An MIT Exploration of Generative AI • From Novel Chemicals to Opera

Co-designing Generative AI Technologies with Older Adults to Support Daily Tasks

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Published on: Sep 10, 2024

DOI: https://doi.org/10.21428/e4baedd9.4f2a95fc

1. Introduction

The increase in life expectancy worldwide is a global success story, but along with reduced birth rates, it has resulted in a growing population of older adults and relatively fewer young adults available to provide care. Over 10% of the world's population is over 65; by 2050, that number is expected to reach 16%.[1] Many countries will experience a more extreme level of population aging. By 2050, the 65-plus cohort is projected to account for 35–40 percent of the populations of several industrialized countries.[2] Countries experiencing a transition to such population structures face significant economic and social effects including potential shortages in key workforce roles driven by the retirement of older workers and increased demand for certain service categories such as professional and informal care providers[3] and age-relevant medical services.

Many older adults prefer to live independently, hoping to stay in their own homes for as long as it is practical,[4] but this can be made difficult and require more support due to physical and cognitive decline.[5] While the prevalence of cognitive conditions such as dementia are decreasing, the overall numbers of cases are still rising due to the growing cohort of older adults.[6,7,8] Finding new ways to support aging individuals and their families as they navigate age-related cognitive changes is becoming increasingly important.[9] This paper reports on two co-design workshops that brought together MIT researchers, older adults, and caregivers to jointly discuss, design and prototype Generative AI (GenAI)–based solutions for assisting older adults with cognitive challenges (Figure 1).

Figure 1
We organized two co-design workshops, with participants and MIT facilitators working closely together to discuss and prototype ideas.

1.1. Aging and Cognition

The cognitive effects of aging vary. Most older adults experience normal cognitive aging, which is associated with modest reductions in functionalities including processing speed, memory, executive functioning, language, and visuospatial abilities.[10] However, many experience pathological cognitive decline; a 2022 study of dementia incidences in the United States found rates of 25-27 percent for mild cognitive impairment (MCI) and 18-35 percent for dementia in adults older than 80, increasing exponentially with age.[11] Cognitive decline is a natural part of aging, though its trajectory tends to accelerate around the age of 65.[12] This trajectory can be altered; for instance, through aerobic exercise and an intellectually engaged lifestyle.[13] MCI can, but does not always, lead to dementia.[14] Even a slight potential for technologies to affect disease progression, for instance, by reducing loneliness and depression, is worth investigating. Moreover, technologies that could help mitigate MCI issues for older adults also have the potential to impact other facets of later life including mental health, employment, and the ability to age in place at home.[15] Reduced cognitive function is one of the most important drivers of institutionalized long-term care;[16] as such, supporting cognitive function is critical for enabling independent living.

1.2. GenAI's Potential

There remains an unmet opportunity for new tools, technologies, and services that better serve the needs and wants of older adults and caregivers,[17] and GenAI may have the potential to fill some of these opportunities.

GenAI systems can reference extensive knowledge about issues relevant to older adults, including medical knowledge, how-to knowledge for tasks and skills, and technical knowledge, enabling support for tasks that previously required extensive programming or were otherwise not amenable to automation.[18] While GenAI is still a developing technology, it is becoming increasingly capable of enabling highly personalized and customized services and assisting with complex tasks. Current multimodal AI models can process different forms of media, with the potential to make sense of the daily activities of older adults.[19] Using audio, video, physiological, and other sensors, GenAI could observe and recognize the activities the adult engages in, such as cooking and taking medications.[20, 21,22] Additionally, GenAI can act as a conversation partner or otherwise provide a convenient, human-like natural language-based form of interaction.[23,24,25] These capabilities may help older adults and their caregivers address issues that have, to date, required costly, one-to-one human assistance, or else lacked practical solutions entirely.

While automating some of the highly complex, physical, hands-on elements of caregiving may be beyond the current limits of GenAI, there may still be areas in which existing GenAI services may improve older adults' quality of life by empowering them to complete tasks independently or enhance the efforts of caregivers by allowing them to do more with less time and energy.[26] For instance, GenAI could monitor safety issues, process bills, provide mental health support, and mediate interactions between patients and health service providers such as doctors and psychologists.[27]

Cognitive assistance for older adults is an attractive application area for GenAI for three reasons: (1) cognitive issues become increasingly common with advancing age,[28] (2) GenAI technologies offer the potential to support interventions previously not amenable to automation, and (3) cognitive assistance technologies could have a positive impact on multiple aspects of later life, from housing to work to activities of daily living.

1.3. Challenges and Concerns around GenAI Technology

Several challenges and concerns surround the usage of GenAI, such as privacy and security,[29] a lack of quality control, cost and energy use, automation-spurred job losses, social manipulation, biases and hallucination, and disparities in access to the Internet and, by extension, GenAI services.[30]

Technology that can replicate an individual's likeness may have beneficial applications such as a voice user interface that uses familiar voices to provide more engaging and persuasive reminders.[31] However, the same technology can negatively affect others' lives if their likeness is used without their consent, such as when someone's voice is used for a financial scam.[32] Data privacy laws are critical to preventing the misuse of personal information with GenAI technology. Regulations such as the General Data Protection Regulation and the California Consumer Privacy Act are already present but do not properly address certain issues with GenAI content, such as how to handle generated content that includes personal information. Biases regarding characteristics such as race, gender, and age can be exacerbated by GenAI technology due to its nature of relying on training data—which tends to already include human biases.[33] Understanding and mitigating these

biases remains a critical issue in the application of GenAI technology. GenAI technology can manipulate people, people can manipulate GenAI technology, and people can use GenAI technology to manipulate other people, resulting in an individual's emotions, perceptions, and behavior being influenced in ways they are not aware of.[34]

The challenges and concerns surrounding GenAI are extensive and complex, and understanding them requires the perspectives of several different groups such as users, developers, and policymakers. Even within the category of "users," different individuals have different needs that must be considered as well. Understanding all these perspectives is critical for responsible development of GenAI technology. Despite many of these challenges remaining unresolved, we nevertheless consider it important for the research community to start experimenting with GenAI technology to support older adults, as promising applications may provide additional input in terms of which problems are important to resolve.

1.4. GenAI and Aging

Older adults face different needs compared to those who are in other stages of life due to factors including changes in physical and cognitive abilities. A few, though not many, GenAI products have been designed explicitly for older adults, such as robots and chatbots that provide medication reminders or social conversation.[35] Several studies have shown that artificial agents, especially robots, can reduce loneliness in older adults by providing companionship and enabling social interactions—though these interventions tend to involve rule-based programming rather than GenAI.[36,37] Older adults are more willing to make use of chatbots that they perceive as useful and easy to use,[38] highlighting the necessity of designing solutions specific to their needs and preferences.

For the past several years, research groups including those at the MIT Media Lab have investigated applications of GenAI for older adults to support memory and socialization. Despite the existence of such prototypes, however, GenAI is still a field that is constantly advancing, and its potential impacts evolve along with its growth. Many individuals may not understand how they may be affected by such technology, whether in positive or negative ways—especially older adults, who are vulnerable to being excluded from digital services.[39]

Older people have long been left out of decisions concerning products and services aimed at their demographic due to several factors including retirees' relative absence from the workforce, ageism,[40] and the disproportionately young workforces found in Internet technology[41] and marketing industries.[42] Older adults are depicted in less than one-fifth of United States advertisements, and often in stereotypical, alienating roles.[43] As a result, even products designed with the best intentions to improve older adults' lives can fall short by failing to take into account their full, complex set of motivations, desires, and ambitions, as well as the depth of experience and mental models they may apply to new technologies.[44,45]

GenAI provides an opportunity to develop technology that supports independent living for older adults, especially through supporting cognitive tasks. In our two-part workshop, we aimed to incorporate older adults' perspectives through the process of co-design with the goal of exploring the following research questions: "How might GenAI support people in cognitive tasks as they age?" and "What are older adults' interests, needs, and concerns around such technologies?" Through this collaborative, interdisciplinary effort, we aimed to establish a concrete example and a **road map** that can offer direction on how GenAI technology can be developed to best support older adults in living independently.

2. Co-designing GenAI Solutions with Older Adults

Researchers from the MIT AgeLab and MIT Media Lab designed a **two-part co-design workshop** in which we facilitated collaboration between older adults, experts on GenAI, and experts on aging to develop novel concepts for GenAI technology to support independent living. With MIT AgeLab's expertise in research around aging and longegivity with older adults and MIT Media Lab's expertise in technology development, including GenAI, we collaborated with older adults to explore design solutions that incorporate GenAI to support aging.

Older adults have been engaged in co-design of new technologies in the past, for example, in technologies focusing on health and fitness applications,[46] Internet of things,[47] and social robots.[48] Co-design and participatory design experiences allow co-designers to bring their lived experiences and expertise to the design team,[49] providing valuable insight and knowledge to the design process. Previous work has shown that older adults in co-design workshops tend to focus on both common older adult needs and their own needs, allowing for a rich breadth and depth of perspective by their participation.[50]

2.1. Workshop Design

The workshops were conducted in person at the MIT Media Lab in Cambridge, Massachusetts, bringing together participants and facilitators with a wide range of experiences. The aim of the first workshop was to come up with concrete scenarios in which older adults experienced difficulties with daily tasks and to brainstorm potential ways future GenAI products could assist them in navigating these challenging scenarios. Based on findings from the first workshop, the second workshop challenged participants to delve deeper into conceptualizing and developing GenAI products or services to address the challenges identified in the first workshop. Workshop participants were also asked to discuss individual, family, community, and societal impacts of the proposed AI solutions developed during the second workshop. Overall, the co-design workshops were meant to serve as a starting place for thinking about how AI could improve the daily experience for older adults and reduce friction associated with cognitive aging.

2.1.1. Workshop Participants

MIT AgeLab and Media Lab researchers recruited a total of 29 workshop participants from a variety of sources, including the AgeLab's existing research panels and local community groups, selecting for older adults between the ages of 70 and 96 without a history of serious cognitive impairment, as well as a few caregivers of older adults. The caregivers were 40–96 years old; many of them were also older adults. Participants represented a variety of backgrounds including family caregivers, doctors, nurses, teachers, and MIT alumni. The facilitators and researchers included MIT faculty, staff, and students affiliated with the Media Lab and AgeLab.

Workshop 1 focused on understanding situations and scenarios that may be cognitively challenging for older adults and asked participants to imagine the ways in which GenAI could help alleviate the mental, emotional, and physical burden of these challenges. Attendees of the workshop were randomly sorted into groups; each group included 3–6 older adults, a main table facilitator, and one or two GenAI experts. The experts were researchers who engaged with GenAI in their work—their role in the workshops being to answer any questions older adults may have about GenAI.

Workshop participants completed a variety of hands-on tasks aimed at facilitating creative thinking and collaboration within the small groups. Participants were given context cards that depicted everyday life activities, such as socializing in a park, to help brainstorm around a concrete problem space (Figure 2). Researchers then gave a presentation to the workshop participants about GenAI with examples of the technology. Participants then expanded on the initial problem scoping to ideate where GenAI could be incorporated into the selected scenarios, if at all, leading to storyboarding of concrete scenarios in which older adults may experience cognitive difficulty and a concept of how a fictional GenAI product or service could serve as a solution (Figure 3). Written material from the participants, notes taken by small-group facilitators, and audio and video recordings of small groups were collected and analyzed.

Figure 2
Workshop participants viewing context cards.

Figure 3
Workshop participants creating storyboards.

Workshop 2 started from the scenarios discussed in Workshop 1 to develop paper prototypes for GenAI products and services aimed at alleviating some of the challenges associated with cognitive aging. During this workshop, facilitators guided small groups of participants through a process of developing a conceptual prototype based on the storyboards developed in Workshop 1. For each prototype, participants discussed the form factor and use cases and mapped out a scenario in which the GenAI tool could be used. After prototype development within the small groups, prototypes were shared with the entire workshop and a facilitator led a large group discussion on benefits, concerns, and societal impacts of each of the designs. Prototype drawings, participant notes, facilitator notes, and audio and video recordings of all phases of the workshop were collected and analyzed.

3. Lessons from the GenAI Co-design Workshops

Our workshop participants, each with different backgrounds and different initial levels of understanding of GenAI, worked together to conceptualize ideas for GenAI applications. Participants expressed specific concerns with such technologies, but overall, they were enthusiastic and optimistic about the potential of GenAI. Participants were motivated to find solutions that could solve the daily problems they faced in their own lives, with several of their conversations centered around personal experiences originating from themselves or their loved ones. Our participants' engagement reflects the narrowing technology adoption gap between young adults and those 65 and older in the United States, highlighting older adults' increased presence in the digital world.[51] Those of us who are creating the future of GenAI technology have a responsibility to

include older adults in design processes by supporting accessible opportunities for them to communicate their needs and ideas for technology design. In alignment with this, we have extracted a number of overarching takeaways from our workshops (Figure 4). These are expanded upon in the following subsections.

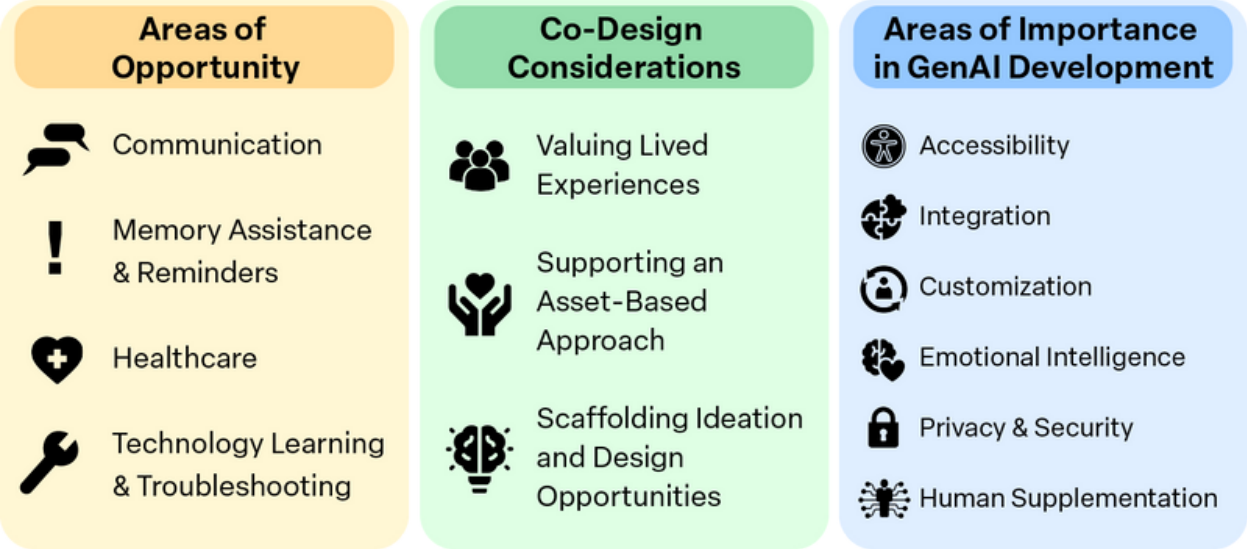

Figure 4
A summary of lessons extracted from our workshops. Made with images from flaticon.com.

3.1. Areas of Opportunity

Older adults participating in our workshops envision several areas in which GenAI technologies could support healthy cognitive aging with a range of impactful applications.

3.1.1. Communication

GenAI could aid conversations in real time and improve peer-to-peer and intergenerational communication by allowing each communicator to be properly heard and feel valued. A powerful application of GenAI would be to "translate" and alter the pace of parts of conversations that are difficult to understand into formats that are easier to process and comprehend by older adults and even enhance speech clarity, a project currently underway in the Fluid Interfaces Group at MIT Media Lab and based on workshop lessons. GenAI could also convey hard-to-comprehend segments to conversation partners or record and replay these segments. Another application could be to generate images to enable nonverbal communication and supplement verbal communication. Another promising GenAI application could be to mediate family meetings and decision-making, especially on challenging topics such as transitions in older adults' life situations and choosing medical treatments. GenAI technologies could summarize the main discussion points and then present discussion suggestions and solutions according to concerns of the older adults and other family members. Participants also suggested that AI scribes and other forms of communication support would be helpful for conversations with doctors and other professionals.

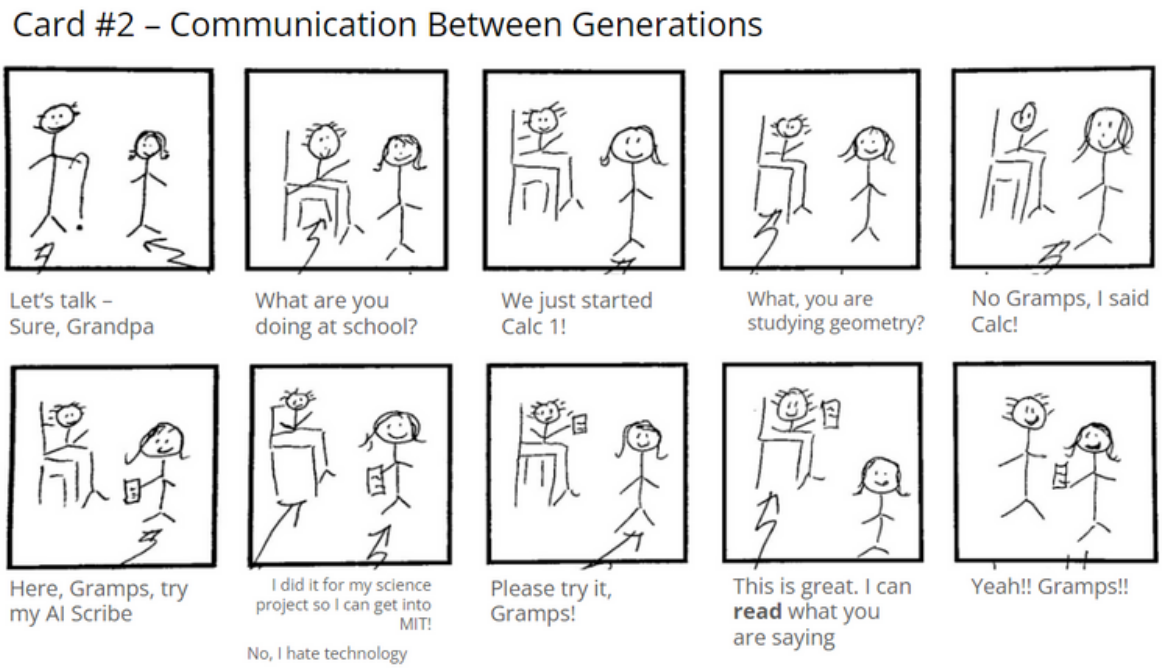

Figure 5
An example of a storyboard created by a participant. It depicts an older man being asked by his granddaughter to have a conversation, though he has trouble hearing. The granddaughter offers an "AI Scribe" that allows the older man to read what she is saying.

3.1.2. Memory Assistance and Reminders

The workshops' older adults and caregivers highlighted various memory augmentation scenarios that could be addressed with AI technologies, such as managing and tracking daily tasks and schedules, providing reminders for appointments, meetings, and special occasions, giving daily reports (e.g., news and weather), and prompting users with the names of people, passwords, and usernames, and other information. GenAI technologies can incorporate the use of multimodal inputs to extend the functions of such memory assistance technologies, enabling more accurate identification and delivery of the information the user needs. Researchers at the Media Lab have already developed prototypes of GenAI systems that augment memory based on minimally disruptive, concise prompts requiring minimal input interactions.[52] A second prototype built at the Lab supports tracking of daily activities based on GenAI-based image classification, locating misplaced items through image captioning, and issuing safety reminders based on detected activity and context.[53] There remains a wide range of research and design opportunities to be experimented with in this area.

3.1.3. Healthcare

GenAI could support increased independence in healthcare activities. A key GenAI application could be in visually identifying the medication being taken and providing information for it in real time. GenAI-based chat systems could act as proactive health companions that track symptoms and medical advice, answer common

medical questions, and provide assistance in emergencies. These systems could also generate and guide users through personalized exercise plans tailored to individual needs and abilities. Other envisioned applications involve safety checks and warnings (e.g., on medical instructions' accuracy and to prevent medication overconsumption) and detecting changes in vocal tone that may be indicative of health issues like stroke.

3.1.4. Technology Learning and Troubleshooting

GenAI technologies could be especially useful for supporting more independent technology learning and use. It could be leveraged to automatically fix technical issues (e.g., screen or brightness issues) and perform generative changes to the user interface to enhance accessibility and usability. Another application that emerged was a system that identifies affective states (like frustration), proactively gives troubleshooting support for devices used daily (like television, personal devices for reading news, etc.), adapts its instructions to users' learning styles, and directs the user to alternative ways of troubleshooting like calling a friend or family member or searching online.

3.2. Co-design Considerations

Reflecting on our experiences in the workshops, we emphasize several areas of importance when co-designing with older adults, including (1) **valuing lived experiences**, (2) **supporting an asset-based approach**, and (3) **scaffolding ideation and design opportunities**. We encourage those who wish to engage in co-design work with older adults to be mindful of these considerations and engage with the broader co-design literature and practice.

3.2.1. Valuing Lived Experiences

Older adults as co-designers provide specialized expertise due to their lived experiences that can often be missed or is assumed by designers when older adults are left out of the design process. The older adults described their lived experiences and others' lived experiences during the workshop, providing an important insight into how GenAI could be incorporated into healthy aging.

3.2.1. Supporting an Asset-Based Approach

We emphasized the wealth of assets that are available to support healthy aging instead of drawing focus to age-related limitations that exacerbate ageism.[54,55,56] We were mindful of this choice through the design and language of the activities and framing of the overall workshops. For instance, the initial topics of discussion were framed not as issues experienced by older adults but as the experiences and abilities they have in their lives. We avoided depicting only negative experiences in the workshop context cards, presenting scenes that may be positive or neutral—normal parts of older adults' lives. We join other researchers who work with older adults in advocating for this asset-based approach to support healthy aging with technology.

3.2.3. Scaffolding Ideation and Design Opportunities

The co-design workshops were scaffolded to support ideation and design of GenAI solutions. We made several considerations in the workshops to support older adults who had a variety of skills and knowledge levels with GenAI. The workshop activities were designed to balance familiar topics and experiences with potential new areas of exploration. We also were mindful of how we organized the co-design groups during the workshop, ensuring that participants with varying levels of familiarity with GenAI had sufficient support for understanding the technology. We provided a foundation for design by first anchoring the design process in areas that were familiar to older adults through the use of context cards (Figure 6). We continued to build upon this foundation to develop the low-fidelity prototypes. We initially scaffolded the activities like this so that older adults could understand how all the pieces of the design process (i.e., problem scoping, initial design, prototyping) were coming together, and we feel that this scaffolding of ideation is an essential principle for co-designing with older adults—especially with complex and potentially unfamiliar technologies such as GenAI.

Figure 6
Example of context card given to the workshop participants.

3.3. Areas of Importance in GenAI Development

Several themes emerged as participants grappled with how GenAI technology could be designed and used to support cognitive aging. We present these as areas of importance to be kept in mind while developing GenAI technologies to support cognitive wellbeing in older adults.

3.3.1. Accessibility

Given the opportunity to design GenAI technology in their lives, older adults and caregivers emphasized the importance of accessibility. They sought intuitive interfaces that could be activated by voice and had elements

such as simple commands, easy setup, large screens, and straightforward buttons. GenAI technology designed for older adults should consider their individual preferences and needs. Understanding how to balance greater functionality with ease of use is critical. If the system is too complex, users may find the technology unmanageable or confusing. If the system is too simple, users may feel the need to have multiple devices or applications to address several needs, which presents another problem of unmanageable complexity.

3.3.2. Integration with Existing Systems

Many of the workshop prototypes involved integration with existing devices and sources of information, such as connecting with medical providers and services or integrating with the user's own devices and applications. Some participants mentioned that an ideal GenAI solution would consist of a single device that would serve as a cell phone, computer, and personal assistant all in one, eliminating the need for multiple technology-enabled devices. Prior AgeLab research with caregivers similarly found that caregivers were not necessarily in need of a new technology-enabled device but rather a technology or service that would serve as a project manager of their care-related tasks, service providers, scheduling, and management.[57] Previous work with older adults has also emphasized the potential of integrating various technology systems together to accomplish multiple goals.[58]

Integration is also a facet of accessibility; adopting new technology becomes easier with familiar systems and interfaces. Many older adults already use existing technologies in their daily lives; for instance, they may use digital or physical calendars to keep track of appointments or set reminders on a mobile device to notify them of the time to take medications. Rather than requiring that users must change their habits entirely in order to adopt a technology that may benefit them, designing GenAI technology to integrate with the user's existing systems may ease the way into its usage. This integration may involve importing the user's data or designing a way to exchange information both ways; for example, accessing and writing emails, reading and writing to a digital calendar, and printing out calendars and agendas to use physically.

3.3.3. Customization

A key element related to accessibility that participants mentioned was personalized customization. While voice activation may work well for some, touch activation and visual interfaces may work better for others. Some may find a device's voice output too fast or difficult to understand despite preferring that modality; these individuals could benefit from a hybrid interface that simultaneously uses text and voice. Additionally, some users may want access to only a few key functions, while others may wish to utilize a more robust set of features. Users are certainly capable of ignoring the functions they are uninterested in, but designing this customization could allow for simplification of interfaces and reduction in the amount and kind of data needed from the user. Unnecessary and undesired interactions with technology can be removed as well. For instance, a user may not want to have a conversational AI system talking about the weather or about upcoming doctor appointments, preferring only to use other features such as medication reminders and assistance in finding lost items.

Through these discussions, participants stressed that GenAI devices should be able to adapt not only to the individual user but also to the changing needs and abilities of an individual user as they move through different life phases. Understanding these different needs and providing users the ability to customize the way they interact with technology will allow more people who stand to benefit from the technology to access it.

3.3.4. Emotional Intelligence

Interactions between user and GenAI technology developed for older adults should be able to incorporate emotional intelligence, allowing them to detect affective states such as frustration. Workshop participants expressed a desire for user interactions to deviate from conventional customer service paradigms and focus on a more empathetic experience in which the GenAI technology can understand and respond appropriately to their emotions. Enabling this functionality could allow for older adults to feel more supported by their technology; the user's emotional information could also be used for more adaptable personalization of the user's experience. Of course, not all older adults might enjoy a GenAI system reading their emotions; some may find it to be an unacceptable privacy violation. This functionality, if integrated, must be something the user opts into and can disable at any time.

3.3.5. Privacy and Security

Another key theme that all of our workshop groups mentioned was concern about the privacy and security of personal data. These topics are already discussed in existing literature regarding GenAI and related technologies, and concerns such as necessity of explicit consent, clear privacy regulations, and responsible handling of data by organizations that develop GenAI are critical. Previous research indicates that the average length of privacy policies for smart home devices utilizing GenAI could be as long as 49 pages, frequently consented to by children or grandchildren rather than the older adults who primarily use these products.[59] We bring focus to more specific concerns with integrated and personalized GenAI that were highlighted by our workshop participants.

While participants expressed interest in a tool for tracking personal medical data and communicating that information with medical providers, they were worried about the consequences of a potential data breach. They are willing to share more sensitive data such as personal health information, but this data must be handled with appropriate consideration of their privacy and with effective security plans in place to prevent and, if needed, respond to data breaches. One way of reducing the risk of data breaches is to securely store personal data on the user's local machine, or at least provide the option to choose between storing locally or storing on a cloud server. One participant said data security plans needed to be "watertight" before he would consider adopting a GenAI technology. Another participant emphasized that personal data should be shared only on a "need-to-know" basis, with as much data stored locally as possible and only strictly necessary data stored and exchanged with cloud systems. Throughout the workshops, we learned that while older adults believe that GenAI solutions have potential, concerns about privacy and security are paramount. Data security plans need to be

clear and comprehensive to ensure adoption, and organizations that handle users' personal data must be transparent about how they handle and store the data.

3.3.6. GenAI as a Human Supplement, Not Replacement

While workshop participants were excited by the potential for GenAI solutions that could assist with challenges associated with aging, participants did not view these tools as a replacement for healthcare professionals, caregivers, family members, or friends. Instead, GenAI solutions centered around supporting and reducing barriers to human-to-human interaction in both healthcare and social realms. GenAI tools were viewed as mediators to supplement or improve existing human-to-human interactions to support healthy aging. In a way, this point is similar to the point about integrating GenAI solutions with existing technologies—to ease the way into adoption, new technologies should smoothly integrate with older adults' existing lifestyles. Additionally, human interactions are precious to older adults who face greater risks of loneliness, and GenAI technologies should not create additional barriers to human interaction. As an example of what this might look like, systems could improve how users communicate with their friends and family members. Or, perhaps, they could make communication with health professionals more efficient while opening opportunities for more empathetic conversations.

GenAI technologies developed to support older users and their caregivers should be designed with consideration for these key themes. GenAI solutions should be flexible and integrative, allowing users to customize functionality to meet both their current and future needs and abilities while also prioritizing privacy and security of sensitive personal data.

4. Road Map: Where Do We Go from Here?

We envision a future in which GenAI technology can support any older adult who stands to benefit from the technology in living healthy, safe, and independent lives for longer. The workshops described here offer an initial step towards that vision. However, there is a long way to go before we can reach such a future. To bridge this gap, we offer a road map consisting of a series of steps towards integrating GenAI into cognitive aging solutions.

1. **Further identify the perspectives of older adults and caregivers.** To design solutions that truly meet the diverse needs of older adults, designing with older adults and involving them in early stages and throughout development is crucial. Additionally, further exploration of caregivers' perspectives may uncover additional opportunities and considerations for the development of GenAI technology for older adults. Our workshop is an initial exploration into these perspectives; we encourage further engagement with older adults and caregivers through co-design workshops, community engagement, and other forms of collaboration.
2. **Engage policymakers to establish better privacy and security policies.** Appropriate regulations for ensuring the privacy and security of users' personal data are essential. Without regulation, policies of organizations handling users' data may be insufficient. These organizations are able to change their policies

at any time, and they may even purposefully create exploitative policies. Many users may not even be aware of vulnerabilities in their privacy and security—most individuals do not read or understand privacy policies and terms of service when engaging with digital services, pointing to widespread regulatory failure even with existing services.[60,61] Given that GenAI solutions for older adults may handle a large amount of sensitive information, improving regulations has become even more pertinent. Researchers, older adults, caregivers, and other parties relevant to integrating GenAI with cognitive aging solutions must engage with regulatory policymakers by communicating what regulations are needed to ensure users' privacy and security and by pushing for establishing these regulations in legislation. While these will need to be continuous conversations as GenAI technology evolves, discussions about improved regulations should be pushed forward *before* countless users face violations to their privacy and security.

3. **Expand research and development in opportunity areas and identify more opportunity areas.** In our workshops, we identified four areas of opportunity for developing GenAI solutions for supporting older adults: communication, memory assistance and reminders, healthcare, and technology learning and troubleshooting. We encourage further investigation into how these areas and others can be supported with GenAI and into development of devices and services that enhance older adults' lives in these areas. Additional opportunity areas may be extracted from the perspectives of older adults and caregivers using the first step of this road map.
4. **Engage in cross-disciplinary collaborations across different spheres.** Our workshop involved a collaboration between experts on GenAI technology from the MIT Media Lab and experts on aging from the MIT AgeLab. Each group was able to provide different in-depth perspectives in designing co-design workshops and extracting insights from the results, thereby enriching the research process. We encourage such cross-disciplinary work across multiple academic spheres and with industry organizations, especially at early stages of development, to better understand and develop GenAI technologies with older adults and caregivers.
5. **Incorporate the specific interests of older adults in GenAI technology.** While designing GenAI technology for older adults, specific interests, including their preferences, needs, and concerns, should be central to the technology's purpose and implementation. We extracted several key themes from our workshop, which we presented as a number of specific interests: the solutions should be accessible, integrated with existing technology and systems, customizable, and incorporated with emotional intelligence; users' privacy and security of personal information should be ensured, and solutions should supplement human interactions rather than replace them.
6. **Test solutions with older adults, families, caregivers, and other relevant parties in the real world.** Older adults and caregivers should be included in more than just early-stage design work; they should also be included consistently throughout development, such as in testing phases. GenAI solutions should be trialed with users and other affected individuals in order to understand the benefits and risks and to further improve on the technology before being launched publicly. As we witnessed in our workshops, older adults are enthusiastic about engaging with the development of GenAI solutions.

7. **Remain open to the diverse and changing interests of older adults.** Older adults are a highly diverse group with highly diverse interests, and this diversity should be considered when designing GenAI solutions. As research expands understanding of older adults' perspectives, solutions should remain open to iterative improvements. Furthermore, older adults' interests will inevitably change over time. Many young and middle-aged adults today have grown up in a society with vastly different experiences with technology, which likely results in different interests from today's older adults. GenAI solutions must evolve along with such changing needs.

5. Conclusion

Our world population is aging. Emerging and innovative technologies using GenAI have the potential to support the quality of life of aging individuals, helping them maintain their cognitive well-being and their capabilities, and in turn allowing them to live independent, healthy lives for longer. Relatively few technological solutions focus specifically on older adults, and GenAI is no exception. Our work illustrates the opportunities in this area and older adults' ideas and concerns regarding such technology. We propose a road map for integrating GenAI into cognitive aging solutions and hope to encourage more work towards a future that supports the wellbeing of older adults with GenAI.

Acknowledgments

We want to thank all the older adults and caregivers who worked with us in the co-design workshops. We appreciate your time, enthusiasm, and effort in this project and collaboration. We acknowledge the contributions of facilitators for the two workshops, who played a crucial role in data collection, guiding participants, and providing expertise on GenAI: Christine Xu, Matt Milton, Prerna Ravi, Cathy Mengying Fang, Thanawit (Tae) Prasongpongchai, Scott Ren, Alexa Balmuth, and Arnav Kapur. We thank Anthony Dodd for supporting the setup of the workshops.

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