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Should we preserve our memory using AI? – An exploratory study to examine the acceptance of AI-assisted reminiscence

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Abstract

Background

Reminiscence therapy (RT) is an important non-pharmacological intervention to support people with memory issues. Recent research has been exploring the use of artificial intelligence (AI) to recreate a person's memories ("synthetic memories") and its potential use in RT. This exploratory study aims to understand factors in acceptance of this AI technology in recreating a person's memory and its related ethical perspectives.

Methods

The study involved three groups of participants, including older adults, informal caregivers and professional therapists, to complete a survey. The survey was conducted either online or by phone. The questions included demographic information, familiarity with AI technology, acceptance of AI-assisted RT, potential benefits and risks, practical considerations, and features that influence acceptance.

Results

Participants in general had a positive attitude towards technology. They believed AI-assisted RT could be beneficial for people living with memory issues. Despite the high level of confidence in using smart technology, support features, such as tutorials and guidance tools, while using the tool, were deemed essential. Cost was an important factor in the decision to use the tool. The most important concerns were misuse and misinterpretation of the data and data accuracy.

Conclusion

This is the first study to investigate the acceptance of AI technology to recreate a person's memory. Further research is needed to gain an in-depth understanding of synthetic memory and its impact on people with memory issues. Research should focus on interdisciplinary approach and tightly engage all relevant users to work collaboratively for the design of AI-assisted RT. Creating a strong ethical framework is also essential to foster trust in new technology use.

BACKGROUND

Memory is our ability to store and retrieve information [1] and can be divided into two types: short and long-term memories [1, 2]. Short-term memory includes information that needs to be remembered for only a brief period, such as recalling a name, and temporally memorizing a phone number. Long-term memory is responsible for storing information over extended periods. It can include personal experiences, as well as skills and habits [1, 2]. Long-term memory can change over time through retelling

a story or as new information is learned after an event [2]. As such, memory serves as the foundation of a person's identity [2].

As people age, they may experience memory difficulties, such as mild cognitive impairment. As the condition progresses, it can develop into dementia, which may gradually lead to a diminished self-concept, reduced quality of life, and increased burden on their informal caregivers, such as family and friends [3–5]. This as a result creates an urgent need for supportive intervention. Non-pharmacological interventions have gained increased attention in recent years for individuals with memory issues [6, 7], due to their relatively fewer adverse effects compared to pharmacological treatments [8].

Non-pharmacological interventions have been acknowledged by many leading medical organizations as the frontline treatment for individuals with memory issues [6, 8]. These interventions have been found not only to mitigate cognitive decline but also to help address emotional and psychological needs [9, 10]. One popular non-pharmacological intervention is reminiscence therapy (RT) [9]. RT is a treatment that involves sharing a person's past experiences and events across their lifespan [11–13]. It is believed that reminiscence can help recollect memories that might otherwise be forgotten [14], which is usually delivered through visual and/or auditory aids, such as photos, and music, to help trigger memories [12, 13].

Research indicates that RT can benefit individuals with memory issues by positively influencing their cognitive function, overall quality of life, and mood [13, 15–18]. By focusing on the retrieval of long-term memories, people who have used RT have reported an improved confidence and sense of mastery of their cognitive abilities. This affirmation of positive cognitive functions in turn can improve people's self-esteem and interpersonal skills. In addition, RT provides the therapist with new avenues of understanding a person's behaviour by revealing their past experiences. By reconnecting the person with their past, RT could also encourage deeper emotional expression [7].

Computerized technologies, such as digital media and mobile apps have also been utilized to deliver RT [9, 19, 20]. Recently, researchers at Domestic Data Streamers have been exploring the use of Artificial Intelligence (AI) in RT. One method is using AI-assisted RT to generate images to recreate an individual's memories based on their detailed descriptions of specific events. Often, these recalled memories do not have tangible records, such as photos. The generated memories are presented as images and/or short video sequences, reflecting a person's described memories, and are referred to as synthetic memories (SMs). Unlike natural memories that are formed and stored in a human brain, SMs are developed by algorithms used in AI-driven text-to-image generation technology (i.e., AI-generated image technology), such as DALL-E and Midjourney [21].

SM creation is usually conducted by professionals, such as therapists, through an interview format. The interview begins with collecting detailed descriptions of the interviewee's specific life memories. These descriptions, known as prompts, are used as input to guide AI-generated image tools to produce visual outputs. These visual outputs are images/short videos of described memory. These images are then presented to the interviewees for feedback and refinement. For example, the generated images may be

changed to black and white, have a square ratio and grain to emulate a possible photograph that could have been taken at the time of the event of the memory. This image selection process is through interactive discussion with the interviewees, which could also stimulate the interviewee's greater memory recollection and enhance memory details. This process is iterative until the visual output closely matches the memory description.

Applications for SMs aiding the RT process include the use of an AI-generated image when other visual aids traditionally used in RT are not available, possibly making RT more accessible. SM is a novel concept and has not been widely explored in literature. To date, no study has explored the acceptance of this AI-generated image technology to recreate a person's memory. The ethical concerns of AI application to memory and their recreation need a guideline. As such, this study aims to address this gap by examining the technology acceptance and its related ethical considerations through a survey of older adults (OA), informal caregivers (IC) of people with memory impairment and professional therapists (PT).

OAs are included because they can be benefited from RT and could be potential users of AI-generated image tool. In addition, they may represent future users as memory concerns usually increase with age. ICs were involved due to their active involvement in the daily care and decision-making of people with memory issues. They usually played a vital role in technology adoption and use. PTs were also considered potential end-users of the technology as they were responsible for delivering the RT. Therefore, their perspectives and concerns would be deemed valuable in AI-generated image tool evaluation, which could be analyzed to guide future research in the use of SMs.

METHODS

We developed a survey that includes perspectives on acceptance of the AI-generated image technology, its potential benefits, risks, and practical implications. The survey combined both 5-point Likert scale items and open-ended questions and was developed incorporating both previously validated instrument (construct for technology acceptance) and self-developed questions derived from a comprehensive literature review. The survey was developed following five steps: 1) Reviews of existing scales that measure technology acceptance, along with documentation about the ethical concerns, practical considerations, potential benefits and risks of AI-generated image technology use; 2) Scale selection and construction; The scale items were developed and adapted from the Almere model which is used to evaluate technology acceptance mainly among older adults [22]. The remaining items were developed based on a comprehensive review of relevant literature and related documents. 3) The initial survey was developed and drafted by two members of the research team; 4) The survey draft was then reviewed and further refined within a multidisciplinary team with expertise in aging technology, survey development, and technology ethics; 5) The new draft was then piloted internally among lab members for clarity, succinctness and relevance of the survey. Feedback during the piloting phase was applied to the final survey refinement prior to data collection. See supplementary files for the surveys of the three groups.

Study participants

Three groups of participants were invited to take the survey: healthy older adults, informal caregivers of people with memory impairments, and professional therapists who have worked with people with memory issues. All participants were recruited in Canada. It should be noted that the PT group has a small sample size with only seven therapists included in the survey.

The OA group included older adults who self-reported being healthy without cognitive impairments at the age of 65 and older. They were able to speak and understand English and able to provide consent. IC group were caregivers at the age of 18 and older, who provided unpaid care to support a family member, friend or loved one who currently has or had memory issues. They also need to speak and understand English and able to provide consent. PT group involved therapists who had experience in working with people with memory issues, able to speak and understand English and able to provide consent.

Study recruitment

A purposive sampling method was used for participants recruitment. Flyers of different groups were posted in public places including organizations that support informal caregivers, shared on social media, and promoted through word of mouth. AGE-WELL NCE, a Canadian technology and aging network, also distributed study information. In addition, participants from other studies who had agreed to be re-contacted were invited for the current study. Potential participants were allowed to complete the survey online (i.e., participants were provided with a survey link hosted by Survey Monkey), over the phone, or virtually (i.e., participants were provided either a Zoom or Team meeting link). Consent forms were collected from all participants before completing the survey.

Survey content

The survey was divided into seven sections: 1) demographic information, 2) awareness and familiarity with the AI-generated image technology, 3) ratings of technology acceptance, 4) perceived potential benefits of the technology, 5) perceived practical considerations, 6) perceived potential risks and 7) features that influence acceptance.

Awareness and familiarity with technology. Participants were asked to rate if they were familiar with the technology using AI for image creation.

Technology acceptance. Our adapted Almere model included six constructs: anxiety, attitude towards technology, intention to use, perceived enjoyment, perceived usefulness, and perceived ease of use. The construct *perceived ease of use* was only included in the PT survey.

Perceived potential benefits. The items investigated the social and emotional aspects of using the tool.

Perceived practical considerations. The items included such as the cost, safety and accuracy of the technology.

Perceived potential risks. The items examined aspects such as data storage and use, potential misuse and misinterpretation of the data.

Technology features. It contained five features – multi-language support, enhanced privacy controls, voice input, interactive tutorials, and clear and simple consent language.

Data analysis

Quantitative data was analyzed using SPSS Statistics (v.29.0.1). Descriptive statistics in frequency distributions, percentages, and means were used. The survey included 5-point Likert Scales ranging from 1 (Strongly Negative) to 5 (Strongly Positive). The range of mean responses for each group was measured to interpret the results. To be specific, *Strongly Positive* was 5 to 4.51; *Positive* was 4.5 to 3.51; *Neutral* was 3.5 to 2.51; *Negative* was 2.5 to 1.51; *Strongly Negative* was 1.5 to 1 [23]. Although direct comparisons across groups were not intended, if the exploratory analysis suggested group differences, comparative analysis was conducted for further investigation.

Due to the small sample sizes, especially in the PT group, normality and homogeneity of variances were assessed prior to conducting inferential analyses among the three groups. Shapiro-Wilk test was used to evaluate the normality of each group and Levene's test was conducted for evaluation of homogeneity of variances. One-way ANOVA was used when the data met both normality and equal variance assumptions when comparing the three groups. Tukey's HSD was used for post-hoc comparison for significant one-way ANOVA. Welch's ANOVA was used when the data only met normality but not equal variance assumption. For significant Welch's ANOVA results, Games-Howell post-hoc comparison was examined. Non-parametric Kruskal-Wallis H test was performed when normality was violated. The Wilcoxon signed-rank test was used to compare the differences of two related statements within each group. In addition, effect size was also evaluated.

The survey collected age ranges (e.g., 65–69) across the three groups. So, midpoint age (e.g., 67) was calculated to approximate as a continuous variable. The PT group was generally younger in age. The Kruskal-Wallis H test confirmed significant age differences across groups using midpoint age variable, $H(2) = 17.03$, $p < 0.001$, with a large effect size ($\eta^2 = 0.28$). Thus, age was examined to determine if it is a potential covariate in group comparisons that showed significant results. Regression models were conducted to assess the effect of age. A significance level of $p < 0.05$ was used with a 95% confidence interval (CI) for all statistical tests.

Qualitative data explored participants' additional thoughts on the potential benefits and risks, practical considerations and their opinions on synthetic memories. Both qualitative and quantitative data focused on the same themes and were presented in an integrated manner in the Results section. The qualitative data was analyzed using NVivo (v.15). Thematic analysis was used to identify key themes. Initial

patterns and concepts were recognized and labeled. Recurring patterns and concepts were then grouped into themes [24]. The first author reviewed all the qualitative responses to become familiar with the data. NVivo was used to code data. Different nodes were first created. Each node was labeled with a description to represent the essence of the content. Similar nodes were then grouped into broader categories, which were then organized into themes.

RESULTS

In total, data from 36 OAs, 14 ICs and 7 PTs were analyzed. Participants completed the survey either online (n = 50) or over the phone (n = 7).

Demographic information

Full demographic information for survey participants can be found in Table 1.

Most informal caregivers (79%) were providing care for individuals with Alzheimer's disease or related dementia. One caregiver provided care for an individual with mental health condition, such as depression. One caregiver did not know the care recipient's memory condition and the other one was not currently caring for anyone and did not choose the option of memory condition. Half of the caregivers had been providing care for about six years or more, and they were primarily the wives (43%) of the care recipients. All three groups showed a positive confidence level in smart technology use, with the PT group having the highest average score and the IC group having the lowest (see Fig. 1). Kruskal-Wallis H test revealed no significant difference across the three groups, $H(2) = 3.68$, $p = 0.16$ with a small effect size, $\eta^2=0.03$.

Among the PT group, only one had experience working with reminiscence therapy. Six therapists had working experience of 7 years or more and one had working experience between 1–3 years. Five reported working in hospital settings and two worked in private practice.

Table 1
Demographic information across three groups

Age	Older adults (n = 36)	Informal caregivers (n = 14)	Professional therapists (n = 7)
	65–69 (25%)	**18–29 (7%)**	**18–29 (14%)**
	70–74 (33%)	**40–49 (7%)**	**30–39 (43%)**
	75–79 (22%)	**50–59 (14%)**	**40–49 (43%)**
	80–84 (17%)	**60–69 (7%)**	
	85–89 (3%)	**70–79 (43%)**	
		80–89 (7%)	
		90 or older (14%)	
Gender	Male (n = 10) (28%)	Male (n = 2) (14%)	Male (n = 1) (14%)
	Female (n = 26) (72%)	Female (n = 12) (86%)	Female (n = 6) (86%)
Ethnicity	White (92%)	White (57%)	White (29%)
	East/Southeast Asian (3%)	East/Southeast Asian (29%)	East/Southeast Asian (71%)
	Other (Jewish and Circum-Mediterranean) (6%)	Prefer not to disclose (14%)	
Household income	Under $25,000 (3%)	$25,000-$45,000 (7%)	n/a
	$25,000-$45,000 (11%)	$45,001-$65,000 (7%)	
	$45,001-$65,000 (11%)	$65,001-100,000 (21%)	
	$65,001-100,000 (36%)	$100,001-$150,000 (7%)	
	$100,001-$150,000 (17%)	Prefer not to disclose (57%)	
	$150,000+ (6%)		
	Prefer not to disclose (17%)		
Living arrangement	Living alone (47%)	Living with a spouse/partner (36%)	n/a
	Living with a spouse/partner (36%)	Living alone (29%)	
	Living with roommate/friends (6%)	Living with roommate/friends (7%)	
	Living with my child(ren) (6%)	Living with my child(ren) (7%)	

n/a – not applicable

	Living with spouse/partner and my child(ren) (3%) Living with a caregiver (3%)	Living with parent(s) and my spouse/partner (7%) Prefer not to disclose (7%)	
Education level	Less than a high-school diploma (3%) High-school certificate (11%) College/Technical diploma (17%) University degree (54%) Post-graduate degree (14%)	Less than a high-school diploma (14%) High-school certificate (7%) College/Technical diploma (7%) University degree (57%) Post-graduate degree (14%)	University degree (29%) Post-graduate degree (71%)
Marital status	Married (31%) Widowed (17%) Divorced (25%) Living common law (8%) Single, never married (19%)	Married (50%) Widowed (14%) Divorced (0) Living common law (7%) Single, never married (29%)	n/a
n/a – not applicable			

Awareness and familiarity with technology

Across all three groups, participants on average were not familiar with the AI-generated image tool. The mean responses for OA, IC and PT groups were 1.53, 1.38 and 2.14 respectively, on a 5-point Likert scale. Only one OA and one IC participants have indicated using it, which were AI Image Generator and DALL.E. They both indicated they were easy to access.

Technology acceptance

Participants were asked to rate their agreement with the statements using a 5-point Likert scale. On average, both the OA and IC groups showed positive acceptance of the AI-generated image technology, with scores of 3.82 and 3.74 respectively (see Fig. 2). The PT group demonstrated a slightly lower average score of 3.43 than the OA and IC groups. A Welch's ANOVA test was conducted and showed significant differences among the three groups in technology acceptance, $F(2, 22.65) = 3.43$, $p = 0.05$. There was a large effect size ($\eta^2=0.23$) among the three groups. Games-Howell post hoc test indicated that there was a significantly higher acceptance score in the OA group than the PT group ($p = 0.042$). To evaluate whether age influenced the significance of group differences, the regression model was conducted and the result showed that age was not a significant predictor of technology acceptance ($p = 0.817$), suggesting that age was not likely to contribute to the group differences.

Acceptance items were divided into six constructs. The construct Perceived Ease of Use was exclusively included in the therapist survey. The PT group had a higher average score in anxiety compared to the other groups. On average, both the OA and IC groups did not show strong anxious responses towards the use of technology. They did not believe the use of the tool would be scary, intimidating, or uneasy. However, the PT group had a towards neutral response for this construct. A Kruskal-Wallis H test revealed that there was a marginal significance among the groups $H(2) = 5.54$, $p = 0.063$ in anxiety about using the tool, with a medium effect size ($\eta^2 = 0.069$). The regression model was run to determine if age contributed to the group difference in anxiety. Results showed a significant group effect on anxiety level in the initial regression model without the age variable added ($p = 0.022$). However, the group effect became marginally significant ($p = 0.059$) when the age was included as a covariate, and age was not a significant predictor on anxiety in the regression model ($p = 0.785$).

Post-hoc analysis using Mann-Whitney U test presented that there was a significant low anxiety score in the OA group when compared with the PT group ($p = 0.025$). But the result was no longer significant after applying the Bonferroni correction (adjusted $\alpha = 0.017$). However, it should be noted that there was a moderate effect size ($r=-0.35$) between the two groups, suggesting a potential meaningful difference in anxiety level towards the tool use between the OA and the PT group.

All three groups on average had a positive feeling about technology (see Fig. 3 *Attitude towards tool*). When participants were asked to share their thoughts on synthetic memory, most across the three groups expressed liking the concept. They believed it could benefit people in need and their families, as well as provide therapeutic effects. Of the fifteen participants who shared their thoughts on synthetic memory, four expressed negative responses to the tool, which all came from the OA group. The responses included concerns that it is threatening, that unpleasant memories could be evoked by using the tool, that recreated memories could be misused for harmful or criminal purposes, and that the accuracy of the recreated memory of person with poor memory may be lacking.

"It would be so easy to create an image and convince a patient suffering from Alzheimer's they have a son or daughter, for example. The person in the image could then use this new belief to get money from the patient" (OA-08).

Most participants believed that they would probably enjoy the technology use (see Fig. 3 *Enjoyment*). On average, all groups believed that the tool would be useful (*Usefulness* construct). Both IC and OA groups would be more likely to use the tool compared to the PT group. However, the difference was not significant according to Kruskal-Wallis H test $H(2) = 2.06$, $p = 0.36$, with a small effect size, $\eta^2 = 0.0012$. Among the six responses from the PT group, two participants indicated that they were not likely to use the tool, three expressed their willingness to use it and one had a neutral response regarding its use.

When therapists were asked about the perceived ease of use of technology, on average, their responses were neutral with an average score of 3.33 regarding whether they could quickly learn to use the tool (see Fig. 4). Therapists felt that they would need support to use the technology, either through a manual

or with assistance from someone present. They generally disagreed with the statement that they could use the tool by themselves without support with an average score of 2.17. A Wilcoxon signed-rank test illustrated a significant difference between the statements of *use the tool without any support* and *use the tool with support* Z=-2.23, $p = 0.026$, suggesting participants from the PT group generally agreed that support was needed when using the new tool.

Perceived potential benefits

All groups, on average, believed the potential benefits of AI-generated image technology to people with memory issues (see Table 5). Both the OA and IC groups felt that the tool can support both social and emotional well-being. The PT group had a neutral response compared to the other groups regarding the tool in improving social interactions. Two therapists did not think the tool could improve social interactions. A Kruskal-Wallis H test was conducted and did not reveal significant difference among the three groups in their agreement whether the tool could improve social interaction, $H(2) = 0.698$, $p = 0.71$. The effect size among the three groups could be negligible due to a negative effect size value.

Table 2
Average responses to the statements regarding potential benefits with 1 = Strongly Disagree to 5 = Strongly Agree

The tool could improve social interaction	**Older adults (n = 36)**	**Informal caregivers (n = 14)**	**Therapists (n = 7)**
	3.72	**3.58**	**3.33**
The tool could bring up feelings	4.17	3.75	4.50
People with memory issues could benefit from the tool	4.03	4.08	4.17

Besides the above-mentioned benefits, all three groups also pointed to the potential therapeutic and cognitive benefits of the tool. Both the OA and PT participants had mentioned the potential use of the tool to treat trauma sufferers and help people to recall the memories they want to preserve from the past. A few participants from the OA group also reported the ability of the synthetic memory to prompt additional memories. For example, one older adult illustrated that "*I expect recreating a memory would prompt additional memory to surface* (OA-22)". Another indicated that "*The tool could call up not just images, but also sounds and smells (OA-23)*". In addition, two older adults also indicated societal benefits of the tool, such as "*recreating scene of crime*" and "*identifying perpetrators of crimes*".

When participants were asked about the most important benefits, the results revealed that most participants from the OA and IC groups believed that the tool had the potential to enhance social interaction. Additionally, most informal caregivers identified the tool's ability to support people with memory issues as another key benefit. For the PT group, there were six responses in total and were spread out in each of the three statements.

Perceived practical considerations

Overall, participants across the three groups had an average neutral response in practical considerations (see Table 5). The practical considerations included statements of cost, the safety of using the tool, whether to blur faces and the accuracy of the data. Additionally, for the OA group, there was also a statement about whether people would feel stigmatized using the tool. Notably, on average all groups indicated that the cost would be a significant factor in their decision to use the tool. The PT group had a neutral response regarding the safety of the tool use, with only one participant agreeing with this statement while others chose neutral.

Both the OA and IC groups had a positive response to this statement and believed it would be safe to use the tool. A Kruskal-Wallis H test demonstrated a significant difference among the three groups $H(2) = 9.64$, $p = 0.008$ with a large effect size $\eta^2 = 0.15$. The Mann-Whitney U test showed that there was a significant difference in the IC group when compared with the PT group ($p = 0.003$) with a large effect size ($r=-0.69$). The significance remained even after applying the Bonferroni correction (adjusted $\alpha = 0.017$). The regression model was conducted and the result showed that age was not a significant predictor of technology acceptance ($p = 0.498$), suggesting that age was not likely to contribute to the group differences.

In terms of the statements about whether people's faces should be blurred in the images, all groups, on average, had a neutral response. It should be noted that the IC group has an average score of 2.54, which is close to *Disagree* for blurred face construct. A few participants from the OA group also expressed that the importance of not blocking the individual's faces if they need to recognize those faces. A Kruskal-Wallis H test was also conducted to examine if there is significant difference between the three groups. The result was not significant $H(2) = 1.12$, $p = 0.57$ with a negative effect size suggesting a negligible effect.

"*Could you start by scanning photos of real people … so the image generated is more recognizable*" (OA-08)

Most participants across the three groups agreed that it would be important that the data should accurately match a person's recollection. Two older adults raised questions regarding system bias. How technology could avoid recreated image bias due to cultural background differences. It was noteworthy that most participants from the OA group would not feel stigmatized when using the tool. See Table 3 for the average responses to each statement regarding practical consideration across the three groups.

"*How the interviewer and prompter can exert undue influence on the interviewee's responses and resulting synthetic memory output? … How the prompter and AI program interpret the description of recalled memories, especially (with) cultural background and language differ*" (OA-25).

Usability of the tool was also brought up across all three groups in the open question. For example, one family caregiver considered the size of the tool and its portability, whether it can be easily taken and used wherever they go. One older adult questioned how easy it is to learn to use the tool. Several therapists mentioned how easy it is to print out the images, and how quickly they can be generated and printed. Functionality is another practical consideration brought up by both the OA and the PT groups.

One older adult wondered whether the tool allowed image editing. One therapist indicated if the images can be resized for visually impaired individuals, if the tool supported for both color and black-and-white images, and options for different printing materials. Lastly, data retention, which was commented by both an older adult and a family caregiver – "*I think there should be a built in "expiry date" after which the images could not be retrieved*" (OA-09); "*I wondered if the idea is that while a person has these memories and can articulate them, that the synthetic pictures are kept until a future time when the memory has declined significantly and can be stimulated by these photos.*" (IC-08).

The most practical consideration for most OA and IC participants was that recreated memories should accurately match a person's actual memories. For the PT group, the greatest practical consideration was that technology should be safe to use.

Table 3
Average responses of the statements regarding practical consideration with 1 = Strongly Disagree to 5 = Strongly Agree.

The cost would be a significant factor	**Older adults (n = 36)**	**Informal caregivers (n = 14)**	**Therapists (n = 7)**
	3.80	**3.85**	**3.67**
It would be safe to use the tool	3.54	4.15	3.17
Faces should be blurred	2.83	2.54	3.00
Recreated memories should accurately match a person's recollection	3.83	3.85	4.33
Feel stigmatized using the tool	1.63	n/a	n/a
n/a – not applicable			

Perceived potential risks

On average, both the OA and PT groups agreed that there were potential risks in using the tool while the IC group had a neutral response (see Table 5). Specifically, the PT group had greater concern regarding all statements compared to the other groups (see Table 4). Both the OA and IC groups had neutral responses regarding the concerns of altered memories. Similarly, the IC group demonstrated a more neutral response to the concerns of potential misuse of the data, and data storage and its use. Although on average, PT group had a higher concern of using the tool (see Table 5), one-way ANOVA did not reveal significant differences across the three groups, $F(2,51) = 1.55$, $p = 0.22$, $\eta^2=0.06$. However, the result indicated a medium effect size, suggesting there may be a meaningful difference between each group. When examining each statement related to the risk of tool use, Kruskal-Wallis H test did not show significant differences across the three groups for each individual statement, and the effect sizes were also small.

In addition, open questions from both the OA and PT groups revealed the potential of provoking unpleasant memories, which could lead to distress, negative emotions and physical pain, such as

headaches. One older adult mentioned how disturbing memories would be dealt with. A couple of therapists addressed what available supports would be in place to help clients manage upsetting memories and emphasized the importance of implementing strategies to handle these negative outcomes, such as "*having clear protocols and guidance on how to manage if using the tool leads to any adverse responses…, so perhaps working closely with behaviour therapists and/or psychologists to develop risk management strategies and how best to support these clients safely…*".

The greatest risk concern across all groups was related to misuse of the recreated memories. In addition, the concern of recreated memories being mistaken was also a key concern for both the PT and the IC groups.

Table 4
Average responses to the statements regarding the potential risk of using the tool with 1 = Strongly Disagree to 5 = Strongly Agree.

Concern of potential misuse of the data	**Older adults (n = 36)**	**Informal caregivers (n = 14)**	**Therapists (n = 7)**
	3.83	**3.23**	**4.00**
Risk of recreated memories being mistaken for real memories	3.69	3.54	3.83
Concern of data storage and use	3.80	3.38	4.00
Concern of original memories being altered	3.37	3.08	4.17

Table 5
Average responses of benefits, practical considerations and risks in using the tool.

Potential benefits	**Older adults (n = 36)**	**Informal caregivers (n = 14)**	**Therapists (n = 7)**
	3.97	**3.81**	**4.00**
Practical considerations	3.20	3.02	3.46
Potential risks	3.67	3.31	4.00

Preferred AI-generated image technology features

Potential features enhancing technology acceptance were identified based on their selection across all groups (see Fig. 5). A 50% cutoff threshold was applied to determine participant preferences. The results indicated that effective interactive tutorials could enhance technology acceptance, as this feature was chosen by over 50% of participants across all groups. Notably, the PT group believed that multi-language support is an important feature compared to the other two groups. In the OA group, enhanced privacy control and interactive tutorials were regarded as important features. For the IC group, over 50% of participants selected interactive tutorials; while 50% chose clear, simple consent features. Similarly, in

the PT group, the features identified as important included multi-language support, enhanced privacy controls, interactive tutorials, and clear, simple consent.

Responses from open-ended questions from both the OA and PT groups highlighted that safeguarding privacy is a key concern. A few participants from the OA group pointed out that enhancing privacy control is paramount so that users can recall any memories, such as detrimental or criminal-related information, without worrying about the recollected information being disclosed, or facing judgment.

"*Because some memory could be detrimental or criminal related information. So it is important to keep user's privacy when using the tool. Safeguard of the privacy of the tool is very important so people can feel free to bring up the memory and not being judged*." (OA-36)

PT participants addressed the importance of ensuring that tool/data was securely stored so that non-related people did not have access to client's data. A clear consent, such as providing rules about types of memories that can be recalled, was suggested as not all memories would be happy or appropriate.

DISCUSSION

In this exploratory study, we surveyed older adults, informal caregivers and professional therapists to investigate the acceptance of using AI-generated image technology to recreate a person's memory (i.e., synthetic memory). We also explored its perceived potential benefits, practical considerations, and potential risks and identified additional features that can enhance acceptance. This study yields novel insights and serves as an initial step in understanding people's attitudes toward synthetic memory and its potential applications in RT for people with memory issues. In general, all three groups positively accepted the tool and demonstrated a constructive attitude to its use. They believed the tool can enhance social and emotional well-being while also benefiting individuals with memory issues.

It should be noted that although all groups expressed a positive attitude towards technology, the PT group exhibited more significant concerns regarding its use and ethical implications when compared to the personal user groups (e.g., OA and IC groups), who were generally more receptive. Specifically, the PT group was found with significant lower level of technology acceptance, and perceived safety in using the technology and marginally significant higher anxiety level in using the tool. However, the interpretation of the findings should be cautious. Due to small sample size of the PT group, this may be associated with more false positive results. Nevertheless, our findings suggest that while synthetic memory may hold promise for RT and cognitive support, further research is needed to address professional skepticism, ensure reliability of the tool in generating SM and robust ethical safeguards are in place.

Our findings suggested the capacity of the tool to improve an individual's social, emotional well-being as well as providing therapeutic and cognitive benefits, demonstrating its potential to support RT. These benefits are in line with the goals of RT, which involves recalling an individual's past life events and experiences [13, 25]. RT aims to enhance cognitive function, quality of life, social interaction and

emotional well-being [13, 15, 17, 25]. Our finding proposed the benefits of applying the tool to increase success in RT.

However, results also demonstrated the fear of evoking disturbed/unpleasant/painful memories, which could result in both physical and emotional harm. Therefore, a well-prepared and detailed management strategy is essential. Therapists should have access to professional counselling resources, as well as practical and emotional support tools to provide to their clients when needed. In addition, therapists should explore coping strategies that their clients have previously used to overcome challenges, helping them to navigate problems and difficulties triggered by disturbed memories. Although sharing unpleasant experiences can provoke distress, it may also bring relief [26].

Although participants were optimistic about the tool, they indicated the importance of having support features. Findings demonstrated that therapists did not feel confident using the tool without any support despite their high confidence in smart technology use. They emphasized the need for support, such as a user manual or guidance from an experienced individual, to enhance their confidence and ability to use the tool effectively. Our findings align with existing literature emphasizing the importance of adequate support, such as tutorials, to improve technology usability and acceptance e.g. [27–29]. Providing training is essential in implementing new technology, and new technology for dementia more specifically [30], as it can build users' confidence and make them feel more comfortable and capable in their interactions with the tool [27, 29].

Besides the need for tutorial features, the study suggests that enhanced privacy control, such as clear guidelines on data storage and use, data access, data retention, and clear, simple consent are also essential to encourage technology acceptance. The literature illustrated that older adults, both with and without dementia, expressed concerns about privacy and security e.g. [31–33], which can pose a significant barrier for their adoption of new technology [32, 34]. Our study also revealed that data misuse and misinterpretation were among the top concerns for most participants. However, a recent review paper revealed that privacy considerations in smart technology remain immature and are still in the early stage of investigation [27]. Developers/organizations have not prioritized addressing these issues [27, 35, 36]. Often, they overlooked the importance of transparency in data-handling practices [27]. As such, it is crucial to take a proactive approach to address these concerns.

Clear and informed consent is critical, especially given the deeply personal nature of synthetic memories. Users must fully understand that AI-generated memories may not be exact replicas of real events. Additionally, consent should be ongoing, allowing users to modify or withdraw their synthetic memories over time. For vulnerable populations, such as older adults with cognitive issues, third-party consent mechanisms should be considered to prevent manipulation or unintended distress. A clear, simple consent process could help build trust among users. Users are more likely to adopt technology if they feel their privacy is fully protected [32]. In addition, the government should prioritize user privacy, collaborate with developers to establish strong privacy safeguards and implement law enforcement

measures to assure privacy compliance [37, 38]. With strong privacy control and clear, simple consent, users would feel more comfortable and secure when using the tool. Thus, increasing its acceptance.

Additional considerations regarding the tool's usability and functionality are needed. Participants raised concerns regarding these aspects, highlighting the importance for developers to address these questions to meet user's needs for better acceptance. The intuitiveness of the tool, its ease of learning and use, reliability of recreating accurate images based on a person's recall, the functionality of editing features, and overall efficiency are critical factors in influencing people's decision regarding tool acceptance. Our findings align with previous research as usability and functionality are two major things for technology acceptance e.g. [27, 39–41].

Previous research demonstrated a strong opposition to having clear facial visibility on cameras, with a preference for depth cameras as they do not display facial images [32]. However, our study showed that most participants from both the OA and IC groups were fine with images that did not obscure a person's face. They tended to disagree with the statement that people's faces should be blurred in recreated memories, while the PT group displayed a neutral response. Several participants from the current study indicated that if the person in the images needed to be recognized, then there was no need to blur their face. This suggests that more research is needed to investigate perspectives from potential users' preferences regarding the blurring of faces in the recreated memories. On the other hand, this finding further highlights the importance of strong privacy control to protect users' sensitive data.

Data accuracy was the top consideration by most participants as they indicated it would be important that recreated memories accurately match a person's recollection. Our findings indicated the importance of the tool's reliability in delivering accurate and trustworthy information. This finding is consistent with the previous research regarding the key feature of technology reliability when using it and its impact on user acceptance [42, 43]. Therefore, ensuring accurate data is essential to building trust, which is crucial for successful tool acceptance.

Providing multi-language support can help remove barriers to technology uptake [27, 44]. However, our study revealed that most participants in the OA and IC groups did not consider multi-language features important, unlike the PT group. This was largely due to English being their primary language. In contrast, 71% of the PT group is non-white, and the majority believe that multi-language support can help improve technology acceptance. As such, multi-language support should still be encouraged to help enhance technology adoption.

Previous research has emphasized the impact of cost and stigmatization on technology use [27, 32, 43, 45]. As expected, our findings also suggested the importance of cost in the decision to use the tool. As such, developers need to consider cost when designing the tool. The tool needs to be affordable to ensure better uptake. One way is to seek government support to subsidize its cost. Although people with positive attitudes toward technology may be willing to pay for caregiving technology, most still believe the government should be responsible for the cost [45]. To improve the quality of care, advocacy should

encourage the government to provide more funding for innovative technology and subsidies for caregiving tools to help reduce the financial burden on families.

Regarding stigma, our study did not report the feeling of stigmatization from the OA group. Research demonstrated that innovative technological interventions could reduce the stigma of people with mental illness, which can be due to the widespread use of technology and making it part of daily life [46]. Our findings are important as stigma is often perceived as a barrier to technology adoption. Therefore, further investigation is needed to confirm the conclusion.

In order to maximize the benefits of the use of this innovative technology, mitigate potential risks and enhance its adoption, research should emphasize more on an interdisciplinary approach and actively engage relevant stakeholders in its development process for guiding a user-centered design. Co-designing emerging technology with stakeholders fosters a deep understanding of their needs, preferences, and concerns and reduces barriers to technology uptake [47, 48]. Additionally, ongoing evaluation throughout the development process, with stakeholder involvement, allows for continuous refinement to better align the technology with user needs and further improve adoption and its usage [49, 50].

ETHICAL CONSIDERATIONS IN THE USE OF AI-GENERATED SYNTHETIC MEMORIES

As AI advances in healthcare and memory preservation, ethical concerns surrounding synthetic memory technology must be carefully and proactively addressed. While this study highlights the positive acceptance of AI-generated memories, key concerns include privacy, data security, informed consent, and the risk of memory distortion.

Privacy and Data Security

Synthetic memories require individuals to share detailed personal experiences, raising concerns about data security and privacy. Without robust safeguards, sensitive information could be vulnerable to unauthorized access, third-party misuse, or even unintentional reconstruction of false memories. Strong data protection measures, such as end-to-end encryption and strict access controls, are essential. Compliance with privacy regulations like the General Data Protection Regulation (GDPR) and Canada’s Privacy Act should be prioritized to protect users' rights [51, 52].

Risk of Memory Distortion and False Memories

AI-generated memories introduce risks of memory distortion, potentially altering a person's sense of self or influencing recollections in unintended ways. The use of synthetic memories in legal or forensic contexts should be strictly avoided, as they lack verifiable authenticity and could lead to misinformation. In therapy, inaccurate memories might cause confusion or emotional distress, requiring safeguards such as transparency indicators, including disclaimers or watermarks distinguishing synthetic content from real historical records [53].

Ethical AI Development and Bias Concerns

AI-generated memories must be designed with fairness and accuracy in mind. If AI models are trained on biased datasets, they may produce culturally insensitive or inaccurate representations of personal memories [54]. Additionally, ethical concerns arise regarding ownership and commercialization—who truly owns a synthetic memory, and could it be exploited for advertising or other commercial purposes [55]? Ensuring transparency in AI algorithms, cultural sensitivity in training data, and user control over modifications is crucial to mitigating these risks.

Societal and Psychological Implications

Beyond individual risks, synthetic memory raises broader societal and psychological concerns. AI-generated memories could reshape how individuals relate to past experiences and family members, particularly if synthetic memories become more emotionally significant than real ones. Ethical questions also arise about recreating memories of deceased loved ones—while some may find comfort in this technology, others may view it as an unnatural manipulation of personal history. Additionally, overreliance on AI for memory retention could diminish natural cognitive recall abilities, requiring further research into long-term psychological effects to ensure synthetic memory remains a tool for empowerment rather than dependency [56–58].

LIMITATIONS

One key limitation of this study is relatively small sample size, especially in the PT group. However, to ensure the validity of the findings, several steps were performed before running the statistical analyses. For example, normality and homogeneity of variance assumptions were checked to determine the appropriateness of statistical tests. The effect sizes were also calculated to assist interpretation. In addition, the qualitative findings were aligned with the quantitative results, offering additional support in the overall findings. Furthermore, this is an exploratory study serving as a vital first step to understand its target users' perspectives on this new topic of synthetic memory. The study provides initial insights and serves as a foundation for further robust research. As such, despite the small sample size, our results remain meaningful and valid, and still offer important perspectives from each of the three groups to understand this new technology acceptance with its ethical considerations.

Another limitation is sampling bias. The majority of participants completed the survey online, which may introduce response bias by selecting participants with internet access and computer skills and excluding people with lower digital literacy and without reliable internet access [59][58]. In addition, there was a high education level across the three groups, and most participants had good confidence in using smart technology which could potentially skew the results towards pro-technology attitudes. Another drawback with online survey was that if participants have questions about the survey, their questions may not be answered [59]. To minimize it, researchers provided contact information to participants prior to their participation and encouraged them to reach out with any questions. Despite the limitation of online survey, its use offered faster participants' recruitment and greater efficiency in data collection. Due to

these limitations, future research is needed with larger sample sizes as well as incorporating more random sample methods with a more diverse demographic background, including individuals with lower education levels and limited proficiency of smart technology, for the generalization of the findings and verify if these exploratory findings truly hold amongst other samples.

CONCLUSION

Synthetic memory, powered by AI-generated image technology, represents a novel approach to preserving and reconstructing personal memories. This exploratory study examined the acceptance of this technology among older adults, informal caregivers, and professional therapists. The findings revealed an overall positive attitude towards synthetic memory, with participants recognizing its potential benefits in enhancing social interactions, emotional well-being, therapeutic and cognitive benefits and supporting individuals with memory impairments. Our study provides an important foundation for future research on synthetic memory technology.

Despite this positive outlook, the study identified key considerations for successful adoption. Participants emphasized the importance of usability support, particularly through interactive tutorials and clear guidance to facilitate ease of use. Additionally, privacy and ethical concerns emerged as significant factors influencing acceptance, with participants expressing apprehension about data security, potential misuse of synthetic memories, and the risk of misinterpretation. The study also highlighted that cost considerations could impact the decision to use the technology, underscoring the need for affordability and accessibility in future implementations. Therefore, developers should prioritize these considerations to improve its adoption.

Finally, while synthetic memory technology offers promise for reminiscence therapy and cognitive support, ethical safeguards must be embedded from the outset. A strong ethical framework including privacy protection, clear consent processes, bias mitigation, and transparency measures is essential to responsible deployment. As this technology evolves, interdisciplinary collaboration between AI developers, healthcare professionals, and policymakers will be necessary to ensure ethical implementation that prioritizes user well-being. By addressing these concerns and enhancing the usability of AI-generated memories, synthetic memory technology has the potential to become a valuable tool in reminiscence therapy, ultimately improving the quality of life for individuals with memory issues and their caregivers. Further studies with larger sample sizes and qualitative insights are needed to refine the ethical and practical frameworks surrounding synthetic memory, ensuring its responsible integration into dementia care and broader therapeutic contexts.

Abbreviations

AI
Artificial Intelligence
IC

Informal Caregiver
OA
Older Adult
PT
Professional Therapists
RT
Reminiscence Therapy
SD
Standard Deviation
SM
Synthetic Memory

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the University of Toronto Research Ethics Board (approval number 46921). Consent forms were collected from all participants before data collection. The consent that was obtained from all of the participants was informed.

All experiments were performed in accordance with relevant guidelines and regulations.

CONSENT FOR PUBLICATION

Not applicable.

DATA AVAILABILITY

Data sharing is not applicable to this article.

FUNDING

No funding was received for conducting this study.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

BY drafted the manuscript. AM initiated and developed the concept of the study. JR provided feedback and contributed to the design of the survey. JM prepared and submitted the REB. BY and JM conducted the recruitment. BY completed the data collection and analysis. All authors read and approved the manuscript.

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Not applicable.

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Figures

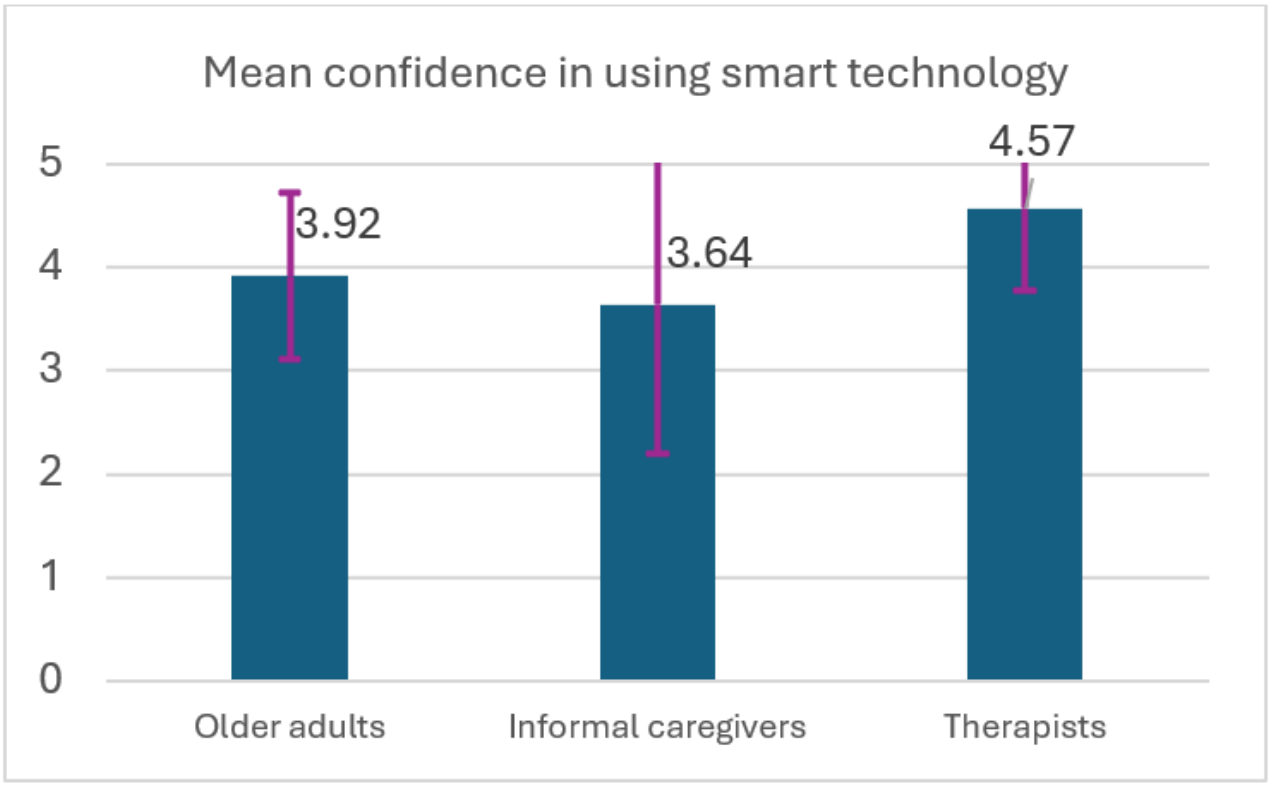


Figure 1

The average response of confidence in using smart technology across three groups. The therapist group showed the highest average confidence level in smart technology use. Bar represents the mean value, and the error bars indicate standard deviation (SD).

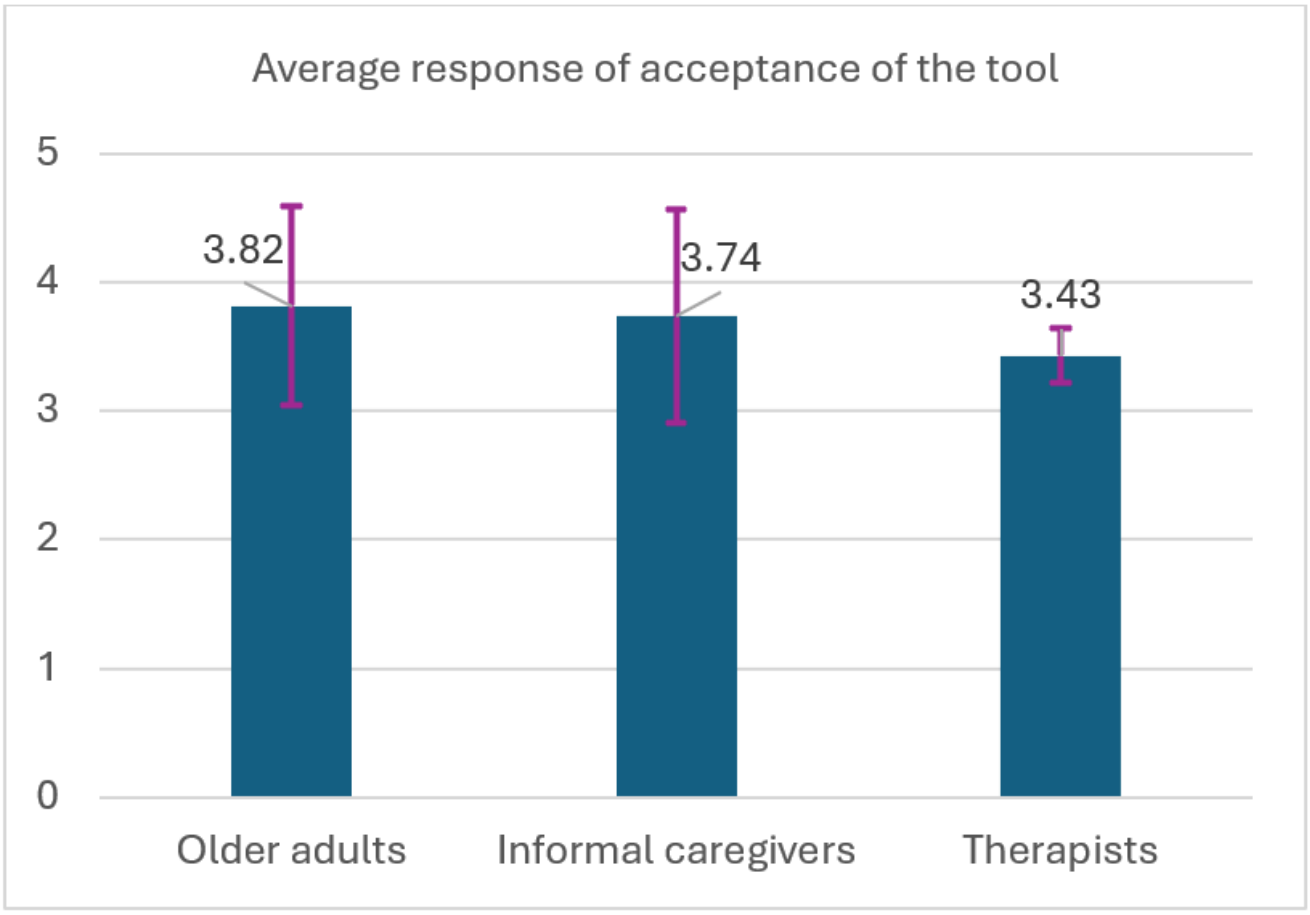


Figure 2

Average response of acceptance of the technology across three groups. The therapist group showed the lowest average acceptance of the AI-generated image tool. Bar represents the mean value, and the error bars indicate SD.

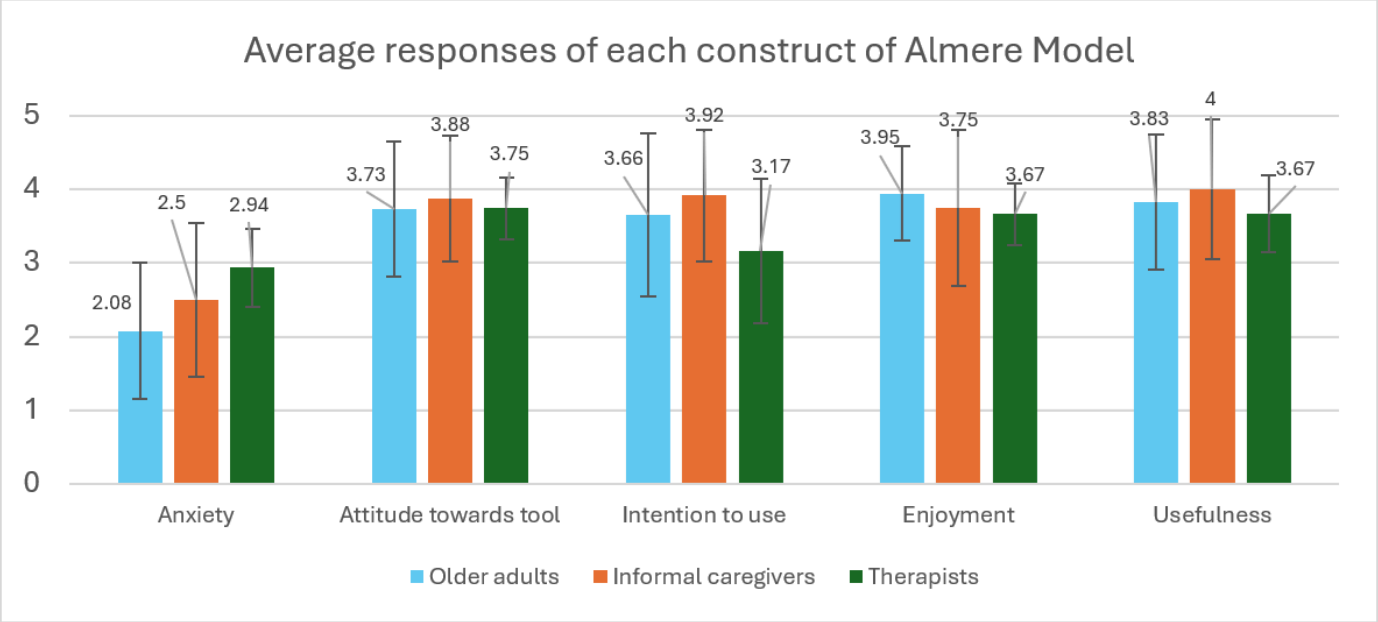


Figure 3

Average responses of the five constructs across the three groups on a 5-point Likert scale. The therapist group showed the highest average response in the construct of *Anxiety*and the lowest average response across the constructs of *Intention to use, Enjoyment* and *Usefulness.* Bar represents the mean value, and the error bars indicate SD.

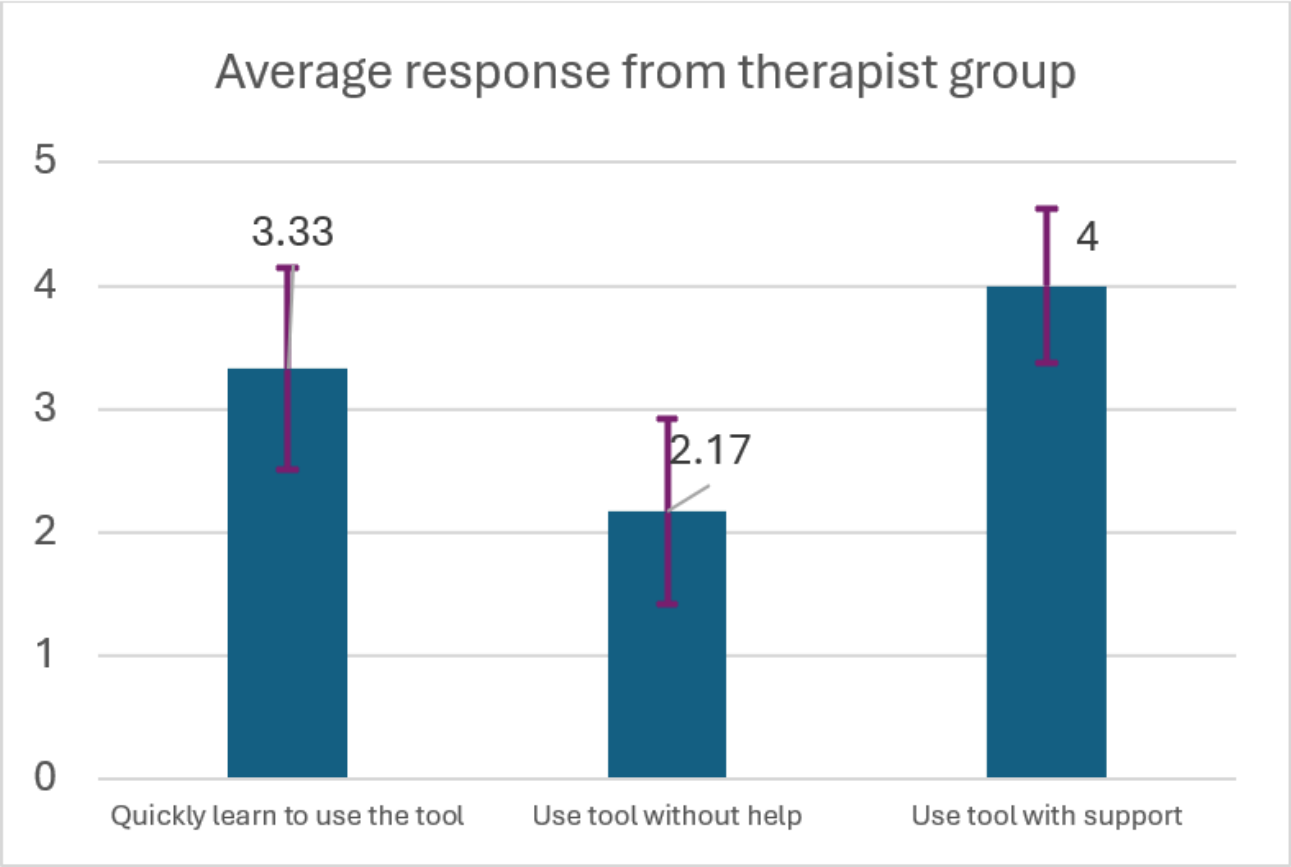


Figure 4

Average responses from therapists regarding perceived ease of use of technology. Therapists showed disagreement in *use tool without help* and believe they need support to use the AI-generated image tool. Bar represents the mean value, and the error bars indicate SD.

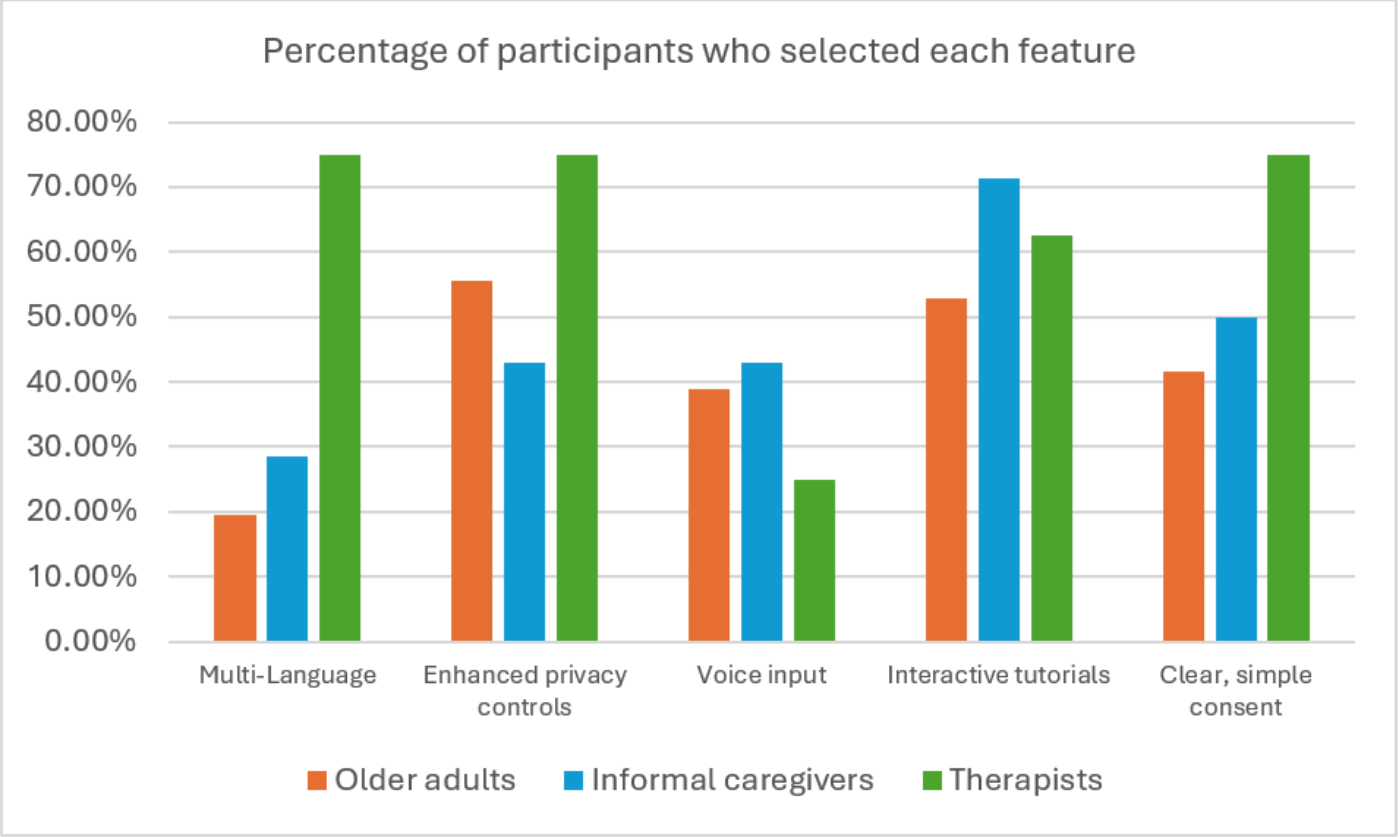


Figure 5

Percentage of participants selecting each feature

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SurveyProfessionalTherapistsv2Aug262024clean.pdf
- SurveyOlderAdultsv2Aug232024clean.pdf
- SurveyFamilyCaregiverv2Aug22clean.pdf