# Technology-Supported Reminiscence Therapy for Those Living with Dementia

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**Abstract**

The AMPER application is designed to support *reminiscence therapy* in a domestic setting for those living with dementia through the use of an Intelligent Virtual Agent (IVA). Such agents have been shown to increase functionality, accessibility and user satisfaction. We describe the application and summarise the design process used to choose the graphical agent for the project. We briefly discuss the implications of using stereotypes or archetypes in this process.

## Introduction

Older age groups are the fastest growing sector of the population in developed western countries because of the post-war baby boom population and increased life expectancy (Economic and Social Affairs 2019). Neurological changes are commonly observed in ageing populations including Alzheimer's Disease (AD) which impacts cognitive skills, such as language, judgment, problem solving (Lazar, Thompson, and Demiris 2014) and the ability to carry out activities of daily living independently. However, memory impairment (Gold and Budson 2008) is one of the most serious symptoms, and this is cited as the most frequent reason for admission to nursing facilities (Andel, Hyer, and Slack 2007). One memory component is Autobiographical Memory (AM), the memory for personal events and facts about the self that allows individuals to maintain a meaningful and coherent life story. AM decline leads to loss of knowledge about personal experiences, diminishes the person's sense of self and thus reduces mood and quality of life (El Haj et al. 2015). Consequently, AD patients tend to become withdrawn and depressed due to communication problems and loss of confidence.

Non-pharmacological interventions for memory difficulties are gaining much attention (Acevedo and Loewenstein 2007) due to the limited efficacy of current drug therapies (Elmaleh et al. 2019) and the brain retaining the capacity to change with learning even during ageing (Landi and Rossini 2010; Buschert, Bokde, and Hampel 2010). Reminiscence Therapy (RT) is one such non-pharmacological intervention which has been shown to be particularly beneficial for older adults. RT involves discussing events and experiences from the past and aims to evoke memories and stimulate mental activity. It uses props such as videos, pictures and objects to assist with the reminiscence experience and can be carried out in a group or on a one-to-one basis (Woods et al. 2018).

The aim of reminiscence is to restore access to those lost memories or at least, maintain the available pool of autobiographical memories, and possibly slow progression of the disease. It has been shown to be particularly beneficial for older adults and can enhance well-being by improving mood and reducing symptoms of depression (Bohlmeijer, Smit, and Cuijpers 2003). Because RT stimulates memory recall, it may help counteract cognitive decline, thereby supporting cognitive function (Woods et al. 2018). It also promotes social interaction and reinforces a sense of identity, allowing older adults to connect with others and affirm the significance of their life experiences (Westerhof, Bohlmeijer, and Webster 2010). Studies suggest that reminiscence therapy can contribute to better mental health outcomes and overall life satisfaction in aging populations . At the early stages of AD, RT can aid access to memories residing in still viable regions of the brain, thus enhancing peoples' well being, sense of identity, and independence(Lök, Bademli, and Selçuk-Tosun 2019; Cuevas et al. 2020).

RT is usually conducted in a group setting with a facilitator. This has advantages of greater social interaction and lower cost, but requires a skilled facilitator and participants who are able to assemble as a group. This places limits on its applicability. Here we report work on a project, AMPER, whose aim is an App with an intelligent graphical story-facilitator agent that supports reminiscing between a user living with dementia and their carer, in a domestic setting. The App runs on a tablet, maximising accessibility, and is now being piloted with healthy elderly participants, before evaluation with the target user group, .

The use of an intelligent graphically-embodied agent with this vulnerable user group aims to be supportive and to increase engagement (a critical challenge in apps designed to support people living with dementia (Maresova et al. 2018; AJ et al. 2019)). However, as Aylett et al point out (Aylett and Romeo 2023), *"When we build systems that harness the power of human conversation we are dealing with something that is central to a human sense of self"*. Thus, selecting a graphical agent for an interface is inherently different from choosing a standard GUI design. We enter the social world

and issues such as gender, ethnicity and diversity become relevant (Bond, Powers, and Raghavendra 2021). For example, the extent to which conversational systems such as Siri and Alexa reinforce gender bias became a topic of public interest in March 2019 when their responses to misogynist comments appeared flirtatious or accepting (UNESCO 2019). After an overview of the AMPER app, we summarise the process of selecting the characters used in the AMPER interface, and how this also raised issues of stereotypical representations.

## Previous Work

AI-driven interactive graphical characters are well-suited to healthcare domains: cost savings and convenience being the most important advantages. They are not intended to replace human healthcare providers but rather to enable the providers to focus their time on exceptional cases by automating routine parts of their work. In the case of mobile applications, these characters are available any time of the day allowing the patients to interact at their own convenience and pace (Bickmore 2022).

For example, in a study of an agent-based discharge nurse, patients preferred receiving their discharge instructions from the agent than their doctor or nurses because they did not feel rushed (Zhou et al. 2014). In another study on patients with chronic conditions, patients interacting with a character on a smartphone reported a significantly higher quality of life at the end of the intervention period compared to those undergoing standard care (Bickmore et al. 2018). Such characters can not only deliver practical medical information to patients but also social, emotional and relational messages. They are ideal for establishing engaging relationships with users to promote behaviour change interventions (Bickmore and Picard 2004).

One challenge in selecting characters for a conversational agent is that engineers may feel confident they can select an agent without any input from potential users or stakeholders. Unconscious bias is a powerful driving force in character creation and in forming the criteria for what is *appropriate*. For example in Richards et al's (Richards, Miranda Maciel, and Janssen 2023) study exploring the co-design of an Embodied Conversational Agent (ECA) for stroke victims, the gender of the agent was chosen because *"females are associated with empathetic caring dialogue"*. Thus, the hairstyle, face shape and whether the character had glasses were chosen based on team input and that of stroke survivors, while the gender of the character was not. This highlights the difficulty in choosing ECA characters: some assumptions must be made but which should be part of the design process, and which should not?

Studies have lent support for an effect known as similarity-attraction (ter Stal et al. 2020) where humans lean towards characters that have similar traits, gender, and age to themselves and find these characters not only more attractive, but also more reliable, trustworthy, and knowledgeable. However, this effect has not been unanimously demonstrated, with some studies showing there may be more of a complementary-attraction effect, that is, a preference for agents that complement their personality (Lee et al. 2006). Other work (Joosse et al. 2013; Lim et al. 2022) found that humans trust and respond favourably to robots whose personalities are similar or complementary to their own depending on the interaction context and the robot role. Therefore, it is important to take context into consideration - the intended role of the character and the target audience - when designing an appropriate appearance for a graphical character (Bond, Powers, and Raghavendra 2021).

In addition, autobiographical life stories are important not only for human social interactions but for engagement with artificial agents (Bickmore, Schulman, and Yin 2009). Such agents must be equipped with *human-like* memory processes to meet user expectations of life-likeness, intelligence and responsiveness (Lim 2012; Leite, Martinho, and Paiva 2013).

## APP Overview

### Interaction Flow

The AMPER system runs as an Android application on a modern large-screen tablet (Wilson et al. 2024). The interaction is carer-assisted with the IVA guiding and facilitating the reminiscence experience in a meaningful way. Figure 1 illustrates the app interaction flow. The interaction begins with our IVA greeting the user. If the user is interacting for the first time, they will be asked for some basic demographic details. We collect information about the age and interests of the user as a way of individualising interaction. While we include an interface allowing the carer to upload digital materials such as photos that are personal to the user, it would be impractical to have to depend on these, and we rely heavily on generationally-relevant materials.

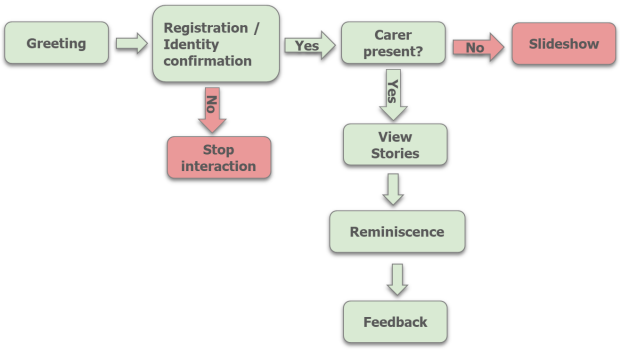



Figure 1: Walkthrough of steps in AMPER app interaction

Each tablet is dedicated to a single user to protect their privacy (personal materials and interaction history), so on subsequent interactions, they will be asked to confirm their identity. They will then be asked whether they have their carer with them. Since this is a carer-assisted intervention, they cannot proceed to the reminiscence stage without their carer but will be taken to a slideshow where they can view the previously reminisced material.

If a carer is present, they will be taken to the story selection screen (shown in Figure 2). A maximum of three stories are displayed for the user to select and reminisce with their

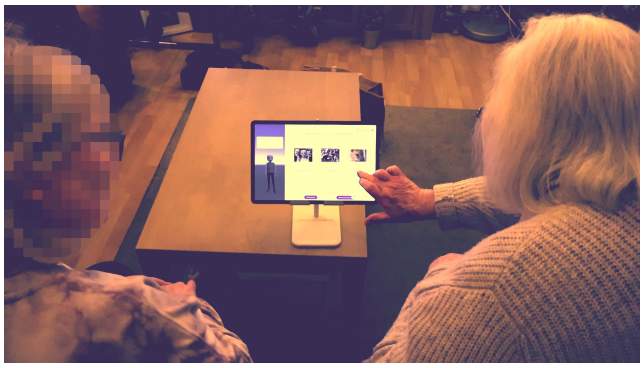


Figure 2: A healthy older adult and family member interacting with the AMPER app.


Figure 3: AMPER app reminiscence screen with carousal of materials

carer. The user's top 8 rated themes are also displayed to remind them of their selected interests. In the background, the application selects the most appropriate collection of pictures, audios, or videos (henceforth collections are referred to as 'stories', and pictures, audios, and videos as 'material') from the re-categorised BBCRemArc [1] database.

Selecting a story displays material from the story, while the IVA narrates it. The IVA then asks a prompting question with each piece of material (Figure 3), encouraging reminiscence between the user and carer. There are two important buttons available to the user - "Do not reminisce this picture again" and "Do not reminisce this story again" during this stage allowing them to eliminate a particular piece of material or a story in case they dislike or are distressed by it.

After reminiscing, the user is asked to provide feedback on their experience by rating on a smiley-ometer. The carer is also asked to keep a diary of all interactions which is submitted weekly. This feedback will be used to adapt the stories and material shown in subsequent interactions.

[1]https://remarc.bbcrewind.co.uk/

## Technical Details

The application can be split into two parts: an activity which flows like a regular app, with screens to display material, buttons for the user to click, and text boxes for the user to enter information; and an embedded Unity [2] activity, which renders, animates, and synthesises the voice of the IVA. We use Unity as it provides a more powerful rendering and animation environment, versus what would be possible using a standard Android activity. The materials presented in the application are stored in a Room database[3], and are used with permission from the BBCRemArc database[4]. Metadata is provided alongside the material, which includes a semantic description, decade of capture, and theme (Animals, Childhood, Events, Leisure, Music, People, Sports, or TV and Radio).

To ensure a better mapping to memory categories, each piece of material from the BBCRemArc was re-categorised into twelve sub-themes by the AMPER team under the categories proposed by Catricalà et al (Catricalà et al. 2023). A balance was ensured across sub-themes, material type (image, video, or audio), and decade. Using the new theme categorisation alongside decade and semantic descriptions of the material from the BBCRemArc database, full descriptions and prompting questions are pre-generated using a Large Language Model (LLM). These full descriptions, after human verification to ensure they meet our app constraints in terms of length and content, are then verbalised by the IVA, prompting discussion between the user and carer.

Our IVAs are embedded in the application by wrapping a Unity application in an Android fragment. This is achieved by exporting the Unity project as an Android library, and importing the exported library into Android Studio. This import process also allows communication between the AMPER standard Android activity and the Unity activity. Data integration points are setup with a Unity script, allowing the IVA to be directed as necessary. An example of this is displayed below, where the IVA is directed to speak and display subtitles after the user has successfully logged in, and material options are displayed:

```
1  UnityPlayer.UnitySendMessage("Canvas",
2  "ShowMessage", "Hello Username, what
       would
3  you like to talk about today?")
```

Speech synthesis is performed using CereProc[5] Text-To-Speech (TTS) technology. Using their Unity cerevoice engine, and a range of compact cerewave voices can be verbalised. Additional XML tags are also added into the text input, enabling emphasis and variability at required points of the narratives. Our IVAs all have similar animations, with simple gesticulations during speech, and idle animations during times of user-carer discussion. Lip syncing will also be added to the IVA by monitoring the output of visemes from the cerevoice engine, and animating the characters

[2]https://unity.com/, last accessed: 05/07/24

[3]https://developer.android.com/training/data-storage/room, last accessed: 05/07/24

[4]https://remarc.bbcrewind.co.uk/, last accessed: 02/04/2024

[5]https://www.cereproc.com/, last accessed: 02/04/2024

mouth positions.

To display the most relevant stories to the user, a spreading activation (Anderson 1983; Lim 2012) algorithm is used which takes inputs of: user age (to calculate ideal decade for reminiscence bump - teenage years and early adulthood, 15 to 30 years (Conway and Pleydell-Pearce 2000)), user interests, and material metadata (e.g. decade, sub-themes). By using this algorithm, semantically similar stories are presented alongside one another, attempting to mimic a human autobiographical memory, ensuring coherency and continuation of the reminiscence experience. For study purposes, and to ensure a comparable interaction experience for all users, they are presented with a maximum of three stories per session, containing three pieces of material each, and with a minimum of two sessions on separate days per week. Additionally, the media types of materials for each story in a session are also matched.

## IVA Selection Process

AMPER has adopted a co-creation design approach (Aylett et al. 2024). Project stakeholders and healthy older adults were actively involved early in this selection process consistent with principles of user-centred design and co-creation (Marti and Bannon 2009). Our process included three distinct phases: 1) co-creation with project stakeholders and identification of a set of desirable IVA traits; 2) a blind internal team rating process to select a subset from available IVAs; 3) a character survey with healthy older adults to select a final 4 IVAs (2 male, 2 female).

### Informal Character Workshop With Stake Holders

The AMPER stakeholder group consists of people who work in relevant areas, including NHS experts in dementia and technology, members of charity organisations and a dementia network, as well as industry experts in memory/memorabilia preservation. Stakeholders were provided with a set of story-telling character exemplars and were asked to provide feedback. These exemplars covered a broad variety of potential types of character design: 3D Naturalistic Graphical Young Man, 3D Cartoon Young Man, Non-human toy-like 3D Female Character, 2D Cartoon Older Female Character, 3D Cartoon Older Man, 3D Naturalistic Graphical Young Woman, 3D Naturalistic Graphical Older Woman. Each character was assessed by the stakeholders based on the following questions:

1. Give up to 5 descriptive words about this character.
2. What is good about it?
3. What is bad about it?
4. Do you think this is a good choice as a story-teller for our specific target group WHY? Or WHY NOT?
5. What would you keep?
6. What would you change?

This was followed by a moderated discussion on the types of possible characters and what traits might be important for a character that was to be used as a story-teller for the AMPER application. From that discussion: 1) The stakeholders preferred a cartoon 3D, Older, Human-like, character; 2) it was concluded that the traits of friendliness, kindness, knowledgeability, amicability, trustworthiness, and non-stereotypical appearance were important for the digital storytelling character as rated by the stakeholders.

### Blind Team Ranking

Given the costs and expertise required for an *ab initio* design, it was clear the project would have to use commercially available characters. The 6-person project team selected 17 commercially-available characters judged to match the stakeholder requirements for an individual blind rating exercise across the selected traits. A character scored 1 if thought to exhibit a specific trait and 0 if thought to lack it. A total and an average trait score were calculated for each character. Six characters were immediately rejected due to receiving the lowest rating. The remaining eleven were further assessed with another three excluded due to high price or animation complexity. The most highly rated eight characters, 4 female and 4 male were then selected for external ranking.

### External Character Selection

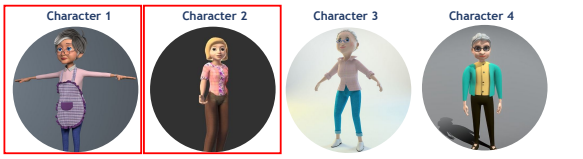
The female and male character surveys included the four female and male characters identified at the previous stage. The survey included eight questions. Question 1 asked participants to write the first three things that came to mind when viewing the character. Questions 2-7 asked participants to rate characters against the traits of friendliness, kindness, knowledge, amicability, trustworthiness and non-stereotypical appearance using a 5-point Likert agreement scale (from 1-Strongly disagree to 5-Strongly agree). Question 8 asked participants to freely write any other comments and/or feedback they had.

Female character survey: A total of N=26 participants (age range 59-87) completed the survey. Male character survey: A total of N=28 participants (age range 59-87) completed the survey. The same participants completed both female and male surveys whilst the order of the surveys was counterbalanced across participants.

For each character, the total score per trait was calculated by summing up the individual score across participants. The grand total score was also calculated by summing up the total trait scores across participants.

Female characters 3 and 4 received the lowest agreement rating per trait and grand total and were excluded. Male characters 3 and 4 received the lowest agreement rating per trait and grand total and were excluded. Characters 1 and 2 from both female and male surveys received the highest agreement score and will be used for the AMPER application. See Figure 4 and Figure 5 which show the trait scores we received from the external participants.

This selection process has limitations. Some are due to the practical constraints of finding characters designed by a third party for the project. Others reveal a tension between co-design and a more rigorous orthogonal trait design process, discussed below.




Total score (Higher is better)

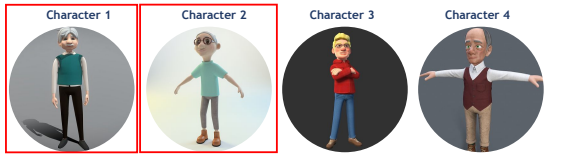
| | Friendly | Kind | Knowledgeable | Amicable | Trustworthy | Non-stereotypical appearance | TOTAL* |
|---|---|---|---|---|---|---|---|
| Character 1 | 98 | 100 | 88 | 102 | 93 | 63 | 544 |
| Character 2 | 100 | 99 | 88 | 102 | 92 | 79 | 560 |
| Character 3 | 80 | 84 | 77 | 84 | 81 | 91 | 497 |
| Character 4 | 83 | 81 | 95 | 83 | 84 | 88 | 514 |

*Minimum individual trait score: 26,*
*Maximum individual trait score: 130*

**sum of individual trait scores*

*Minimum total score: 156,*
*Maximum total score: 780*

Figure 4: Trait scores for the 4 short listed female graphical characters.




Total score (higher is better)

| | Friendly | Kind | Knowledgeable | Amicable | Trustworthy | Non-stereotypical appearance | TOTAL* |
|---|---|---|---|---|---|---|---|
| Character 1 | 94 | 94 | 91 | 94 | 95 | 79 | 547 |
| Character 2 | 105 | 95 | 79 | 105 | 88 | 100 | 572 |
| Character 3 | 64 | 70 | 93 | 67 | 84 | 82 | 460 |
| Character 4 | 74 | 80 | 80 | 80 | 84 | 81 | 479 |

*Minimum individual trait score: 28,*
*Maximum individual trait score: 140,*

**sum of individual trait scores*

*Minimum total score: 168,*
*Maximum total score: 840*

Figure 5: Trait scores for the 4 short listed male graphical characters.

## Correlation Between Features

Statistical analyses (Aylett et al. 2024) as well as descriptive measures for the characters were produced using R statistical software (v4.2.3, R Core Team 2023). Spearman Rank correlation analyses were performed to examine associations between the different character traits. False Discovery Rates (FDR) were applied to correct for multiple comparisons (Pike 2011).

This reveals a strong correlation between *Friendly/Kind/Amicable* (Spearman's rho $0.6 - 0.79$). These traits have weak correlation with *Knowledgeable* (Spearman's rho $< 0.25$), while *Trustworthy* shows a moderate correlation (Spearman's rho $0.3 - 0.4$) with other traits. The exception is *Non-stereotypical* which does not correlate with any other traits. The correlations between the other five traits are all positive.

Thus the non-stereotypical trait was an outlier compared to the other traits. The *Trustworthy* and *Knowledgeable* traits show a relationship with the friendly traits but with some divergence. This reflects previous literature findings that there is a tension between being authoritative (which also contributes to a sense of trust and competence) and being friendly (ter Stal et al. 2020).

| | **fr** | **kn** | **kw** | **am** | **tr** | **ns** |
|---|---|---|---|---|---|---|
| **fr** | - | - | - | - | - | - |
| **kn** | **0.66** | - | - | - | - | - |
| **kw** | **0.17** | **0.20** | - | - | - | - |
| **am** | **0.70** | **0.67** | **0.16** | - | - | - |
| **tr** | **0.37** | **0.47** | **0.37** | **0.44** | - | - |
| **ns** | 0.04 | -0.04 | 0.01 | -0.00 | 0.06 | - |

Table 1: Correlation between traits: Spearman rho (2 dp) p-value $< 0.25$ in bold. fr=Friendly, kn=Kind, kw=Knowledgeable, am=Amicable, tr=Trustworthy, ns=Non-stereotypical.

One should however note other practical constraints on the external ranking. Two characters were excluded because they exceeded our budget; another was excluded because animation would be too complex. Furthermore, we could not alter the pose or dress of the characters for the selection process (as that would have required manipulating models we had not yet purchased).

Female 1 was wearing an apron. No specific test on how this altered perceptions of stereotypicality was carried out, but there is a traditional western connection between aprons and traditional female *home-makers*. The words *kitchen* and *cook[ing]* appeared in over 50% of the three word groups used by participants to rate this character and may alone have impacted the character's *non-stereotypical* trait score. Pose may also have a significant impact. Male 3 has his arms folded, this can be regarded as an authoritative and unfriendly pose and this character rated low on friendly traits and high on the *knowledgeable* trait. Words used by participants to describe this character included *defensive, standoffish, unbending, aggressive*.

## Rigorous Orthogonal Design vs Co-Design

Looking at the correlations of the traits it is clear they are not orthogonal. More formal designs for a trait markup system (such as Big 5 (McCrae and Costa 1987)) involve examining underlying orthogonal factors, then relating these directly to trait names and finally validating a questionnaire for use in studies.

However, one should distinguish between creating a system for scientific discovery (such as the big 5) and a process guiding co-design. Especially given that the bottom line on graphic character selection may be for an engineer to pick a candidate because *"they like it"*. Not only are there research team resource constraints, mentioned above, of time, cost and technical expertise, but busy stakeholders also have limits on what they can commit to the process. Our process represents a trade-off between rigour and feasibility.

Arguably, in the co-design context, orthogonal traits may not be appropriate. That stakeholders chose three traits heavily correlated with each other can be interpreted as representing an informal weighting. The result is that the *friendly* element of the character was three times more important than

how knowledgeable, trustworthy or non-stereotypical it was. Whether this is due to the intended use of AMPER (i.e., people expect such features in agents/characters that will interact with patients with dementia see (Hunt et al. 2023)) requires further research.

### Archetype vs Stereotype

> *"To state it simply, archetypes provide foundations to build on and allow endless variety; stereotypes label and limit by assuming all members of a group share similar traits."* - (Gibson 1988)

The analysis of traits above raises the issue that choosing agents by prioritising views on how end users will relate to them, may also propagate stereotypical views of aging. Such stereotypical views are regarded as central to ageism *"As soon as we neglect the differences between individuals, we over-generalise and treat older people, ageing, and old age in a stereotypical manner. This stereotypical construction of older people, ageing, and old age is called 'ageism.'"* (Ayalon and Tesch-Römer 2018). Although dementia is not inevitable with age, it does increase with age. Thus people with dementia may experience the stigma that is associated with the disease as well as the stigma of ageism or the *'double stigma of dementia'* (Urbańska, Szcześniak, and Rymaszewska 2015). A concern for the AMPER project was to avoid stereotypical views of aging and choose a graphical agent sensitive to these concerns.

It has also been suggested that carers' acceptance of negative ageist stereotypes are caused in part by seeing an older person at their most vulnerable and dependant (Brown et al. 2009). Thus, given AMPER aims to support carers of those diagnosed with dementia, a key project priority is to avoid reinforcing such negative stereotypes.

Both the visual representation and social performance of the agent can reinforce or discourage negative or patronizing stereotypes of older people. The lack of a correlation between other traits suggest we can design effective agents without resorting to stereotypes. However, it also suggests the *non-stereotypical* trait as we presented it was not a barrier to selecting an agent, viz the most favoured female agent also scored the least on the *non-stereotypical* trait.

Actors are required to deal with this ambiguity on a day-to-day basis. Shontelle Thrash (Thrash 2022), a black actress and academic working in the US, argues that the requirement is not to avoid stereotypes but rather to transcend them. Roles are often written as stereotypes, but there is space for a performance to add nuance and complexity.

According to the Oxford Learner's Dictionary an archetype is *"the most typical or perfect example of a particular kind of person or thing"* (Online 2024 (accessed February 18, 2024) whereas a stereotype is *"a fixed idea or image that many people have of a particular type of person or thing, but which is often not true in reality and may cause hurt and offence"* (Online 2024 (accessed February 18, 2024). This can help explain our ambiguous results for the *non-stereotypical* trait. On one hand, we want a graphical character that is a good example of a particular person and will be easy to relate to, but on the other we want to avoid ageism from a stereotypical character that is limiting and not true to reality.

As with a dramatic performance, the visual representation is only the beginning of the agent's development. Context is central; we are presenting the picture of a performer, and while we can cast an actor partly based on appearance, whether an actor produces a limiting stereotypical performance is dependent on many other factors. Aylett et al. (Aylett, Cowan, and Clark 2019) suggests seeing artificial social agents as dramatic performers, a type of artificial actor, can be a helpful basis for designing their behavior. We can then regard selecting a graphical character as more like casting an actor than designing an interface, a perspective that helps untangle the conflict of a character being relatable vs being stereotypical. If we seek an archetype as the basis of the character, how it is then extended and behaves can transcend stereotypes. This does not mean we should be blind to disrespectful and hurtful stereotypes, but being stereotypical alone is not a reason to initially reject a graphical character.

## Impact Statement

The AMPER APP is currently at the stage of initial usability testing and is about to be piloted with healthy older participants, since there are problematic ethical issues in carrying out basic usability testing with a vulnerable population like our target participants. After improvements are implemented, we will run a randomised controlled trial over six months with 40 participants from our target population in their homes. This will address how far projected positive impacts on memory and self-esteem of participants via user-carer reminiscence therapy are achieved. Good outcomes at this stage would serve as a basis for future clinical trials in a new project.

Our main contribution at this stage is to make reminiscence therapy more widely available than it currently is by using an intelligent story-facilitator in a domestic setting. We expect that this will aid carer-participant interaction by structuring what can become a dispiriting and frustrating experience. If our work also demonstrates a slowing of memory loss and/or improvement in mood and behaviour by the participant, then this is likely to contribute to lengthening the period in which they can live in their own home, the overall aim of Aging in Place initiatives.

## Acknowledgments

Support for this research was provided by EPSRC (AMPER: award number EP/V056131/1, EP/V05564X/1).

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