit. I'm a big quitter. I don't do math. I let the computer take care of my checkbook, I just don't. I've never been good at math, and I think that's a cognitive thing."* (P14)

Participant P12 described relying on their spouse for reminders and updates about daily activities:

> *"My husband is very, very organized, and he often sets the stage for the day, like he reminded me, it's quarter to three to come up [to this interview]...And we talk in the morning about what's coming up that day. And I don't think it's because I've just gotten lazy, because he does it...And sometimes I have to ask*

> *him what we're doing, because I forget. So I do rely on him a lot. I'm sure I could do everything if he didn't, but he takes care of all that."* (P12)

5.3 Awareness of changes in life transitions

Life transitions or contexts such as isolation, retirement, and relocation shaped how participants became aware of changes and what support they needed.

5.3.1 Isolation. When participants were prompted to describe aspects of daily life that might relate to cognitive performance, participant P8 emphasized social engagement and the decision to move into a senior community. They explained how moving made them realize the effect of prior isolation on their well-being, and the *need* for group contact for social connection:

> *"I moved into here [senior community] because I was tired of being alone. My husband died of Alzheimer's, and so I was home alone for three years, tired of taking care of the house, taking care of the lawn, taking care of the new furnace, and I needed people. And I go to lunch with friends, but then I had all evening...I just moved in March, and maybe [by] the second month I thought, my God, I really was isolated. So I need the stimulation of the group."* (P8)

Participant P9 described how widowhood created isolation and reduced daily interactions. Their *experience* emphasized minimal interaction over many years and a *need* for stronger social bonds and conversations with others to feel engaged. Relocation to a senior community helped introduce new interactions:

> *"I've been here [senior community] about two months, and prior to that, I was a widow for five years, and realized most of my interaction, most of my speaking during the days with the television set. So for me, this transition has been very fine socially; I need to be able to talk to people again. I need to listen. I need listening. I think is a biggie for me. Just kind of I want to know these people. I may be here from now until I die, and these are going to be the most important people in my life. I want to know them well."* (P9)

5.3.2 Retirement. Participants became aware of fewer opportunities for intellectual or cognitive stimulation after retirement. Participant P1 described their *experience* of losing intellectually demanding tasks after retiring. They expressed a *need* to find new intellectual challenges to maintain their cognitive performance.

> *"I just went into retirement about two months ago. I think I might still take on half time work starting this next school year. I'm not sure that I want to be back in high school or college, but I'm pondering that because I would still want to be intellectually challenged."* (P1)

Another participant mentioned their *experience* involved recognizing the need to stay mentally active after retirement. Participant P12 described choosing puzzles as an engaging activity. The *need* was for activities that provided challenge and kept the mind engaged.

> *"One thing I think that I have tried to do is try to do puzzles, you know, try to challenge my mind."* (P12)

5.4 Technology as both a barrier to and enabler of cognitive engagement

Participant P1 described technology as both a constant source of challenge and a source of frustration. They mentioned being a part of a generation that (they felt) had missed early exposure to technology, which made later learning slow and discouraging. This experience was linked to feelings of cognitive performance slowing down, loss of confidence, and increased frustration. Their account shows how interacting with technology becomes a way to stay aware of changes.

> *"Well, [technology] continues to challenge me, because I have to keep learning...It's that I'm noticing [and] getting frustrated because I realized that I am the generation that missed most of this...The thing is that I learn things, but very slowly. And with technology, it might be just my phone or, 'Wait, how do you do that? Okay, no, I know you zoom up for that, but how do you change that?' It's becoming more frustrating because it's not part of my daily life. So I would really enjoy learning, but not just learning. From YouTube clips. The reason it's too much information, and I'm like, I have to stop the YouTube clip and write step one. Start again, backtrack, then start again. It's getting tougher and tougher, and I didn't realize because I am slowing down cognitively. So it's getting not just frustrating, but I'm losing confidence. That's a direct link to me to forgetting stuff. It's losing confidence."* (P1)

One participant described how changes in cognitive performance can make relearning technology more challenging, making once-proficient skills harder to recover. The *experience* involved struggling to recover skills that were once easy to use, while the *need* was for support that made re-learning more manageable when returning to programs:

> *"If your cognitive performance slips, your ability to use technology deteriorates...if you can't remember where to find the appropriate icon on your computer to do what you want, then you're stymied. Then you have to ask for help or fiddle around with it until you get it right. I find that I've been very proficient with some computer programs in the past, but if I pull them up from scratch to use them now, I've got to wade through them and re-familiarize myself because of lack of use."* (P2)

Participant P11 explained that they subscribed to a brain training program with the motivation to maintain cognitive performance. Their *experience* with the website demanded skills in remembering steps, handling private details (like passwords), and adapting to fast-paced tasks that exceeded what the participant could manage. Instead of building confidence, the website made them feel that improving was very challenging, which discouraged them from continuing the activity. They *needed* appropriate technology design that accommodated their skills and pace in using technology. As a result, the technology use blocked access to activities that the participant valued for maintaining cognitive performance.

> *"I signed up for CogniFit to try to help my brain get some exercise, but I couldn't really navigate the website, so I couldn't use this. I just had to cancel it because it was at the baseline. It was over my head, it moved too fast, and I didn't understand. It was very discouraging. And so I just canceled it. And I wish that I had had a lower starting point where it would have been easy, so I could gain confidence. It was already over my ability to really navigate and to do the exercises they were asking me to do. And so that I didn't continue it...It's not user friendly to me and I would like a cognition game program or something to practice your math or whatever. But because it's there on the computer that interface is like a barrier to me. To getting to the help that I could probably use, because I don't know how to get in and log in and all those things, and then you forget your password, and I don't know what my password is, and it's just, it's a barrier. The computer is a barrier. I can see this stuff on the other side, the wonderful activities, and I can see the value of them, but they get too hard, so fast, that it just freaks me out. And I can't do this. So I don't try it anymore because I get frustrated."* (P11)

Participant P3 described their *experience* of technology use as a way to stay aware of cognitive changes. Additionally, they described technology as a tool that enables engagement, and as a source of dependence that reduces confidence and self-reliance. The participant's account described how technology made them aware of cognitive changes and also overly dependent on it. They described "holes in the brain" as a metaphor for age-related difficulty in recalling words. Because they could no longer rely on memory to speak freely, they turned to PowerPoint slides as a way to keep language in front of them during presentations. The PowerPoint slides met their need for the presentation. However, it made them aware of reduced cognitive demand, and as a result, feeling dependent on it. They described giving a presentation in their mid-80s:

> *"I have some holes in very specific places in my brain, and periodically, words, not always the same ones, fall through those holes and they are irretrievable. They they stay there until they want to come back out. It might be an hour, it might be two weeks. You know, I can't speak extemporaneously anymore, I have to have it totally in front of me...So this PowerPoint had a lot of writing on it, but there were some things that weren't on it. I didn't trust my memory to remember the things that were not readable, so I had to have it in front of me. Ten years ago, in my 70s, I would have been fine. But now I'm in my mid 80s, and it's fitting that the eights have holes. They're depressing. And it is depressing to be secondary in life to a computer. And part of my problem is because of the computer, because the computer allows me to do PowerPoints, I don't have to remember as well. So you know the oil can that is supposed to help the brain squeak through things isn't available. It just is not available. There's nothing I can do about it."* (P3)

6 Discussion

Our study explored what experiences, needs, and barriers are faced by older adults with age-related cognitive changes. Findings show that awareness of cognitive changes is contextual and socially embedded. Participants described awareness of cognitive changes with everyday tasks such as puzzles, reading, and financial management, and in life transitions such as retirement or relocation. Their responses suggested that our prompts made them reflect on what they could still do, what had become too difficult, and what adjustments they needed. For instance, retirement removed work routines that provided mental challenge, so participants looked for puzzles or part-time work to replace them. Relocation created new social opportunities, while retirement reduced them. Older adults' accounts suggested that their self-awareness of cognitive performance emerges from regular activities that maintain routines and social engagement, and new transitions that create new opportunities or barriers. Our work seconds the idea of "busy ethic" that links activity with "successful aging" and cognitive preservation in Lazar et al.'s study [29] of older adults' motivations that influenced the way they participated in leisure activities.

Participants used compensatory strategies to manage cognitive changes in daily life. They described tools such as checklists and written notes, which helped maintain independence during everyday tasks. Prior work on compensatory or external aids reports similar patterns. Compensatory efforts provide benefits by enabling or improving participation in many activities, but can also raise concerns about over-reliance [39]. Additionally, technology use shaped how participants perceived their cognitive performance. Such tools like slides or financial software enabled continued engagement but reduced reliance on memory. Some participants were aware that their ability to pick up skills again had changed, such as relearning software after periods of non-use.

6.1 Implications for Design

Older adults have varied experiences, abilities, and skills, which shape their needs through different stages of life [43]. Their accounts show that cognitive changes appear differently across activities, transitions, and technology use. As a result, our findings do not point to one design approach. In the following sections, we draw out how these insights can guide technology research and design for older adults.

6.1.1 Social Comparison as a Mechanism for Reflection. Social interaction is an important way for older adults to reflect on their cognitive performance. They compared their routines with less active peers in their senior living community to interpret whether they were doing enough to remain cognitively engaged. Reassurance from peers also shaped awareness of changes after life transitions (i.e., retirement) by normalizing cognitive changes. Our results complement the findings of prior work that has shown older adults use comparisons in interpreting smart home data [8]. Caldeira et al. found that participants valued data about activities such as going outdoors or time spent being active when it was presented alongside peer data [8]. They used these comparisons to affirm that their lifestyle was active. In our study, participants connected everyday activities like puzzles, socializing, and routines to assess and reinforce their sense of cognitive performance.

Building on these insights around the prevalence of social comparison, novel digital systems can potentially motivate older adults' participation in beneficial activities by providing ways to compare themselves with peers and strangers. An example of this is LabintheWild [41], an online platform where people complete tasks and learn how their performance compares to others on a global scale. When compared with others, curiosity can also become a source of motivation to do better [28]. When applied to cognitive performance, a comparison-based approach can motivate adults to engage in puzzles, conversations, or learning tasks, instead of focusing on errors or decline. This shifts feedback from a deficit model, which is common in studies with older adults and aging [59], to a model that emphasizes peer activity and participation. Systems that show feedback can motivate engagement and avoids framing aging as a "problem" or being defined by decline. However, comparative feedback can have negative consequences [8]. For older adults, negative comparisons risk discouraging participation or damaging identity. A possible solution is to design comparisons that focus on what was achieved rather than mentioning lost abilities or focusing on measures that feel competitive.

6.1.2 Balancing Support and Cognitive Engagement. Participants described how technology supported daily activities while also reducing opportunities for cognitive engagement. Tools change how older adults interpret their abilities, often linking reliance on technology with a loss of confidence and independence. For instance, a participant (P3) explained that relying on slides allowed to create PowerPoint slides but reduced confidence to speak from memory. Such interpretation extends research on cognitive offloading, where tasks move from memory to external aids [44]. Similarly, offloading has been observed in compensation tools and generative AI systems, which can reduce engagement and cognitive skills, like critical thinking [18, 26]. In our study, participants emphasized that offloading also meant losing the opportunity to practice cognitive skills when using technology.

Participants described retirement as a life transition, one participant considered part-time work as a way to stay intellectually active. One challenge for designing human-centered systems for older adults is supporting effective workflows without removing opportunities for mental effort. A more supportive approach might scaffold some engagement and decision-making by prompting users to review steps or confirm results rather than bypassing them. Prior work shows that older adults can be motivated to participate in activities that support their cognitive well-being [6, 29]. In one study, older adults were motivated to complete mentally stimulating tasks since it allowed them to develop their cognitive skills [6]. These tasks resemble "brain games" but add real-world value. Older adults can also benefit from meaningful engagement when they act as producers rather than passive consumers of technology [58, 60].

6.2 Tracking Cognitive Performance

The use of tracking tools is beneficial for older adults since it supports the management of their self-care routines and well-being [37, 54]. Personal informatics systems allow people to collect and reflect on personal data, such as sleep [15] or physical activity [31], but questions remain about how cognitive performance might be tracked [46]. Our findings show that participants interpret daily activities, such as gardening and socializing (Table 2) as indicators of cognitive performance. They saw these activities as a way to reflect on if they are staying active in later life. Research on activity tracking has shown that older adults want systems to reflect activities they consider important, such as hobbies [59]. Current work has begun to question what a system for cognitive personal informatics might look like, including what should count as a unit of activity and how goals could be set without framing aging as decline [46].

6.2.1 Tracking Cognitive Performance through Everyday Activities. The connection between daily activities and cognitive performance represented participants' beliefs (or folk theories) about staying mentally active. Current cognitive tracking systems often focus on test scores or biomedical markers [11, 21], which risk ignoring what older adults themselves interpret as important for their cognitive well-being. Ignoring these perspectives can make tools feel irrelevant or stigmatizing. Prior approaches in lived informatics draw attention to the value of daily life practices: "*There will be difficulties in personal informatics if we ignore the way that personal tracking is enmeshed with everyday life and people's outlook on their future*" [45]. Designing tracking systems that represent/include older adults' indicators of cognitive performance—such as regular reading, gardening, or social interaction—aligns with active aging by supporting participation in valued activities [59].

Prior work in subjective cognitive decline shows that perceptions of worsening performance can reflect mood factors such as stress or depression rather than objective cognitive changes [68]. In our findings, participants reflected on changes when they saw cognitive decline among others in their community, or when they felt less capable with tasks like reading or software use. These perceptions shaped their needs and sometimes led them to avoid activities. Designing tracking systems that link activities with other contextual factors, such as mood or social activity, could help distinguish perceived abilities from actual abilities. Older adults may gain a richer view of how their daily life influences their cognitive performance, supporting more constructive beliefs. Overall, systems for tracking cognitive performance could focus on tracking participation in everyday activities, visualize changes over time, and provide feedback that affirms continued engagement.

6.3 Research Challenges and Limitations

Our study balanced methodological rigor with sensitivity to the realities of working with older adults [3]. Asking older adults to speak about cognitive performance required care because the topic can feel sensitive or stigmatizing, which may discourage participation [61]. Interviewers must make decisions to handle stigma and emotions, including how to introduce the topic, when to ask, and what to do after the interview [36]. In our interview study, many participants described the interviews as meaningful, noting that they offered space to express concerns and reflect on their experiences. Cognitive performance was an emotional subject for some participants. Two participants cried when reflecting on their experiences, yet they continued because they said they valued the opportunity to be heard. We clarified to all participants before and during the study (including around difficult moments) that they could stop the interview and leave without any judgment or adverse consequences.

Our study's goal was to provide situated accounts of how awareness of cognitive change unfolds in later life. All participants had college or graduate degrees, which limited differences in educational background. The results showed that awareness of cognitive changes emerged in context, in daily living and life transitions, the study did not trace every aspect of cognitive performance or every aspect of life. Participants emphasized different areas of life, with some focusing on technology and others on social connections or emotional experiences. This variation shows that aging is shaped by different abilities and circumstances. Future work that focuses on narrower domains, such as financial management or digital learning, could extend these accounts by offering views of how cognitive changes unfold in specific contexts.

7 Conclusion

Our study explored how older adults describe their experiences with cognitive performance and the needs and barriers that arise across daily activities and life transitions. Participants reflected on puzzles, gardening, reading, and conversations as ways to remain mentally active. These activities served as personal indicators of ability, yet transitions such as retirement and relocation reshaped access to them. Retirement removed routines that had once provided daily mental challenges, while relocation expanded or restricted social opportunities depending on the setting. Technology played a dual role by enabling participation while sometimes removing chances to practice skills when tasks were automated.

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