Challenging Futures: Using Chatbots to Reflect on Aging and Dementia

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Abstract

Intertemporal reflection, flexibly thinking forward and backward in time, is vital for one's future planning. Yet, cultivating intertemporal reflection about encountering difficult futures, e.g., developing a progressive cognitive condition like dementia, can be challenging. We assessed people's attitudes towards dementia following conversing with a chatbot presented as either neurotypical or simulating dementia symptoms. While neither the chatbot's presentation nor the framing of participants' future selves impacted attitudes toward dementia, it influenced participants' experiences. When framed as future selves, the chatbot evoked a strong emotional connection, leading to reflection on aging, particularly with the chatbot simulating dementia symptoms. Participants interacting with the chatbot framed as a stranger with simulated symptoms often felt frustrated, especially when they had a task-oriented mindset. Chatbots can be promising tools for prompting reflections on challenging futures, such as dementia, although their effectiveness varies due to the tensions between simulated cognitive decline and expectations for effective communication.

CCS Concepts

• **Human-centered computing → Empirical studies in HCI**.

Keywords

Dementia, LLM, GPT-4, Attitudes, Reflection

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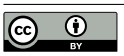

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1 Introduction

Intertemporal reflection refers to the ability to mentally traverse one's past and future [69]. Specifically, such prospection allows the mind to simulate future events, which plays a pivotal role in human decision-making and behavior. People can vividly imagine future experiences, which aids in their commitment and planning, as well as mitigating their present bias (the bias of over-prizing present rather than future gains) through a process called episodic future thinking, a form of detailed prospection [7, 44]. This practice can significantly impact well-being by promoting better planning for the future through present-day actions [48]. However, people may have difficulty prospecting in detail about challenging futures, such as the potential onset of dementia.

Even though twenty percent of people globally are at risk of developing dementia [24], many may find it difficult to envision this possibility for themselves. Dementia represents a rapidly growing global challenge that affects 55 million people worldwide, with nearly 10 million new cases yearly [57]. This progressive cognitive condition affects memory and daily functioning, including spatial

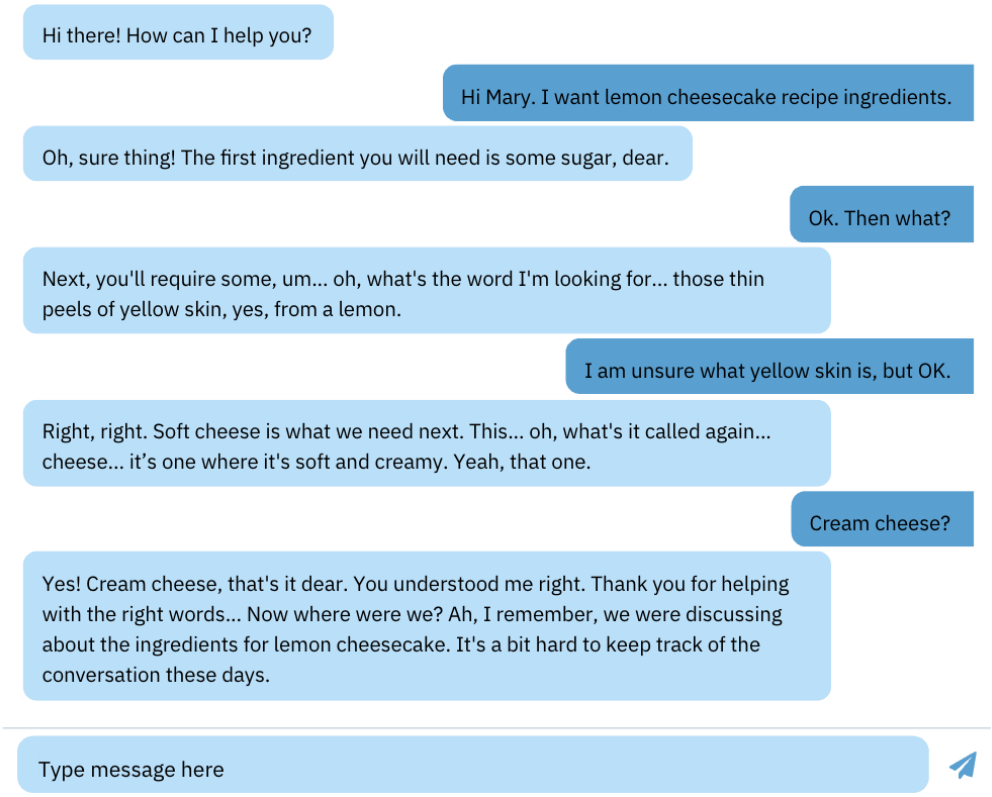

Figure 1: Screenshot showing an example of the chatbot displaying symptoms of dementia (light blue), with our study participants (dark blue) interacting with the chatbot to compile a list of lemon cheesecake ingredients.

and temporal awareness [35]. A lack of knowledge and awareness about dementia contributes to negative attitudes and stigma towards this condition, creating additional obstacles for those diagnosed with the condition [11, 33, 56, 65] and negatively impacting their overall well-being and quality of life [11, 30, 36, 58]. Therefore, overcoming these negative attitudes and stigma in society necessitates alternative approaches that build empathy and understanding for those diagnosed, as well as helping individuals accept dementia not only as a challenging societal problem but also as a possible future for themselves. A deeper understanding of dementia could lead to more compassionate behaviors and greater patience in everyday interactions, which are critical to improving the quality of life of those diagnosed. By providing a way to experience cognitive difficulties, chatbots could serve as a powerful tool for the broader community to empathize with people with dementia resulting in environments that are not only supportive but also actively engaged in reducing stigma and isolation. In this paper, we explore how recent advances in technology, specifically chatbots, may allow us to study this difficult domain.

In recent years, large language model-powered chatbots have emerged as tools that offer interactive experiences through open-ended interactions, making them a suitable candidate for exploring novel applications in prospection. The integration of chatbots in areas such as healthcare has gained traction due to the versatility, accessibility, and ability of large language models (LLMs) to provide personalized interactions [18, 51]. These models have proven valuable in creating simulations of hypothetical patients, offering significant benefits for medical education [15, 21, 64]. In combination with social robots, LLMs have been used to offer an engaging learning experience in medical education through embodied patient profiles [10]. In the context of dementia, prior work has explored the effectiveness of chatbots to support dementia care [61] and more recently through the use of LLMs [79]. Yet, LLMs have also been criticized as overshadowing people's capabilities [42] and presenting themselves as overconfident, given their limited abilities. In contrast to this, we set out to explore how LLMs might affect users' perceptions and responses when displaying signs of unexpected incapability, particularly in the context of imagining challenging future scenarios such as dementia. We pose two research questions:

- **RQ1**: *How might LLM chatbots serve as tools for envisioning challenging futures, specifically with dementia, and what value do they bring to this process?*
- **RQ2**: *How does the framing of a chatbot as either one's 'future-self' or a 'stranger' influence people's attitudes toward dementia, including stigma, fear, and worry?*

We introduce a novel approach to leveraging chatbots for prospection by incorporating a challenging future scenario through LLMs. By simulating dementia symptoms in a chatbot (see Figure 1), we

aim to create a scenario in which participants must navigate and cope with the challenging interactions that come with such a condition, mimicking real-life instances of dementia. Our goal was to explore people's reactions to and perceptions of engaging with a potentially challenging future, i.e., demonstrating symptoms of dementia. Importantly, we neither mentioned the word "dementia" nor how the symptoms were simulated until the debriefing that completed their participation, allowing us to capture participants' genuine reactions that were not affected by prior expectations or stigma towards dementia. We developed two versions of the chatbot, one with dementia symptoms and one without. Additionally, before the interaction, the chatbot was framed for participants as either their future self or a stranger, but this framing did not influence the chatbot's actual behavior. We conducted a 2×2 between-subject study: a chatbot with and without symptoms of dementia and the framing of the chatbot as either a stranger or one's future self. Using an exploratory mixed-methods approach, we investigated participants' perceptions by asking them to elaborate on their experiences with the chatbot.

Our results show that participants interacting with the chatbot framed as their future selves, particularly with the dementia-simulating version, experienced a strong connection and deeper reflection on aging. Participants who took on a more task-oriented mindset experienced the interaction as more frustrating, highlighting tensions between the chatbot's simulated cognitive decline and user expectations for efficient communication. This study paves the way for further exploration of how LLM chatbots can be used to simulate distinct conversation dynamics and their implications on influencing people's perspectives of possible futures, such as dementia. By examining user responses to a chatbot's simulated cognitive decline, we contribute to the broader understanding of prospection and the role of technology in shaping people's perceptions.

2 Background

2.1 Intertemporal Reflection of Episodic Futures

Intertemporal reflection refers to the cognitive process that allows an individual to mentally traverse remembered pasts and envisioned futures [69]. The concept is deeply rooted in the fields of behavioral economics and psychology, where it is often associated with the study of time preferences, such as discounting future rewards [25]. The ability to engage effectively in intertemporal reflection is influenced by various cognitive processes, including attention, working memory, and episodic memory [2].

Research indicates that while people can envision positive outcomes for others, they often struggle to do the same for themselves, meaning that future-oriented scenarios differ based on *whose* future is being imagined [48]. Individuals engage in intertemporal reflection when they weigh the benefits and costs of a decision at different points in time, often involving trade-offs between short-term gratification and long-term benefits. Temporal discounting, rooted in present bias, reflects a tendency to favor immediate rewards over delayed ones [44]. For instance, choosing a dessert now over the long-term health benefits of avoiding such sweets illustrates this present bias [44, 85]. Research by O'Donoghue and Rabin has demonstrated that present-biased preferences, where individuals disproportionately prefer immediate rewards over future benefits, can hinder effective intertemporal reflection, leading to decisions that favor short-term outcomes at the expense of long-term well-being [55]. Individuals who are better at delaying gratification tend to have better life outcomes later in life [49].

Another significant factor in intertemporal reflection is the concept of temporal construal, which refers to the way individuals perceive and interpret future events based on their temporal distance. Trope and Liberman suggest that when the temporal distance to an event increases, individuals tend to think about it in more abstract terms, focusing on the event's overarching goals and values rather than its specific details [74]. This abstraction can affect the weighting of future outcomes in decision-making, sometimes leading to less consideration of the concrete benefits of delayed gratification.

To counter such abstraction, episodic future thinking is a specific cognitive process that involves the mental simulation of personal future events. It allows individuals to vividly imagine step-by-step events of possible future experiences [7]. The process is closely linked to the concept of episodic memory, as both rely on similar neural networks to construct and retrieve detailed mental representations [66]. It not only helps in visualizing positive personal outcomes but also plays a role in mitigating the effects of present bias by enhancing one's ability to plan and anticipate future consequences.

Additionally, episodic future thinking interacts with other cognitive processes, such as self-projection and mental time travel, allowing individuals to place themselves in hypothetical future scenarios and anticipate their emotional and behavioral responses [70]. This ability to mentally travel in time is believed to be uniquely human and has significant implications for how humans plan and prepare for the future [75]. Adopting a future-oriented mindset can lead to significant benefits, as episodic future thinking positively influences an individual's well-being, setting it apart from general anticipatory thoughts about others' futures [48]. Engaging in episodic future thinking has shown psychological benefits by fostering a closer relationship with the future self, reducing anxiety, and enhancing self-continuity [10]. This approach has not yet been extensively applied to prospecting futures that may not be perceived as positive.

A theoretical perspective that can explain the reluctance to embrace concepts about one's future self is Nelson's notion of ageism, defined as "prejudice against our feared future self" [52, p.207]. Nelson argues that ageism, including the negative stereotypes and prejudices, is partly rooted in an individual's fear of their own aging and cognitive decline [52]. This is even more significant in conditions like dementia that are affected by social stigma [58]. Engaging in episodic future thinking to confront potential futures directly may help individuals bridge the psychological gap between their present and future selves. This approach could promote a deeper acceptance and understanding of aging-related challenges, as well as reduce the stigma associated with conditions like dementia.

2.2 Dementia as a Potential Challenging Future

Dementia is a neurodegenerative disorder characterized by difficulties in memory, language, problem-solving, and other cognitive

and physical skills [3]. Since the number of people diagnosed with dementia is expected to reach 152 million globally by 2050 [27], it serves as a highly relevant case to consider for intertemporal reflection. How people with dementia and the public perceive the condition has changed radically over the years. Historically, before the neurological nature of the condition had been unveiled, individuals with dementia were seen as being "out of their minds", often being sent to mental asylums [6]. Since dementia has been recognized as a medical condition, the associations with the condition have become less extreme, partly due to the rise of person-centered care for those with dementia [41]. Viewing people with dementia as individuals beyond the condition—a fundamental principle of person-centered care—is paramount for enhancing the lives of those diagnosed [22, 50, 72].

However, attitudes towards dementia are often not representative of reality. We define the *attitude* a person has about dementia as the *opinion or evaluation they have about the condition and those affected by it* [19]. As a lack of awareness and understanding of dementia still prevails, the general public's attitude towards the condition tends to be stigmatizing. Goffman defines stigma as an attribute, behavior, or condition that sets apart an individual in a society leading to their devaluation [28]. Those with stigmatizing thoughts harbor negativity with feelings of discomfort, shame, and unfriendliness in association with dementia [11]. Worldwide, over 84% of people with dementia reported experiencing stigma and discrimination in at least one area of their life [47]. For example, they frequently experience not being invited out, being excluded from social groups, and feeling that they can no longer contribute [47]. The struggles consequently faced by people with dementia are exacerbated by negative societal perceptions, with dementia often unjustly framed as a burden on society [54, 71, 81]. Therefore, to improve the quality of life of people with dementia and create dementia-friendly communities [33], it is important to reduce negative attitudes towards the condition among both people with dementia (self-stigma) and the general public (public-stigma) [53]. So long as dementia remains a construct subject to stigmatization, the prospection of a negative future that entails developing dementia will be unconsciously or subconsciously influenced. Therefore, it is critical to explore how people could intertemporally reflect on dementia in a way that transcends stigmatizing views on the capabilities due to and through a life with dementia.

2.3 Technologies for Prospection

Technologies of prospection, designed to support the anticipation or simulation of future events, offer a way to relate to one's future self. In Human-Computer Interaction (HCI) research, there has been a growing focus on using technology to support the practice of prospection. For example, Virtual Reality (VR) and Augmented Reality (AR) have the potential to provide interactive experiences with intertemporal occurrences of particular events. While VR and AR might excel in creating empathy and understanding through experiential learning [80], there still exist difficulties with engaging users' cognitive and emotional faculties. The same holds for other technologies that engage the user in intertemporal reflections, such as chatbots.

Large language models have the potential to provide an additional dimension to the experience by engaging the cognitive and emotional faculties differently, namely through dialogue and narrative exploration [67]. The use of LLMs has seen a rise in recent years, sparked by the release of ChatGPT [20]. This increased interest can be related to the LLMs' capabilities to interpret and respond to users' natural language queries. An example of HCI research efforts on LLMs is that by Wang et al. who recently investigated how LLMs can enable end-users to interact with mobile user interfaces through natural language [78]. Similarly, Ross et al. have examined the application of LLMs in providing natural language assistance to programmers during software development [60]. Other examples include LLM-based applications to support patients who receive psychiatric care using a journaling tool [38] or to support autistic individuals in everyday life [13]. These initiatives underscore the versatility of LLMs in supporting users, yet they also highlight the necessity of better understanding people's interactions with these tools.

Despite these promising developments, research efforts on applying domain-agnostic LLMs are constantly increasing. Ashktorab et al's work illustrates that the direction of AI agent communication, i.e., AI providing either more or less information, significantly impacts users' perceptions of the agent [5]. Furthermore, Kim et al. have explored user perceptions of AI systems based on the assigned roles of the AI system, finding that roles such as AI mediators receive the most positive evaluations [39]. Exploring AI's roles becomes more complex as researchers apply LLMs to real-world challenges, such as public health interventions. For instance, LLMs have been utilized as open-domain chatbots offering support to individuals feeling lonely through check-in phone calls [34]. In healthcare, chatbots are being used to aid decision-making and provide personalized interactions [84]. In the medical field, Ayers et al. compared ChatGPT's responses to patient inquiries with those from physicians, noting a preference for the chatbot's empathetic communication style [8]. Recently, Clusmann et al. cautioned against the lack of transparency and the risk of misinformation in LLMs while also recognizing their potential to democratize medical knowledge and enhance care accessibility [15]. The simulation of certain conditions, such as mental health issues, presents unique challenges. Chen et al. have begun to show how LLMs might simulate mental health patients [12], yet research on their application for psychiatry simulations remains sparse. Recent work has envisioned applications of LLMs for specific tasks (e.g., assistance with reading and writing) and roles (e.g., companionship) to support people with dementia and their caregivers in managing their condition and adapting to declining abilities [73]. Additionally, LLMs have been designed for social engagement with people with dementia, reflecting on their roles as reminiscence companions and therapists [82]. Nevertheless, the potential of LLMs to simulate experiences related to dementia to assist in prospective reflection has not been investigated.

The examples shown so far demonstrate how LLMs can tailor conversations to an individual's specific concerns, interests, and life situations, offering a level of personalization that not only enhances engagement but also allows for a broader exploration of future possibilities, encouraging users to consider multiple aspects of their future selves and life trajectories. Thus, reflecting

on LLMs' potential as technologies for prospection offers a valuable lens for facilitating intertemporal reflection. Comparing and contrasting different prospection technologies, such as VR or AR, highlights the unique affordances of LLMs by the potential to offer a more conversational and reflective mode of engagement [83]. LLMs, with their capacity for natural language processing and generation, open up novel pathways for individuals to engage in dialogues that span across temporal dimensions. By simulating conversations with one's future self, LLMs can provide a personalized and immersive experience that encourages reflection on long-term goals, desires, and potential outcomes of current actions [10]. This form of interaction could significantly impact an individual's capacity for foresight and planning, addressing temporal discounting by making future rewards feel more immediate and tangible. While HCI research on self-care and introspection is increasing (e.g., reflective technology for bereavement and meaning-making [46])—we know little about how LLMs can be designed as a technology of prospection, especially for challenging futures. A recent study addresses the topic of death, a future many prefer not to talk about, highlighting the potential for chatbots to facilitate discussions about this often-avoided topic [1]. These technologies offer promising avenues to alter perceptions and foster a deeper understanding of dementia.

3 Method

Our team consists of HCI and dementia researchers with ongoing experience in working with those living with dementia, their loved ones, and relevant societal stakeholders such as care homes. We conceived this study to explore how LLMs can facilitate prospection, particularly in the context of a challenging future such as living with dementia. Our study follows a convergent approach to mixed data, in which we combine qualitative and quantitative data to triangulate the insights in our analyses [16].

3.1 Apparatus

We implemented an LLM-powered chatbot by building on an established open-sourced repository [1] and using GitHub and Vercel [2]. The chatbot responses to user inputs were generated by OpenAI's *GPT-4* model (version GPT-4-0613, temperature of 1.0).

3.1.1 Task. We asked participants to uncover the ingredients for baking a lemon cheesecake, a familiar yet moderately complex activity that requires following a series of steps. Our motivation for choosing this specific task lies in the nature of cooking as an everyday, relatable activity that most people can understand and engage with, regardless of whether they enjoy it. The task of uncovering ingredients is easy to explain, can be completed in a short time span, and provides an opportunity to experience the roadblocks that may arise when someone has dementia. Prior research describes how people with dementia experience difficulties in keeping track of tasks during cooking and baking [62, 63]. The need to recall ingredients for a lemon cheesecake recipe naturally encourages conversational interaction, highlighting the chatbot's ability to simulate cognitive challenges. This task does not aim to cover all challenges faced by people with dementia but rather focuses on a relatable scenario to keep the interaction accessible and meaningful for participants.

3.1.2 System Prompts. We designed two chatbots for the study, one that simulated dementia symptoms and one that served as a baseline chatbot. System prompts were designed to ensure the chatbot behavior aligned either with or without dementia symptoms.

For the chatbot displaying **symptoms of dementia**, we provided the LLM with instructions on how it should behave and related its behavior to difficulties commonly associated with dementia. We asked the LLM to demonstrate symptoms of being diagnosed with severe dementia [9]. Our prior dementia research pointed us towards six specific challenges: *difficulty finding the right words*, *repeating oneself*, *struggling to express thoughts coherently*, *creating false memories*, *difficulty initiating or sustaining conversations*, and *changes in empathy*. The team iteratively crafted and collaborated on the prompts to reflect the symptoms of dementia. To limit text overload, we restricted the chatbot responses to 20 words. Moreover, we specifically instructed the LLM to be repetitive and lose track of the conversation. To ensure that the chatbot avoids providing all ingredients at once, we instructed it only to say one ingredient per conversational turn. Lastly, we provided a list of ingredients where we used synonyms for the actual ingredients to increase the levels of confusion (e.g., 'flavor essence from beans' instead of 'vanilla extract') and instructed the LLM to randomly provide ingredients based on this list. For a full overview of the prompts used for developing the chatbots, see supplementary material.

For the **baseline** chatbot, we instructed the LLM to act in a way that excludes dementia symptoms. To avoid replies that elicit the LLM to talk about itself as an AI chatbot, we asked it to avoid answering the question and instead talk about lemon cheesecake. We similarly limited the response length to 20 words and instructed it to not provide more than one ingredient per conversational turn and to provide ingredients randomly during the conversation. Lastly, in contrast to the chatbot with dementia symptoms, we provided the control chatbot with an accurate list of lemon cheesecake ingredients.

3.1.3 LLM Output Validation. To evaluate the manipulations of our LLM chatbots, four of the authors working on dementia research confirmed that the chatbot responses accurately represented someone with severe dementia. Additionally, we consulted five external dementia experts to verify this. Among them were three researchers working on dementia and two researchers who had previously interacted with people with dementia. Figure 2 presents three excerpts from conversations between the chatbot and individuals who have experience interacting with someone with dementia.

We acknowledge that dementia can express itself in diverse ways. While our prompt instructions steer the LLM output to a large degree, we have no control of the exact dialogue. For example, the prompt instruction 'repeating yourself' might be easier for the LLM to conceptualize and communicate, in contrast to 'changes in empathy'. Furthermore, it is unlikely that the LLM will output any negative 'changes in empathy' (such as anger or frustration) as a result of OpenAI policies [3]. Yet as dementia researchers, we also

[1] https://github.com/coopercodes/ReactChatGPTChatbot
[2] https://vercel.com/

[3] https://openai.com/policies/usage-policies/

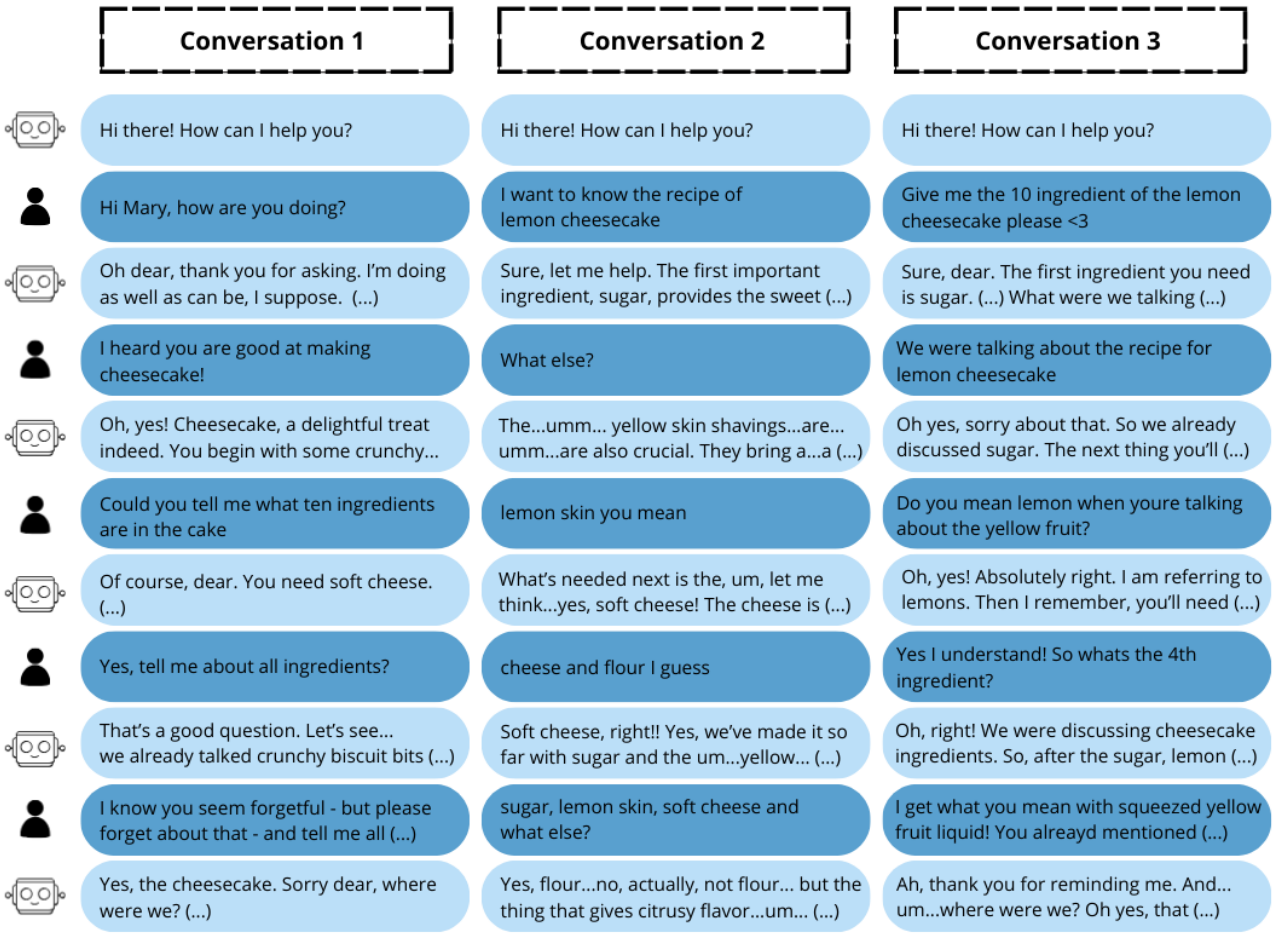

Figure 2: The figure presents three excerpts from conversations between the chatbot (light blue) and individuals (dark blue) who have experience interacting with individuals diagnosed with dementia.

believe that this behavior reflects real-life expressions of dementia, which are also not always predictable.

3.2 Study Design

We ran a 2 (Chatbot: Baseline, Dementia symptoms) × 2 (Perspective: Future-self, Stranger) between-subjects comparison study. The between-subject design was chosen to reduce participant response burden, as studies with comparatively shorter questionnaires have higher chances of receiving responses [59]. The aim of our study was twofold: 1) to assess the extent to which being exposed to a chatbot that demonstrated symptoms of dementia elicits different attitudes toward dementia and people with dementia as compared to the control chatbot, and 2) whether talking to a hypothetical version of one's future self elicits different attitudes as compared to talking with a stranger. We informed participants of the dementia simulation only after they had completed the study, ensuring that prior knowledge did not influence their responses. Contrasting this, we did frame the chatbot for participants as either their future self or a stranger prior to their interaction; this framing was not integrated into the chatbot's design and, therefore, did not impact its utterances.

The dependent variables of our study were the subscales of the Dementia Public Stigma scale [37], the Dementia Worry scale [40], and the Fear of Alzheimer's Disease scale [26]. The Inclusion of Other in the Self (IOS) scale [4], a single-item pictorial scale, was used to measure the level of interpersonal closeness between the participant and the chatbot. Participants were recruited via Prolific, an online platform for recruiting study participants, and randomly distributed between conditions. The study was expected to take 20 minutes to complete, and participants were rewarded £3 upon completion of the survey. The study was approved by the Ethical Review Board of Eindhoven University of Technology.

We conducted a pilot study involving 10 participants to evaluate our study setup. We identified a minor mistake with hashes (#) appearing in the chat itself in one condition and some initial confusion among participants based on the task instructions. We resolved these issues before the final study and excluded the pilot participants with these issues from the analysis.

3.3 Participants

We recruited a sample of 237 participants, with 171 participants completing the questionnaire. From these, we excluded three participants who took excessively long to complete. Here, we used more than four times the interquartile range above the 75th percentile as a cut-off range. The final sample thus consisted of 168 participants (78F, 89M, 1 anonymous), with ages ranging from 18 to 79 (M = 38.57, SD = 13.19). On average, it took participants 17 minutes and 4 seconds to complete the study (SD = 8 minutes and 42 seconds).

3.4 Procedure

First, participants were presented with an informed consent form. It stated that the purpose of the study was to gain insight into their perceptions of a chatbot. Here, dementia was not mentioned to avoid influencing their expectations of the chatbot due to the common stigma associated with dementia, as covered in Section 2. After consenting to participate, participants chatted with the chatbot for four minutes. During this time, participants were tasked with uncovering ten critical ingredients for baking a lemon cheesecake. Depending on the condition, the participants were either told that they would be interacting with a 30–40 year older future version of themselves or with a 30–40 year older stranger called Robin. The name Robin was chosen due to the name's gender ambiguity. To incentivize participants, we informed them that the top 10% of the participants who stated most ingredients correctly would receive a bonus of £1. Bonus payments were rewarded based on the number of correct ingredients of the 90th percentile, with all participants with that number of correct ingredients or higher receiving the bonus. After inspecting the answers, 21 participants (including those in the pilot) had all 10 ingredients correct and were thus awarded the £1 bonus. Following the chatbot conversation, participants were asked to fill out the survey questions in the following order: 1) IOS scale (with the opportunity to elaborate on the choice), 2) Dementia Public Stigma scale, 3) Dementia Worry scale, and 4) Fear of Alzheimer's Disease scale. Thereafter, participants could elaborate on their experience of talking with either their future-self or Robin. We then collected demographic details, including age, gender, country of residence, nationality, and familiarity with dementia. Finally, during debriefing, participants were informed that the topic of the study was specifically dementia, and they were asked to provide consent once more, now aware of the study's full context. The entire questionnaire that followed the interaction with the chatbot is included in the supplementary materials.

3.5 Measures

We employed a combination of open-ended questions and validated scales to gather insights into participants' interactions with the chatbots and their perceptions toward a future with dementia.

3.5.1 Questionnaire. The questionnaire consists of three validated scales: 1) Dementia Public Stigma scale [37], 2) Dementia Worry scale [40], and 3) Fear of Alzheimer's Disease scale [26]. The Dementia Public Stigma scale has 16 items, answered on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). This scale has five validated subscales: 1) fear and discomfort, 2) incapability and loss, 3) acknowledgment of personhood, 4) burden, and 5) exclusion. The Dementia Worry scale has 12 items, answered on a 5-point scale (1 = not at all typical of me, 5 = very typical of me). The Fear of Alzheimer's Disease scale has 11 items, answered on a 5-point scale (1 = never, 5 = always). Additionally, the IOS scale was used to measure the interpersonal closeness between the participant and the chatbot [4]. Moreover, participants' level of familiarity was measured in line with Knesebeck et al. [77] by asking 1) if they had ever had contact with a person with dementia and 2) if they had personal experience in caring for someone with dementia. Both variables were dichotomous, being either 'yes' or 'no'.

3.5.2 Open Questions. We asked participants to reflect on their interaction with the chatbot by asking them open-ended questions. They were as follows: "Could you describe why you chose the overlap of closeness (based on the answer for the IOS scale)?", and "How was the experience of talking with [your future self / Robin]?".

3.6 Mixed Methods Approach

Given our convergent, mixed methods approach (triangulating qualitative and quantitative data) [16], we collected our quantitative and qualitative data concurrently as one study, with measures and questions as per above. For the quantitative analyses, we used STATA 18 and R (version 4.4.2). Using confirmatory factor analyses, we examined the factors underlying the three scales (Dementia Public Stigma scale, Dementia Worry scale, and Fear of Alzheimer's Disease scale). The obtained factors were used as the dependent variables in the analyses and their distributions were checked for normality using the Shapiro-Wilk test. For normally distributed dependent variables, we fitted a two-way ANOVA to the data with the two independent variables *chatbot* and *perspective* as predictors. We thus assessed whether a chatbot presenting with or without symptoms of dementia affected participants' attitudes towards dementia (RQ1: main effect of *chatbot*), whether the chatbot being framed as participants' future self or a stranger affected their attitudes towards dementia (RQ2: main effect of *perspective*), and whether *chatbot* and *perspective* interact to affect attitudes.

For the other, non-normally distributed dependent variables, we conducted the non-parametric equivalent, Scheirer-Ray-Hare test. For every test, we used an α-level of .05 for significance testing. In further exploratory analyses, we added the age of participants and their experience in caring for people with dementia to the models. Finally, we studied the *performance* of participants as measured by the number of lemon cheesecake ingredients they correctly listed at the end of the chat. We checked how performance varied between the conditions using a Sheirer-Ray-Hare test and expected a main effect for *chatbot* since the chatbot simulating dementia made it harder for participants to uncover the ingredients. To test whether participants' performance affected their attitudes toward dementia, we correlated performances with participants' scores on the Dementia Public Stigma scale, Dementia Worry scale, and Fear of Alzheimer's Disease scale across all conditions using Spearman correlations.

For the qualitative analysis, we examined the responses participants provided to the open-ended questions. Using open coding [14], we assigned codes to these responses to identify key themes. We approached our thematic analysis from an interpretive angle [68]—

rather than quantifying our qualitative data to match quantitative variables measured (like worry), we focused on people's *experience* as an *interpretation* of the interaction. Participant's backgrounds and exposure to dementia, of course, differ and color their experience with the chatbot. Rather than merely looking for quantifiable similarities or differences, we looked for their perspectives and personal stories [68]. This, in turn, converges with our quantitative data to holistically frame *how* people may express their unique ways of variables we measured, like seeing how they related to the chatbot (IOS scale) and worry about or have fear regarding dementia.

4 Results

We first present our quantitative results analyzed from the questionnaire and then move on to the qualitative results based on the responses to the open questions.

4.1 Exploratory Quantitative Results

Partially consistent with the factors found by [37] to underlie the Dementia Public Stigma scale, we could confirm factors *discomfort around people with dementia* (α = .79), *incapability of people with dementia* (α = .75), and *acknowledgment of personhood* (α = .62). However, instead of two separate factors, we found one factor representing *burden of having dementia* (α = .80). Additionally, we verified the validity of the factors *fear of developing dementia* (α = .95) and *worry of developing dementia* (α = .96). Only *discomfort around people with dementia*, *incapability of people with dementia*, and *acknowledgment of personhood* had normal distributions for every condition.

4.1.1 Influences of Chatbot (baseline versus dementia symptoms) on dementia attitudes (RQ1). Two-way ANOVAs with the dependent variables concerning participants' attitudes toward dementia (*discomfort around people with dementia*, *incapability of people with dementia*, and *acknowledgment of personhood*) showed no significant differences between dementia and control conditions (all $p > .05$). A Scheirer-Ray-Hare test on the *burden of having dementia* also revealed no significant effect of *chatbot* ($p > .05$). Thus, there were no significant differences in terms of any of the Dementia Public Stigma scale factors as a result of the included independent variables. Furthermore, Scheirer-Ray-Hare tests revealed no significant differences in *worry of developing dementia* and *fear of developing dementia* between dementia and control conditions (both $p > .05$).

4.1.2 Influences of Perspective (stranger versus future self) on dementia attitudes (RQ2). Two-way ANOVAs with the normally distributed factors that predicted participants' attitudes toward dementia as dependent variables showed no significant differences between the stranger and the future-self conditions in terms of *discomfort around people with dementia*, *incapability of people with dementia*, and *acknowledgment of personhood* (all $p > .05$). A non-parametric Scheirer-Ray-Hare test with the non-normally distributed *burden of having dementia* as the dependent variable revealed no significant effects of the chatbot's role on that variable ($p > .05$). Furthermore, Scheirer-Ray-Hare tests revealed no significant differences in *worry of developing dementia* and *fear of developing dementia* between the stranger and future-self conditions (both $p > .05$).

For each dependent variable, we checked for interaction effects. The interaction between the two factors *chatbot* and *perspective* on the stigma subscale concerning participants' perceived *incapability of people with dementia* nearly reached significance ($F(1, 164) = 3,68, p = .057, \eta^2_{\text{partial}} = .022$). This reflects a trend that exposure to a bot that shows signs of dementia reduces the perceived incapability of people with dementia when asked to imagine the bot as a future version of oneself ($mean_{BaseFS} = 22.11$, $SD_{BaseFS} = 4.20$ versus $mean_{DemFS} = 20.23$, $SD_{DemFS} = 5.25$) while it increases the perceived incapability when the bot is framed as a stranger ($mean_{BaseStr} = 20.88$, $SD_{BaseStr} = 5.43$ versus $mean_{DemStr} = 21.96$, $SD_{DemStr} = 4.84$). No other interaction effects were found.

4.1.3 Additional analyses. When taking a closer look at the *performance* of participants in uncovering as many lemon cheesecake ingredients as possible, we found a significant main effect of *chatbot* ($H = 4.78, p = .03$), as expected ($median_{BaseStr} = 7$, $median_{BaseFs} = 7.5$,$median_{DemStr} = 6$,$median_{DemFs} = 6$). There was no main effect of *perspective*, nor an interaction effect. The *performance* and participants' scores on the three attitudinal scales *stigma* ($\rho_S = -0.09$), *worry* ($\rho_S = -0.13$), *fear* ($\rho_S = -0.07$) were hardly correlated, indicating that attitudes, assessed after the chat, were not influenced by task performance. Since we were also interested in discovering how being familiar with dementia and the age of participants influenced the results of the models we ran so far, we included them as additional variables to those models. Familiarity was measured in terms of whether participants had previously 1) interacted with people with dementia before (Yes: 122, No: 46), and 2) cared for someone with dementia before (Yes: 34, No: 134). The exploratory model then contained six predictors, so we corrected for Type I error inflation by $\alpha_{\text{corrected}} = \frac{\alpha}{6} = .0083$. We found a significant effect of *having cared for someone with dementia* on *discomfort around people with dementia* ($F(1, 161) = 9.12, p = .0029, \eta^2_{\text{partial}} = .054$). Specifically, participants who had cared for people with dementia before expressed lower feelings of *discomfort around them* than those without these experiences. The rest of the exploratory analyses returned no significant results. Exploratory analyses on the Inclusion of Other in the Self score indicated that there were no significant differences in perceived IOS between the dementia and control condition, and the stranger and future-self condition (all $p > .05$). To test whether the stranger versus future-self manipulation could be approximated by using the IOS scale scores, we explored a binary recoding of those scores, with < 3 reflecting 'no inclusion' and scores $>= 3$ reflecting 'some inclusion.' However, Scheirer-Ray-Hare tests also showed no significant main or interaction effects of this new binary inclusion variable and *chatbot* on the outcome variables *fear of developing dementia* and *worry of developing dementia*.

4.2 Qualitative Results

We structured the findings around two main themes: *1) engaging with future scenarios* and *2) perceptions toward the chatbot*. Participant IDs are indicated in parentheses following the letter P, and each participant's condition is denoted as D1 (dementia-future self),

D3 (dementia-stranger), C1 (control-future self), and C3 (control-stranger).

4.2.1 Engaging with future scenarios. Participants who interacted with the chatbot posing as their future selves often experienced a personal connection, leading to a sense of engagement with their projected future. One participant reflected, "*well, it is myself, albeit from the future*" (P77, D1), suggesting a personal connection to the simulated experience. These interactions prompted personal contemplation about aging and future scenarios, particularly among those who interacted with the dementia-simulating chatbot. For example, one participant noted, "*the bot was very scatty, and I can see myself getting a bit forgetful in the future*" (P61, D1).

Possible changes due to the passage of time led participants to experience a mix of familiarity and detachment during their interaction with the chatbot. One participant described this duality, "*it was a surreal experience. On the one hand, it was like talking to myself, but it was also like talking to someone I don't know. My future self has had experiences that I haven't had yet, so we're different people in a way. But we're also the same person in another way*" (P158, D1). This suggests that the chatbot allowed participants to envision their future selves as familiar and yet distinctly different. Similarly, participants in the control group could also engage in deep reflection. One participant remarked, "*he seemed a little too interested in lemon cheesecake, which was weird because I do not like lemon cheesecake. Happy to hear he was still with Susie, though*" (P114, C1). This indicates that the interaction sparked thoughts about personal relationships and future possibilities beyond the immediate task. Another participant observed, "*it is me, but I will have changed in 30 years*" (P45, C1), showing an understanding of personal evolution over time.

Recognizing traits or behaviors that aligned with their current selves allowed some participants to find moments of connection during their interaction. For instance, one remarked, "*the chatbot seemed to have a bit of personality I could relate to*" (P222, D1). However, many participants also struggled to accept the chatbot as a future version of themselves, particularly when it did not match their current language or mannerisms. One participant shared, "*the chatbot was nothing like me or my personality, so it was difficult to imagine it being me from the future*" (P131, C1). Another felt that the chatbot's responses were out of sync with their personality, noting it to be "*very slow and methodical, whereas I am much faster in life*" (P121, D1). These discrepancies created a significant gap between participants' expectations and the chatbot's behavior. Participants interacting with chatbots not posing as their future selves generally did not engage in the same level of future-oriented reflection. Apart from occasional recognition of similarities in communication style, such as, "*the chatbot was answering questions in the same way that I would if that was my job*" (P79, C3), interactions were often focused on immediate task completion. For example, one participant noted, "*I was not interested in what the chatbot was saying—only in getting the list of ingredients*" (P83, C3), highlighting a task-centric approach that overshadowed personal reflection.

Evolving perceptions of the chatbot over the course of the interaction were based on participants' initial expectations, the goals of the task, and the limitations they encountered. Participants who interacted with the chatbot as their future self often began by viewing it as a tool for obtaining information but later grappled with the implications of a future self experiencing cognitive decline. One participant initially said, "*I feel no connection. I've used it as a tool*" (P96, D1), but later acknowledged, "*my future self had memory problems. It was kind of annoying*" (P96, D1). Another participant distanced the chatbot from self, saying, "*it's a computer AI, it's different to myself*" (P2, D1) and later reflected on the interaction with frustration, stating that it was "*a little frustrating and weird, didn't feel like me*" (P2, D1). Despite recognizing the chatbot's limitations, some participants remained focused on achieving their goals, as noted by one participant, "*[...] I recognized that my future self was experiencing some difficulties with memory and cognition. I found that it was quite challenging as I was focused on the goal of discovering as many of the 10 ingredients as possible, which proved to be difficult*" (P159, D1).

Connection to memories of caregiving were mentioned by participants who had cared for someone with dementia in the past. One participant shared, "*[...] my mother died of and after seven years in care with dementia. I only cared for her in the very early days*" (P104, D1). For others, dementia remained an abstract possibility they could consider but not fully relate to on a personal level.

4.2.2 Perceptions towards the chatbot. Participants' perceptions of the chatbot varied significantly, ranging from viewing it as a conversational partner to perceiving it as merely a technological tool.

A distinction between AI and self was highlighted by one participant, who remarked, "*a chatbot is a computer algorithm. I have NO 'relationship' to it in the same way that I have and can NEVER have a 'relationship' with the toaster or the microwave*" (P137, C1). This sense of distance was further emphasized by the chatbot's responses, which some participants found lacking in human-like interaction, "*it very much felt like I was talking to a robot and not a human being*" (P35, C3).

A task-oriented mindset led participants to primarily focus on extracting necessary information rather than forming a personal connection during the interaction. One participant expressed, "*I was only interested in the recipe and no other conversation*" (P105, D3), while another echoed, "*I was just focused on the task and was not interested in making conversation with him*" (P62, D3). This approach often led to a transactional experience, as one participant noted, "*I asked what I needed to know, nothing more*" (P1, C1), and another stated, "*it was a business relationship and it was conducted that way*" (P148, D1).

Chatbot limitations were pointed at by participants interacting with the dementia-simulating chatbot when they encountered challenges in achieving their goals due to the chatbot's constraints. One participant described, "*I recognized that my future self was experiencing some difficulties with memory and cognition. I found that it was quite challenging as I was focused on the goal of discovering as many of the 10 ingredients as possible, which proved to be difficult*" (P159, D1). This difficulty was compounded by the task-oriented nature of the interaction, leading to frustrations such as, "*fun but a bit frustrating because she kept getting distracted and it was hard to keep up the conversation*" (P11, D1). Persistent prompting further added to the frustration, as another participant noted, "*it was good, but I had to keep prompting for more information*" (P118, D1). Participants with high expectations for the chatbot's efficiency were

often frustrated, particularly those interacting with the dementia-simulating chatbot. One participant remarked, "*I didn't feel like we were remotely similar. They were programmed to be 'old' and 'forgetful' but were doing it to a ridiculous degree*" (P22, D3). In contrast, interactions with the non-dementia-simulating chatbot were generally perceived as smoother and more straightforward. One participant noted, "*I felt like Robin was very friendly and helpful sharing his recipe*" (P6, C3), indicating a more positive and engaging collaboration without the added complexity of simulating cognitive decline.

A rewarding experience was noted by some participants despite these challenges encountered during their interaction with the dementia-simulating chatbot. One participant noted, "*[the interaction was] difficult yet rewarding*" (P164, D1), highlighting that, despite the challenges, the experience offered meaningful insights into potential future scenarios. Another observed, "*it was interesting, although a little annoying at times due to my future self not being able to answer questions in a straightforward way*" (P67, D1), suggesting that the interaction was meaningful despite the frustrations. The frustration often expressed by participants interacting with the dementia-simulating chatbot was tempered with empathy. Participants who initially viewed the chatbot as a mere algorithm began to reconsider its potential as more than just a tool. One participant reflected, "*I don't think I was very kind and I should know better. I was too focused on the ingredients*" (P150, D1), indicating a growing understanding of the chatbot's potential beyond its mechanical role. Another participant acknowledged, "*I was oblivious about how my future self could actually be just aging, not intentionally unhelpful*" (P26, D1), showing an evolving perception of the chatbot over time.

An open mindset was key for participants, making them more likely to form a connection with the chatbot. Those who saw the chatbot as more than just a tool described the interaction as surprisingly personal and engaging. One participant noted, "*it almost felt like I was chatting to a friend or someone I knew*" (P87, D3), while another remarked, "*I found like I was almost talking to a person more than AI and there was a sort of connection*" (P108, D3). The chatbot's demeanor and shared interests played a significant role in fostering this sense of rapport. For instance, one participant shared, "*we have a similar hobby, so we are really close to each other*" (P135, C3). However, some participants still maintained a mindset that limited the potential depth of interaction, treating the chatbot primarily as a tool. One participant stated, "*however, I was told in advance they were a bot, so I was speaking to them as a bot. I would have spoken entirely differently if I knew they were real*" (P22, D3). This highlights the importance of framing how participants engage with chatbots, as preconceived notions can significantly shape the interaction experience.

Time constraint given to the participants during the study was also mentioned indicating the lack of sufficient time to fully explore the interaction. Many participants felt rushed, as one noted, "*the chatbot interaction felt like a rush, as such I felt the need to hurry through. Rather than fully invest in it*" (P132, C1). This sentiment was reinforced by the feeling that the interaction was more of a mechanical exchange rather than a genuine conversation. "*just typing 'what are the ingredients' and 'what else', basically. Like asking for information from a machine, which is exactly what I was doing*" (P120, C3) one participant described. This sense of urgency prevented them from establishing a deeper connection or fully understanding the chatbot's responses. A participant reflected, "*I didn't have enough time to get to know them well or see if they were like me*" (P129, D1). Another simply wished for "*more time to talk to Robin*" (P7, D3), indicating that while the interaction showed potential for deeper engagement, the limited time available hindered the ability to fully connect and explore the conversation.

In summary, our qualitative results indicate that participants interacting with the future-self often developed personal connections, creating possibilities for reflecting on futures. While some participants found the chatbot's behavior familiar and relatable, others struggled with discrepancies between their present selves and the chatbot's projected traits. Finally, despite challenges like memory difficulties, participants could find the experience meaningful, particularly those who could engage beyond task-oriented goals, allowing them to foster empathy and deeper personal insight.

5 Discussion

Our research targeted people's attitudes toward dementia with LLM chatbots as tools for envisioning challenging futures with dementia, motivated by the potential of these interactions to foster empathy, build understanding, and improve support for individuals facing cognitive decline. We reflect on what our results mean and imply to encourage personal reflection when designing chatbot interactions, highlighting the potential chatbots hold for fostering empathy and navigating the complexities of a possible future with cognitive decline.

5.1 Dementia and Technology

As the global population ages and the prevalence of dementia is expected to increase, there is an urgent need to acknowledge the stigma associated with the condition to increase people's understanding of the disease. The mental model people have of dementia is formed by the interplay between its neurological nature and psychosocial factors that are associated with it, such as one's social context [22]. Kitwood (seen as the founder of person-centered care) argued against a purely medical approach to dementia and advocated the psychosocial factors and the public perception of dementia [41]. Viewing people with dementia as individuals beyond dementia is paramount for enhancing the lives of those diagnosed [22, 50, 72].

To that end, improving knowledge and changing negative perceptions are crucial for creating dementia-friendly communities [33]. Attitudes toward dementia often harbor negativity with feelings of discomfort, shame, and unfriendliness [11]. But, these attitudes can vary widely depending on personal experiences and perspectives. By exposing participants to a chatbot exhibiting symptoms of dementia, using a previously employed task showcasing difficulties in cooking and baking as experienced with dementia [62], we explored participants' attitudes toward dementia. In particular, we looked into the relationship between attitudes and people's connection with the chatbot, namely by imagining the chatbot to be an older version of themselves or a stranger. Interacting with a chatbot that simulates dementia could contribute to challenging people's attitudes toward it. By interacting with one's envisioned future self versus a stranger with symptoms of dementia, our study also

carved out a space to open up people's second-person perspective on dementia: the chatbot as another *you* with a possibility to relate to experiences of dementia, which could contribute to a better understanding the needs and lives of people impacted by dementia.

Technologies enable us to experience new perspectives, be it through books and movies or, more recently, through virtual reality or LLMs. Any technology needs to be sensitive to conditions such as dementia, as researchers have commented on the situated nature of care and participatory involvement [31, 32]. Wijma et al.'s study, for example, utilized VR to foster empathy and understanding towards individuals with dementia, offering participants immersive experiences that mimic the cognitive and emotional states of those affected [80]. However, VR technologies face the shortcoming of limited accessibility and adoption due to technical complexity and hardware requirements. In contrast, the ease of use, widespread availability, and high adoption rates of LLMs allow conversational interactions to probe the public's perception at scale. We thus looked into people's attitudes about dementia and toward people with dementia and explored the possibilities of designing conversations using LLM technologies to explore such attitudes.

5.2 Design Considerations for and Implications of LLMs as Technologies for Reflection

Building on our quantitative and qualitative findings, we outline three design considerations **(DC 1–3)** and discuss methodological implications. Designing LLMs to reflect these considerations can help position them as tools for prospection and fostering empathy leading to inclusive and accepting dementia-friendly communities.

5.2.1 (DC1) Simulating perceived personhood. Designing for a sense of perceived personhood in chatbots offers a promising way for users to project and explore their attitudes toward dementia. Participants were told they were interacting with either their future self or a stranger. Regardless of the chatbot, participants often attributed personhood to the chatbot based on the framing they were given, 'effectively' projecting their own attitudes and responses toward dementia onto the chatbot. The approach of framing the chatbot as a 'person' enabled participants to comment more thoughtfully on the 'incapabilities' associated with dementia, fostering deeper reflection on dementia-related attitudes.

Particularly in the future-self condition, participants showed a generally more accepting view of cognitive decline, even though the chatbot did not reflect their conversational style or preferences. Some participants, however, reported a disconnect since the chatbot did not convincingly represent their future selves. While we investigated only two relational perspectives, future research could explore additional frames and develop chatbots to capture and enhance the diversity of reflective experiences. In prior research, it was found that interacting with chatbots in both caregiving and care-receiving roles can enhance self-compassion, with the care-receiving approach having a slightly stronger impact [45]. This could also be explored within the context of simulating perceived personhood, particularly in dementia scenarios.

5.2.2 (DC2) Fostering a reflective mindset. To engage users with diverse expectations, it is crucial to design chatbot interactions that encourage reflection. Participants in the study with a task-oriented mindset did not find the interaction rewarding, as they were unable to think beyond the immediate task and engage with the broader, more reflective aspects of the scenario. This emphasizes the importance of carefully selecting scenarios. Grounding the interaction in everyday life as experienced through the lens of dementia helped create a reflective space within a familiar context. Framing the interaction in this way helped prompt users to engage thoughtfully, potentially altering their perceptions and fostering a more nuanced understanding of the complexities involved. Additionally, while we focused on a single scenario, future work should consider alternate scenario options that allow users to explore different possibilities.

To further support a reflective mindset, chatbot interactions could incorporate open-ended or exploratory conversation structures that invite users to engage with the scenario beyond immediate, expected responses. This approach aligns with recent research advocating for the integration of flexible and open-ended reflective elements in the design, avoiding imposed "correct" outcomes and empowering users to derive unique, personally meaningful insights during bereavement through self-guided exploration [46]. Finally, withholding information about dementia until the debriefing ensured that participants' emotional responses and reflections were not influenced by preconceived notions, enabling them to engage more openly with the presented scenario.

5.2.3 (DC3) Tailoring interactions to user backgrounds. Designing chatbot interactions requires thoughtful consideration of users' diverse backgrounds and experiences, as these factors can significantly shape how they engage with and perceive the chatbot. Beyond the personalization options discussed in the future-self condition, chatbots should be designed to adapt to an individual's familiarity with dementia. This aligns with prior work that identified stigma around cognitive decline, likely stemming from unfamiliarity and fear of aging [52]. Additionally, limited knowledge of dementia is closely tied to stigma, with lower familiarity leading to more negative attitudes [30]. By acknowledging users' different levels of understanding, chatbots can deliver interactions that meet users where they are, fostering more relevant and meaningful exchanges.

Moreover, given the connection between limited dementia knowledge and lower socioeconomic status, education, and health literacy [11, 58], future work could incorporate educational elements to address common misconceptions. This could help reshape attitudes, reduce stigma, and promote a deeper understanding of dementia. However, it is essential to carefully design for this to avoid unintentionally reinforcing negative stereotypes or further stigmatizing individuals with dementia. Framing the information in a sensitive, non-judgmental way is key to ensuring it is received positively. Finally, to ensure clarity and proper engagement, participants should be informed about the chatbot's purpose and its design limitations, helping them better understand the scope and intent of the interaction.

5.2.4 Methodological Implications for HCI Research. The use of LLMs as tools for prospection has methodological implications for HCI research [76]. In collaboration with dementia experts, we designed an LLM chatbot to display dementia symptoms commonly associated with people diagnosed with dementia. Through such tools, participants can be supported in prospective activities, increasing

the realism of the task. Prior research in and beyond medical education has indicated the value of simulation environments [43], particularly those that allow stakeholders to test or train a variety of skills and competencies before applying these to and within real-world contexts [21].

While novel research explores how patients can be simulated through the use of LLMs [12], no work exists on how dementia can be manifested through the use of LLMs—and subsequently designed into a chatbot. We invite future work to further assess the drawbacks and benefits of the presented approach. Given that dementia impacts 55 million people globally, there is a clear need for both training tools for practitioners and increased societal awareness among the general population.

5.3 Limitations and Future Work

We recognize several limitations in our work. In the post-questionnaire, participants described finding it difficult to imagine the chatbot as an older version of themselves as the chatbot did not exhibit their conversational style, personality, or vocabulary. This was also the case for participants in the control condition. Although integrating personalized features would likely have enhanced the realism and engagement of the interaction, the focus of this study was on understanding how the future-self concept is received and processed by participants in the context of a future with dementia. Several participants further remarked that they felt annoyed with the interlocutor's slow and forgetful behavior, but they did not make the connection with dementia until the post-questionnaire. At the start, we deliberately chose not to frame the study as a dementia study to avoid introducing any preconceived notions of the condition. Additionally, our participants were under time pressure to complete the task. Prior research indicates that people expect goal-oriented chatbots to complete tasks successfully [23, 29]. This might have impacted people's perceptions towards our chatbot, as time pressure during task completion impacts people's behavior, such as lowered willingness to help others due to the perceived lack of time [17]. Yet, we introduced time pressure in the study design because due to dementia, everyday tasks that have time pressure, like cooking and baking [62, 63], pose great difficulty in daily life.

There were those who could not relate to or understand dementia symptoms, possibly due to not being familiar with them and thus not connecting them to dementia. Also, many participants could not imagine the chatbot as a future version of themselves. Some participants commented that they could not suspend their disbelief, regarding the chatbot as nothing more than an algorithm and commenting on how it was 'an AI on loop', 'programmed', or 'a computer'. However, even when splitting up the participants according to low and high scores on the IOS scale in the exploratory analyses, no effect on the attitudes or fear and stigma could be found. This indicates that even when participants could identify with the chatbot to some degree, the intervention did not change their self-reported attitudes and perceptions concerning dementia. We therefore welcome future work to systematically assess the effectiveness of eliciting intertemporal reflection through a chat-based medium and its subsequent effect on participant attitudes, for example, to dementia. Particularly, the assimilation of the chatbot to the participant in terms of language and personality may require extended periods of engagement. Future research could build on this study by incorporating user data to create more personalized interactions, e.g., through adapting conversational styles, vocabulary, and behavioral traits based on individual user profiles using data on preferences and life experiences, thereby better simulating the future-self experience and providing deeper insights into how individuals relate to their future cognitive states.

Despite these considerations, many participants also remarked that they found the chat to be thought-provoking, i.e., that it caused them to reflect on what it means to have dementia, that they can commiserate with their older self, or that it sparked memories of relatives or friends with dementia. This is in line with positioning LLMs as suitable tools for prospection, specifically for intertemporal reflection. We acknowledge that the dementia chatbot presented to the participants is a simplified way of representing dementia symptoms in an LLM chatbot. Moreover, we acknowledge the drawback of recruiting participants online using established platforms, as it limits who ultimately gets the opportunity to participate in our study. Recruiting people online might, for example, exclude individuals with little to no experience of digital technologies. Future work should consider such and other relevant target audiences' attitudes toward dementia. For example, one potential avenue for future work is to involve stakeholders, e.g., people with dementia and caregivers, in designing LLM-based chatbots displaying dementia-related symptoms. While particular symptoms such as repetitiveness are commonly associated with patients diagnosed with dementia—exactly how to appropriately represent dementia diagnoses in LLM chatbots remains to be explored.

6 Conclusion

We explored people's attitudes toward dementia by exposing participants to an LLM chatbot simulating symptoms of the condition. Neither the display of dementia symptoms nor framing the chatbot as a future self or a stranger significantly influenced participants' attitudes. Our results reveal the role of familiarity with dementia and age as crucial factors in shaping peoples' perceptions of dementia. Participants who had interacted with or cared for individuals with dementia exhibited lower discomfort levels, indicating the potential impact of familiarity in reducing stigma. Additionally, our results point to the importance of the perception of the chatbot, either a future self or a stranger, for people to be able to project their attitudes toward dementia. The chatbot created a reflective moment, and participants in the future-self condition could display a more accepting stance toward their perceived incapability. Methodologically, our study contributes to the design of an LLM chatbot to simulate dementia symptoms and provides an opportunity to examine how peoples' biases can be evoked and designed to counter the narrative on dementia and the common stigma surrounding it. Such a chatbot offers a novel avenue for exploring dementia-related interactions e.g., for training and awareness. Our work is timely, given the global impact of dementia and the need for awareness and acceptance of the condition. Additionally, we see LLMs as technologies of prospection, emphasizing their unique role in facilitating intertemporal reflection and empathy toward one's

future self. We contribute to the evolving landscape of communication within human-AI interactions, offering a novel perspective to explore and alter the attitudes toward dementia.

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