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"You Know, I Swipe My Card and Hope for the Best": Technology and Cognition as Dual Landscapes of Change

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Abstract

Mild cognitive impairment (MCI), or objective and subjective cognitive decline, affects an estimated 15%–20% of individuals over the age of 65 . People with MCI generally live in community settings but may be at risk for functional changes in out-of-home participation, particularly when their instrumental activities are cognitively demanding or complex. Technology is part of the interface in complex person-place relationships. The purpose of this study is to examine the nature of everyday technology use in the context of out-of-home participation for community-dwelling older adults with MCI. Community-dwelling older adults with MCI (MoCA <26, >17; ($n=10$)) were recruited for data collection using a Go-along method (naturalistic observation, semi-structured interviews, and photography) for multiple out-of-home activities. Findings from this project suggested that participants felt that technology, like their cognition, was out of their control and difficult to predict or change. Four ways the participants experienced the "technology landscape" in their daily lives included: enabling being present, facilitating participation, impeding goals, and constricting options. We present a model of the intersection of cognition, participation, and technology in daily life, and discuss ways that technology can most effectively be used to extend well-being for a population aging in place.

Keywords

everyday technology, go-along interview, mild cognitive impairment, social participation, aging in place, out-of-home behavior

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Introduction

Technology in daily life is omnipresent. The digital era offers automatization, social connection, and convenience to enhance quality of life, with continued promise in the coming decades (Stansberry et al., 2019). Among older adults in the United States, three in four people 50+ say they regularly rely on technology to stay connected, and a third of those 70+ use technology to maintain personal independence (Kakulla, 2021). Smart phone ownership, which is a proxy indicator of technology use in daily life, has steadily increased to an estimated 61% of those 65+ in the United States (Faverio, 2022). In the wake of the COVID-19 pandemic, there is also evidence of accelerated adoption of technology among older adults for instrumental tasks such as grocery shopping, health management, and financial transactions (AARP, 2021).

The role of technology for social interaction and maintaining interpersonal connections has also expanded during COVID-19 responses worldwide. While offering new venues for staying connected, existing technology use disparities have also been heightened. At the start of the pandemic, in March 2020, only 20% of community-dwelling older adults regularly participated in online social gatherings (Vogels, 2020), while 25% of those 65+ reported no at-home use of the internet (Perrin & Atske, 2021). Non-participation in digital technologies is particularly problematic during times of physical distancing, leading to more social exclusion in populations already at risk for isolation (Xie et al., 2020). Seifert et al. (2021) identified this as a "double burden" of digital and social exclusion in daily life, particularly for vulnerable older adults aging in the community and in long-term care settings.

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One of these particularly vulnerable subsets is individuals experiencing mild cognitive impairment (MCI). MCI, or objective and subjective cognitive decline, affects an estimated 15%–20% of individuals over the age of 65 (Alzheimer's Association, 2018). Although there is wide variation in type and trajectory, people with MCI generally live in community settings and experience subjective change (Sachdev et al., 2015) in functional ability associated with decline in memory and executive function (Petersen et al., 2009). There have been several studies that specifically examine how having MCI impacts one's ability to effectively and accurately use everyday technology (ET). In a series of inquires with community-dwelling older adults in Sweden, a group of scholars established that individuals with mild dementia experienced barriers to ET use across multiple domains (Nygard & Starkhammar, 2007); that progressive decline in cognitive ability was associated with decreasing technological ability (Malinowsky et al., 2010); and that there were significant differences in self-perception and observed ET use among groups with MCI (Nygard et al., 2012; Rosenberg et al., 2009). The use of ET was also strongly associated with impaired performance in daily activities (ADLs) for individuals with MCI (Ryd et al., 2015). There is substantial evidence that the ability to use and benefit from technology in daily life is impaired for older adults who are experiencing cognitive changes, with many of these studies focusing on in-home technology (such as microwaves, phones, remotes, and digital devices).

There is also strong evidence that older adults with changes in cognitive status are likely to have curtailed abilities to engage in instrumental activities in community spaces beyond the home (Nygard & Kottorp, 2014). In fact, for individuals with dementia, challenges to completing instrumental activities outside of the home are the primary barrier to continuing to age in place (Thoma-Lurken et al., 2018; Ura et al., 2021). Declines in cognition have been theorized to predict declines in community participation, with discretionary leisure (Chaudhury et al., 2021) and complex outings (Wettstein et al., 2015) being the first to be pruned. The relationship of individual and community is more complex, however, with a recent international study finding that the active processes of "lived place" involve action, agency, and social practices of the individuals with dementia (Ward et al., 2021). For individuals with MCI, similar processes are likely at play and are critical to understand.

To date, the nature of the person-place relationship for individuals with MCI is not well studied nor understood. Few studies have considered out-of-home participation patterns for this population, particularly via naturalistic qualitative methods instead of self-report methods. Even fewer studies have considered technology as a feature of out-of-home contexts for this population. The evidence about MCI and technology use that does exist is predominately framed via a lens of restriction, limitation, and disability. Additional understanding of capacity and successes is needed. This study was designed to address the gap in knowledge about participation in everyday out-of-home activities for people with MCI, with a secondary question about how the technology they use, choose, and encounter impacts daily experience. For the purposes of this study, technology is defined as the electronic, technological or mechanical equipment that exist in the everyday life of the individual (Nygard, 2008). In particular, the research question guided observations toward digital interfaces in community contexts, such as digital parking and retail interfaces, smartphones and laptops, technology in a vehicle or store, or wearable technology such as smart watches. The question guiding the analysis presented here is: What is the nature of out-of-home experience with technology in the context of daily life situations for community-dwelling older adults with MCI?

Methodology

Design

We employed a go-along interview (GAI) design with high ecological validity. This methodology, where researchers accompany participants in the naturally occurring contexts of their lives, is well suited for gaining insight into aspects of experience that are tacit, difficult to articulate, or sensorial and imbedded in specific social contexts (Carpiano, 2009). The GAI is compatible with multiple observational data collection strategies (Hand et al., 2017), and particularly well-suited for studying a complex situation integrating a variety of data sources. For this study, where participants had potential limitations in recall and verbal expression, we chose a combination of GAI and observational field notes to generate a robust dataset.

Recruitment and Ethics

Recruitment for the study occurred via fliers at local community senior centers, University-affiliated programs for older adults, and through local neighborhood newsletters. Inclusion criteria, assessed during the first point of contact, included self-report of cognitive changes, community-dwelling status, and ability to communicate in English. Exclusion criteria, assessed during the first in-person meeting, included a Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) screening score of >26 out of 30 or inability to recall the purpose of the study. Following the MoCA screening, all participants were given printed information about the study and provided written informed consent. Participants were compensated 60 USD at the conclusion of data collection activities.

Twenty-three individuals expressed interest in the study: two did not meet the inclusion criteria (no current self-reported cognitive change); one met all criteria but did

Table 1. Participant Demographics.

	Age	Gender	Ethnicity	Drives	MoCA (out of 30)	Self-rated health (1–5)	Living arrangement
Vera	82	F	C	Y	22	3	Lives with spouse
Donald	90	M	C	Y	25	4	Lives with son
Mary	69	F	C	N	22	3	Lives alone
Frank	67	M	C	N	25	4	Lives with girlfriend
John	75	M	C	Y	26	4	Lives with spouse
Helen	84	F	C	Y	26	4	Lives alone
Doris	78	F	C	Y	26	4	Lives alone
Claudia	75	F	C	Y	26	4	Lives alone
Arthur	75	M	C	Y	22	4	Lives with spouse
Marian	83	F	C	Y	25	5	Lives alone

not respond to invitation for initial meeting, eight were excluded based on a MoCA score of >26 (Milani et al., 2018), and two were eligible but decided not to participate due to scheduling conflicts. This yielded a final sample of 10 participants.

Procedures

Following screening and obtaining informed consent, research team members discussed typical daily routines and outings with each participant to identify common outings and to make GAI plans. At the first GAI, the researcher met the participant at home and traveled for the outing either by foot (walking), driving together (participant driving), or driving separately (researcher following to destination in several instances where the participant preferred not to have a passenger) according to the participants' usual mode of travel. During the GAI, the researcher asked questions about routines, change over time, preferences, decisions, challenges, and features of the physical and social space. Immediately following the GAI, the researcher wrote in-depth descriptive field notes. This process was repeated for the second GAI, which was to another destination/location chosen by each participant. After both GAIs were complete, the researcher completed a final brief interview with any follow-up questions, including a single-item self-rated health indicator. Each GAI was approximately 1 hour (ranged 50–180 minutes) and follow-up interviews ranged from 15–40 minutes.

Statement on COVID-19

All data collection occurred during time periods where COVID-19 restrictions in community activity and travel were not in effect. The first four participants were enrolled, and all data collection was completed in Spring 2020 prior to the initial lockdowns required in the pandemic response. The next wave of recruitment occurred in Summer 2021 and Fall 2021, once in-person research was again allowed in the region and approved by the Institutional Review Board.

Analysis

The final dataset included 20 sets of field notes, four interview transcripts (interviews > 30 min.), six sets of interview annotations, and scores on the MoCA and self-rated health scores. Initial analysis followed a grounded theory approach to open coding with iterative memo writing by all team (researcher and graduate student) members. Early codes across all cases were grouped into emerging conceptual categories (Charmaz, 2014), which were further refined via memo-writing and axial coding. Finally, the four emerging conceptual categories were modeled in relation to one another, with exemplars selected to best represent each. A final interpretive stage was then conducted, using a case matrix with all available information (O'Cathain et al., 2010). The diagram and four conceptual categories compose the results presented here.

Results

Participants included 10 older adults (four male, six female) living in the community with MCI (MoCA scores ranged from 22 to 26). All four males lived with someone else in their residence, while only one of the females had a co-habitant. The average age was 78, eight drove a personal car, and reported neutral to positive (3–5 of 5) health status. Demographic details are presented in Table 1.

Experiences with Changing Cognition

During the go-along outings, participants regularly commented on what they found frustrating or challenging. One key element of frustration was a feeling of "shifting sands" and constant change. Several shared instances where they had difficulty remembering others' names during spontaneous interactions, forgot lists or directions that they "wouldn't have done last week," or felt like something that should be "easy" was unnecessarily complicated by forgetfulness. On the whole, the range of cognitive change and impairment experienced by

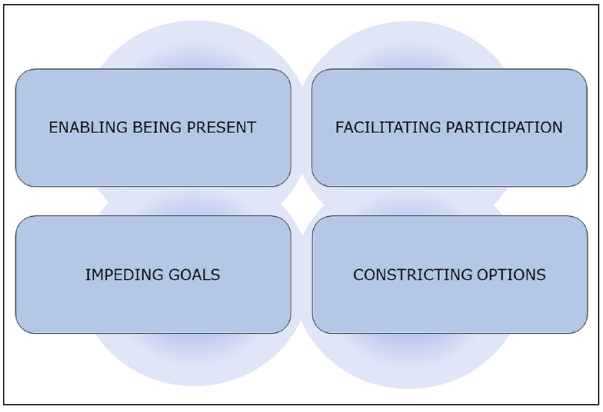

Figure 1. Experiences with technology.

these individuals included not being able to rely on short-term memory, struggling with directions and navigation in both familiar and novel locations, feeling vulnerable and unpleasantly visible in situations when speed was needed, and having a sense that some of the things that "make life easier" for others had an inverse effect on them. These cognitive changes and impairments had a regular yet variable impact on daily life, so participants also acknowledged a sense of unpredictability. These findings indicate that the participants were in a potentially time-limited window of experiencing notable impairment, yet still having awareness about what those changes meant.

The Technology Landscape

There were four primary ways the participants experienced technology in the context of their out-of-home activities and participation in the community setting: *enabling being present, facilitating participation, impeding goals*, and *constricting options*. Each will be described below using examples and quotes from the participants. While they are separated here for clarity, it is important to note that these are not "buckets" into which different types of technology or activity are categorized, but rather modes of experience that may overlap and shift over time (Figure 1).

Enabling being present. Technology in daily life increased the opportunities for activities that were discretionary and personally meaningful. This happened in two ways. First, participants described how using technology raised their awareness about events that were happening. Examples included being on email distribution lists for local interest groups, getting notifications from a neighborhood app, and subscribing to coupon services that regularly sent prompts of potential activities. Claudia explained that a friend signed her up for Groupon, and she recently saw a program with free tickets for seniors; she enjoyed attending the play that she otherwise would not have known about. The passive receipt of these opportunities was enabling, since the participants did not need to actively initiate or plan outings.

Second, technology had an enabling characteristic by extending participants' ability to engage in various community locations that otherwise may have been out of reach due to cognitive limitations. A primary example of this, mentioned by multiple participants, was the use of a GPS while driving to provide route-navigation and verbal instructions of directions to destinations. Arthur described his struggle with directions, which he said was life-long but rapidly worsening: he would arrive at an intersection in his own neighborhood and be unsure of which direction to turn. Arthur had his wife program the destination into his GPS device in the morning before she left so he would be able to find his way to shops. Other examples of participants using technology to extend their capacity for participation in the community included setting phone reminders about when to leave for appointments and doing a "practice run with Google Earth" ahead of time. Enabling being present was a mode through which technology in daily life was *value-added*: the technology of email, apps, GPS, software, and smartphone technology allowed participants access and the capacity to engage in things that otherwise would be difficult, impossible, or unknown to them.

Facilitating participation. There were several ways that technology appeared to serve as a "lubricant" for community and social participation, allowing individuals with MCI to carry out the "normal things" (Frank) and accustomed routines. In this category, there was a noted distinction in examples from pre-COVID data collection and post-lockdown life. For example, technology facilitated participation before the pandemic such as participants' use of email, texts, or video calls to stay connected to friends and family and get regular reminders about planned activities.

Following the rapid spread of digital platforms during the various stages of the COVID-19 pandemic, participants also talked about how technology facilitated participation by lowering the threshold of effort required to be socially engaged. Helen attended Zoom (online audiovisual platform) exercise classes, John attended Zoom courses at the local university, and Arthur attended weekly Zoom Buddhist services. While they acknowledged that these experiences were "not the same" as attending in person, the technology of the video-conferencing platform made participation exceedingly more achievable. Similarly, various participants talked about the new-found ease of using automated grocery orders, delivered curbside, which simplified the challenge of grocery shopping; or the ease of paying via one-touch smartphone app. Frank described how having a pre-loaded gift card from his daughter facilitated his ability to pay in the drive through of his favorite coffee store chain. By ordering his coffee ahead of time on the app, the process became "smooth sailing" and provided him a sense of ease and competence without the in-person interface. In a range of ways, technology made it *easier to feel competent* in social situations and easier to be successful at necessary tasks and activities.

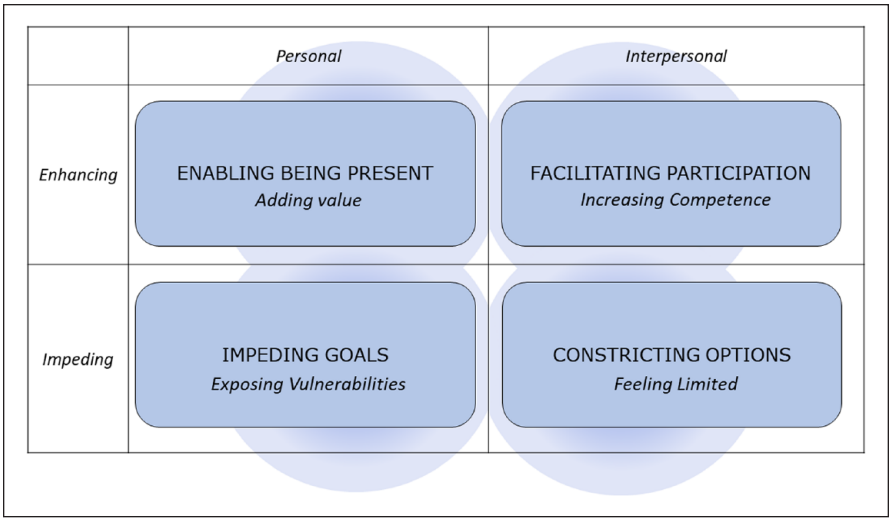

Figure 2. Dual landscapes.

Impeding goals. Contrary to the examples above, technology in daily life also operated as an impediment to engaging in the activities or in the ways participants wished. For example, Claudia preferred to shop in the morning, when she had the most energy, but occasionally there was no one operating the cashier line during the morning hours. The overwhelming prospect of using self-checkout was "not a possibility"; therefore, she only shops later in the day when a cashier is available, despite being the time she is more fatigued. Technology was an impediment in several other ways related to financial transactions. Participants were observed avoiding spontaneous decisions about purchases, limiting their amount of laundry to what could be done with quarters (thus avoiding the use of a pre-paid card system), and fumbling at the checkout or restaurants with credit cards. Vera shrugged, "You know, I swipe my card and hope for the best," and Helen joked after checking out that she was never sure if she "paid twice or not at all," particularly when she needed to use the chip system with her credit card.

During one observation, Mary was taking a taxi to the discount box store for her weekly essentials, explaining on the way that she tried hard not to inconvenience friends by always asking for a ride. She explained further that the ride cost three dollars, and she tipped two dollars; however, the researcher observed her pay for the cab ride with the prepaid card, then she hit the "suggested tip" button, which left a tip of five dollars for the three-dollar ride. Mary appeared unaware that she had paid more than double the tip she intended in both directions of this outing. Vera, who cared for her husband with more significant cognitive challenges, generally felt competent but said ruefully that it was "a real blow" when "[she] can't even work the parking meter" with the touch screen system. In all these instances, systems that were designed for the convenience and ease of users in the general population had an inverse impact on these individuals. Technology impeded success and was a challenge to their personal identity and self-confidence. In financial situations, technology appeared to frequently exacerbate risk and expose vulnerabilities in daily life.

Constricting options. Finally, technology interfaces were a source of constriction when it came to the available choices and opportunities available to participants. This category included constricted physical access, such as the need to use a certain smartphone app to pay for street parking in a section of the downtown district. John and his wife instead rented a parking space in a parking garage for a monthly fee, and only went to restaurants or museums that were walkable from that location. There were also examples of constricted access via technology-mediated systems. Donald expressed a desire to attend some of the fascinating nature and conservancy programs offered for free at a nature park he frequently hiked, but although free, they required an online signup via a membership account which he found unmanageably cumbersome. Therefore, he had never attended the program.

Technology could also be a factor in broader interpersonal life roles and pursuits. While several alluded to feeling the strain of learning and adapting to new technologies during COVID-19, there was a sense of pace and skill related to technology that constricted everyday engagement patterns. Describing how she spaced out errands to no more than one each day, Claudia said, "everything is more complicated than you'd expect" and took more of her mental energy and focus than in past years. Participants commented on feeling that technology sped up the world around them, so even when they were unchanged, they felt slow by comparison. Doris had worked at a children's toy store at the local mall for many years. While she had offers to advance to better paying roles, she said she always declined because she did not think she could learn tasks such as managing the register or ordering inventory via the online system. The result was that she had stayed in the "greeter" role at

work, working "for pennies." Overall, this category included examples of how various forms of technology limited opportunities and challenged the ongoing enactment of roles they valued.

Dual Landscapes of Change

Participants felt that technology, like their cognition, was out of their control and difficult to predict or change. The intersection of these two influences can be mapped across the four modes of experience, as shown in Figure 2. Depicted in the first row, technology interfaces in daily life could have a positive and enhancing impact: it served to add value to daily life by enabling engagement and increased ability and competence while engaging. Reciprocally, technology also functioned to curtail participation by exposing points of vulnerability and limiting physical and systemic access to opportunities (second row).

There was also a distinction between the personal and contextual aspects of the technology-cognition interaction. As grouped in the first column, there was an intimately personal aspect of the impact of technology on daily life. The individual's quality of life was either enhanced through the ability to engage in meaningful activities or limited as their wishes and personal capacity and self-image were challenged. There was also a contextual and interpersonal aspect, grouped in the second column, where the technology in the physical and social environment facilitated engagement and increased competence, or decreased the number and quality of options available to individuals with cognitive change. As previously stated, these four modes of experiencing the technology landscape were not mutually exclusive, with participants having both enhancing and limiting influences in the context of daily life.

Discussion

The individuals in this study regularly engaged in activities in the community, despite experiencing changes in their cognitive abilities. Observations and accounts of quotidian experiences showed the significant—yet sometimes tacit or hidden—role of technology in daily life that shaped these patterns of engagement. Key findings include the four modes of experiencing this technology landscape, where technology served to enable, facilitate, impede, and outright constrict participation for this population. Furthermore, we found that cognitive change and well-being intersected with these modes of experience, with enhancing/limiting and personal/interpersonal factors as dual landscapes of change that the participants navigated on a regular basis. The go-along methodology was feasible and effective in generating rich insights and examples. These results extend the literature about aging in place with cognitive impairment, and about how the various digital technologies that mediate engagement out of the home are experienced.

One contribution of this research is the articulation of ways in which ET specifically serves to support and extend participation for those with cognitive changes. These modes of experience vary from the ways that technology extends and facilitates participation for the general population, which is often designed for convenience and efficiency, and add nuance to a body of literature that has tended to focus on the barriers and limitations (e.g., Nygard & Starkhammar, 2007). These findings are consistent with evidence that older adults with notable cognitive change can develop creative solutions (Hedman et al., 2016), use coping strategies (Sturge et al., 2020), and learn by doing in daily life (Rosenberg & Nygard, 2013). Another interesting aspect of these findings is the reciprocal impact we observed when technology meant to ease participation for the general population actually increased the challenge for those with MCI. This has policy implications, and highlights the need to consider universal design principles in the public-facing technology in a community (e.g., parking meter systems, retail purchases, restaurant, and self-service payment options). This study was explicitly focused on the experiences of older adults with MCI, and these findings may be unique or may be like experiences of other populations at risk for curtailed out-of-home participation. Additional research is needed to understand these patterns and needs with ecologically valid methods.

In comparison to the study of ET within the home context, our findings suggest that the role of technology for a population aging in place transcends the theoretical dualism that is often adopted. For example, measuring the frequency or accuracy of technology use is not necessarily indicative of the older adults' ability to carry out required or desired tasks. An ecologically valid observational approach identifies patterns of participation in context and can represent technology as part of a person-place relationship, not an object. For this reason, while more nuances may be challenging to transfer into policy, this research is a small step toward centering function and supporting older adults with cognitive impairment who regularly interact with technology in community settings.

The intersection of task, technology, social and physical places, and personal preferences in these "intersecting landscapes" extend our understanding of technology as existing within holistic, social contexts. While using technology does require an individual to possess certain cognitive and motor skills (Malinowsky et al., 2018), the use of technology was found to be an aspect of experience that mediated the ability and nature of participation. From this perspective, ET use is best understood embedded in real-life contexts as compared to simulated skill tests (Schmidt & Wahl, 2019), which supports the validity of the methodology employed here.

As Walsh et al. (2020) suggested, there appears to be a complex association between activity engagement and ET use for older adults, which we also believe to be true

for the subset with MCI based on our findings. Participation out of home is critical for quality of life while aging in place yet are at risk for those experiencing cognitive change (Sturge et al., 2020). This research offers a valuable perspective into the influence of technology in community settings and out-of-home participation patterns. The existence of "invisible" technology thresholds to engagement and the potential of vulnerability and error in financial transactions should be of particular focus for professionals working to support this population.

Limitations and Next Steps

There are several limitations that should be considered when interpreting and applying these findings. Foremost, the convenience sample was from one geographic region, and their experiences should not be generalized to adults living with MCI in communities that may have notable differences; the sample was not racially diverse; and a larger sample size could represent a broader range of ways that older adults interface with technology in the community. For example, older adults who are frail or in poorer health may be less likely to be drivers, or less able to learn and use new technology across multiple domains. However, approximately 84% of people aged 65–85 in the United States have a driver's license, so this sample is reflective of that distribution. A second factor potentially limiting the application of these findings is that sampling and data collection occurred both before and after the acute phase of the COVID-19 pandemic in the United States. While this was an interesting point of reflection and comparison in our analysis, it is probable that the rapid uptake of technology medium in daily life—and particularly retail and leisure industries—will have an increasingly stark impact on individuals' community participation patterns in every age sector. This will be an important area for follow up and future inquiry.

Conclusion

In representing the experience of older adults as technology users, social discourse and media have a tendency toward caricature: technology is cast as a frustration and barrier for older adults—conversely, the growing gerotechnology industry capitalizes on the image of technological innovations as the solution to many of the common challenges associated with aging in place. This research suggests that ET is experienced in nuanced ways while participating beyond the home context, with the potential to support and inhibit ongoing participation in community spaces. Technology, including the "invisible" technology demands that are increasingly part of engaging in daily life, have unique significance for the ways older adults with MCI engage. This research is an initial step in understanding the range of ways these experiences unfold and can inform strategies for adopting or adapting technology to support quality of life and ongoing participation. Professionals and policy makers should challenge conceptualizations of technology for older adults that are overly simplistic in order to meet the needs of individuals who experience cognitive changes while aging in place.

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