Avatar Lit Review

Overview of Study	Relevant Findings	Citation
This paper describes the implementation and evaluation of a 'photorealistic' avatar for elderly with mild cognitive impairment or dementia	It was found that the elderly users preferred photos of familiar faces such as relatives and known caregivers were preferred to be used as 'talking heads' avatars. A high level of realism for virtual characters, not only in its appearance, but also its facial expressions and gesticulation, in order to achieve acceptance	Morandell, Martin & Stainer-Hochgatterer, Andreas & Fagel, Sascha & Wassertheurer, Siegfried. (2008). Avatars in Assistive Homes for the Elderly. 5298. 391-402. 10.1007/978-3-540-89350-9_27.
The researchers of this paper developed an app to detect dementia in elderly through analyzing their interactions with an avatar that puts them through six different procedures: self-introduction, gaze, reading, fixed Q&A, random Q&A, and retelling	Researchers found that subtitles actually helped seniors, especially the dementia group, understand what the avatar is saying, by integrating both visual and auditory sensors	Tanaka, H., Adachi, H., Ukita, N., Ikeda, M., Kazui, H., Kudo, T., & Nakamura, S. (2017). Detecting Dementia Through Interactive Computer Avatars. *IEEE journal of translational engineering in health and medicine*, *5*, 2200111. doi:10.1109/JTEHM.2017.2752152
This study evaluates the response of cognitively impaired or elderly people to a Wizard-of-Oz prototype of a virtual calendar assistant. The subject had to interact with the assistant and add appointments to a virtual calendar.	Elderly taking part in participatory design processes like focus groups helped to increase the acceptability of the technology introduced. In the early steps of the participatory process, the elderly recognized the usefulness of the assistive technology for third persons, but not themselves. It also confirms the effect that humanoid avatars elicit social interaction from elderly through storytelling	Yaghoubzadeh R., Kramer M., Pitsch K., et al. : 'Virtual agents as daily assistants for elderly or cognitively impaired people'. Int. Workshop on Intelligent Virtual Agents, 2013, pp. 79–91
This study tested out a companion agent operated by a Wizard-of-Oz mechanism, and recorded topics of conversation between the elderly and the companion agent, as well as the elderly's	After interacting with the agent, participants made comments about how not talking to her any more was "like losing a friend." Another was also pleasantly surprised how they had such a connection to what they clearly knew was a	Vardoulakis, L., Ring, L., Barry, B., Sidner, C., & Bickmore, T. (2012). Designing Relational Agents as Long Term Social Companions for Older Adults. 10.1007/978-3-642-33197-8_30.

self-evaluation of its effectiveness.	computer-generated human being. However, some negative reactions had to do with the lack of realism, the static nature of the agent's interactions as well as the simplicity of the agent's abilities.	
This was an empirical study performed on elderly people (normal aging, mild cognitive impairment & Alzhemier's patients) using an ambient intelligence interface with an avatar, examining the effect of an avatar in natural interaction with elderly users, on both subjective and objective measures.	It was found that the presence of an avatar has neither a positive nor negative effect on the recall of elderly people. However, it did have a positive effect on the subjective measures (acceptance & believability). Healthy elderly and the elderly with mild cognitive impairment were capable of recognizing emotions in the facial expressions of the avatar and found the experience of having the emotional avatar in the interface as pleasant.	Ortiz A. et al. (2007) Elderly Users in Ambient Intelligence: Does an Avatar Improve the Interaction?. In: Stephanidis C., Pieper M. (eds) Universal Access in Ambient Intelligence Environments. Lecture Notes in Computer Science, vol 4397. Springer, Berlin, Heidelberg
The aim of this study was to develop an emotionally intelligent cognitive assistant (ICA) to help elderly with Alzhemier's disease to complete daily living activities, in this case hand-washing, more independently. A camera was mounted above sinks that the elderly would use, and tracks hand location. Another camera mounted nearby utilizes face expression recognition to record facial attributes of users.	After deducing Evaluation/valence, Potency/control, and Activity/arousal (EPA) scores for each of the participants, researchers found that they would react to instructions given by the avatar differently. As such, they modified the avatar based on the EPA rating they received. For example, someone with a high P score would receive a more submissive prompt from the avatar, almost like a suggestion instead of an instruction. However, someone who is more submissive in nature would receive firmer direct instruction.	König A, Francis LE, Joshi J, Robillard JM, Hoey J. Qualitative study of affective identities in dementia patients for the design of cognitive assistive technologies. *J Rehab Assist Technol Eng.* (2017) 4:1–15. doi: 10.1177/2055668316685038

How they evaluated elderly-avatar interactions:

- Vardoulakis, L., Ring, L., Barry, B., Sidner, C., & Bickmore, T.
    - Conducted in-person, semi-structured interviews with participants to explore their experience w/ in home agent
        - Audio recorded, transcribed, coded for themes
        - Questionnaire:

Question	**Anchor 1**	**Anchor 7**	**Mean (SD)**
How satisfied were you with Tanya?	Not at all	Very satisfied	6 (1.09)
How much would you like to continue working with Tanya?	Not at all	Very much	5.36 (1.68)
Would you rather have talked to a person than Tanya?	Definitely prefer a person	Definitely prefer Tanya	4.08 (1.78)
I feel comfortable having Tanya in my home.	Disagree completely	Agree completely	

- Ortiz A. et al.
    - Every interface evaluated in terms of its likability, pleasantness, entertainability, ease & complexity.
    - Questions regarding willingness of subject to have virtual character appear in other computational applications

Table 1. Questionnaire 1

Questionnaire 1
Which objects do you remember?
On a scale of 1 to 10, which presentation did you like more?
On a scale of 1 to 10, how do you rate the pleasantness of each presentation?
On a scale of 1 to 10,how do you rate the entertainability of each presentation?
On a scale of 1 to 10, how do you rate the easiness of each presentation?
On a scale of 1 to 10, how do you rate the complexity of each presentation?

Table 2. Questionnaire 2

Questionnaire 2
On a scale of 1 to 10, how do you rate the ease of each emotion identification?
On a scale of 1 to 10, how do you rate the realism of each emotion?
Which of the avatars did you like more, the woman or the man?
Did you like that this virtual character appears in another applications?
Would you like it if this virtual character appeared in other applications?

- König A, Francis LE, Joshi J, Robillard JM, Hoey J.
    - Semi-structured interview tool designed for older adult residents of a care home as well as their residents, based on principles of affect control theory (avatar customized based on personalities of users ranging from dominant to submissive).

Overview of Study	Relevant Findings	Citation
This paper describes the implementation of an avatar-based 3D visualization system exploiting wearable sensors	The study utilized focus groups with caregivers (nurses in this case)	Pouke, M., Häkkilä, J. (2013). Elderly Healthcare Monitoring Using an Avatar Based 3D Virtual Environment. *International*

and human activity simulations.	FG1: showed actual avatar-based system visualizing elderly patient's actions to interview participants (nurses/doctors), asked for first impressions FG2: nurses working with elderly home care; concentrated on acquiring most relevant info to be visualized/best visualization methods for homecare providers (pictures attached below) Online survey was also administered to 17 participants working in home care, following structure and content of second focus group.	*Journal of Environmental Research and Public Health*. 10, 7283-7298.
This paper is a proposal for a natural human computer paradigm for people with cognitive impairments such as Alzheimer's disease. It consists of a realistic avatar rendered on a TV set playing the role of a virtual personal assistant that shows reminders, notifications, as well as performs short dialogues with the user. The television remote is used as a return channel to capture the user's responses.	The researchers observed users throughout the entire process and performed qualitative and quantitative data analyses. Doing this helps understand why and how participants engage with the avatar. For example, why they answer questions wrongly or what their feelings are towards the avatar, whether they understood the voice/meaning.	Carrasco, E., Epelde, G., Moreno, A. Ortiz, A., Garcia, I., Buiza, C., Urdaneta, E. et al. (2008). Natural Interaction between Avatars and Persons with Alzheimer's Disease. *ICCHP, 2008, LNCS 5105*, 38-45.
This paper tested and evaluated a digital companion system (Gerijoy) to explore its impact on older adults' social interactions, anxiety, depressive symptoms and acceptance of the system. Gerijoy is a virtual pet companion displayed on a tablet that interacts with clients and is able to share pictures and provide reminders, among numerous other functions.	The study conducted baseline testing in the form of asking participants about their expectations as to how their interactions with the avatar will evolve over time. The exit interview consisted of participants' attachment to the virtual pet, system strengths and weaknesses.	Demiris, G., Thompson, H., Lazar, A., Lin, S. (2017). Evaluation of a Digital Companion for Older Adults with Mild Cognitive Impairment. *AMIA Annual Symposium Proceedings Archive, 2016.* 496-503.

This paper aims to investigate the types of avatars elderly users prefer and hence provide them with a richer interaction experience through the use of avatars as virtual representations of themselves.	The paper wanted to answer a few questions regarding elderly's response to avatars, namely: will elderly users evaluate anthropomorphic avatars more positively than non-anthropomorphic avatars in terms of their perception of homophily, credibility and attractiveness, and does the age of avatars have any impact on elderly users' perception on homophily, credibility and attractiveness of the avatars. They used corresponding scales that the elderly could rate the avatars on, based on the aforementioned questions. Interestingly, it was found that predominantly children avatars with Asian ethnicity ranked highest in terms of trustworthiness among the elderly, the complete being true of avatars that do not look like them, for example, a typical Western (Caucasian) male.	Cheong, W., Jung, Y., Theng, Y. (2011). Avatar: A Virtual Face for the Elderly. *Proceedings of the 10th International Conference and Its Applications in Industry.* 491-498.
This paper explores the feasibility of a novel app, Touchstream, with older adults with cancer. The app works as a planner, displaying activities like doctor's appointments, medication reminders etc.	At the end of the study period, patients and/or caregivers met with researchers for a semistructured interview covering three themes: general experience (experience & value of app in different patients), design (brightness, font, touchscreen) and functionality.	Loh, K., Ramsdale, E., Culakova, E., Mendler, J., Liesveld, J., Dwyer, K., & McHugh, C. et al. (2018). Novel mHealth App to Deliver Geriatric Assessment-Driven Interventions for Older Adults With Cancer: Pilot Feasibility and Usability Study. JMIR Cancer 2018; 4(2) e 10926
This paper describes the implementation and evaluation of a 'photorealistic' avatar for elderly with mild cognitive impairment or dementia	The researchers first held a pre-testing session with participants, where they got to know more about participants and get a sense of their daily life situations. They tested if information presented via a GUI with synthetic speech can be understood & processed by users. In addition, they identified the preferred head to create an avatar from. During	Morandell, Martin & Stainer-Hochgatterer, Andreas & Fagel, Sascha & Wassertheurer, Siegfried. (2008). Avatars in Assistive Homes for the Elderly. 5298. 391-402. 10.1007/978-3-540-89350-9_27.

	the testing, they made observations regarding participants' reactions to the app and how they interacted with the avatar. There was no post-testing feedback/questionnaire	