

Can You Teach an Old Dog New Tricks? How Older Adults Perceive Embodied Agents

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ABSTRACT

In this experiment we investigate how older adults perceive an embodied agent as compared to younger people in the context of an information giving task. Our results show that older adults found the agent less friendly and likeable than the younger participants in our experiment, and that they had a strong preference for a human presenter. However, the older adults were relatively positive on some aspects of the agent's presentation, and their task performance for agent and human presenter was similar.

Keywords

Embodied agents, information presentation, older adults

INTRODUCTION

In order to make human-computer interaction similar to face-to-face communication between humans, an increasing number of interfaces are being equipped with human-looking virtual characters that can use natural language and display nonverbal behaviours. In this paper we will refer to them as 'embodied agents' or simply as 'agents'. Users have been shown to like embodied agents and find them engaging [9,13]. Cassell et al. [4] observed that "users' behaviors appeared natural, as though they were interacting with another person" when using MACK (Media lab Autonomous Conversational Kiosk), an embodied agent answering questions about and giving directions to the MIT Media Lab's research groups, projects and people.

The main idea behind the use of embodied agents is to make computer interfaces more intuitive. Given that the elderly have more difficulty working with computers than the young [5], this seems even more important for older users than for younger ones. Nevertheless, there have been only a few studies of older people working with embodied agents. In the GrandChair system [12] an embodied agent that looked like a child was used to elicit stories from older

people. It was evaluated with 15 women of 55-65 years old, 14 of which reported that they enjoyed the experience. In the FitTrack system [2], an embodied agent functioning as a personal trainer asked users about their exercise plans, with the goal of increasing the users' physical activity. It was evaluated with 21 adults of 62-84, of whom half interacted with the agent daily for two months, and half served as a control group. Results indicated that the agent was accepted and liked, and that the system was very effective.

Both studies reported above involved systems designed specifically for older users. However, embodied agents are most often used in applications aimed at the general public, e.g., information kiosks such as MACK. Here, young and old have to work with the same agent. Given that older adults tend to prefer dealing with people rather than machines [11], they may feel differently about embodied agents than young adults do. However, to our knowledge so far there have been no comparative studies of different age groups working with the same embodied agent. Therefore we carried out an experiment investigating the effects of an information presentation by an embodied agent on two different age groups: students and older adults. The main results are reported below; for more details see [7].

EXPERIMENT

The question we tried to answer in our experiment is how older adults perceive an embodied agent as compared to young adults, in the context of an information presentation task (i.e., giving a route description). The participants in the experiment watched an agent present a route description and then judged the trustworthiness and presentation style of the agent, and the quality of the route description. The participants were confronted with the agent during a very short time only. Because it takes older adults some time to get used to new technology [1], we hypothesized that the older participants would be less positive about the agent and its route description than the younger participants.

We also showed the participants the same route description presented by a human guide, and asked them for their preference. We expected that most seniors would prefer the human guide over the agent, cf. [11]. For younger users we

made no predictions concerning their preference: on the one hand, young people might be open to new technology, but on the other hand, a preference for dealing with real persons might well be an age-independent human tendency.

Finally, we also looked at task performance, i.e., how well the users could recall the information that had been presented to them. Because older adults exhibit major declines in episodic memory [3], we expected them to perform worse on this task than the younger subjects.

Design

The experiment had two conditions. In the first condition, subjects were initially presented with a route description given by a human guide, recorded on video. In the second condition, this initial route description was given by an embodied agent. We used a video recording of a human guide rather than a 'real' person in order to prevent any unwanted variations between route descriptions. In a live performance it would be impossible for the guide to keep the route description exactly the same. To achieve valid results, however, within conditions each participant should get the same presentation. This is also the reason why we chose a non-interactive task rather than an interactive one.

After the participants had watched the route description by the human or the agent guide, they filled in a questionnaire, rating among other things trustworthiness and presentation style of the guide. Then they were shown the same route description, but this time presented by the version of the guide they had not seen yet (the embodied agent in condition one, and the human guide in condition two). After this second movie, when the participants had seen both the agent and the human guide, they were asked which version of the guide they preferred. The experiment was carried out twice: first with college students, and then with older adults.

Material

The route presentation movies were created as follows. First, we made a video recording of a human presenter who spontaneously described the route. This presentation was simulated as closely as possible using a Cantoche¹ Living ActorTM agent. To prevent large differences in appearance or performance from influencing the users' preference for the human or the agent, we selected an agent that looked realistic rather than cartoon-like and had a large repertoire of gestures. The agent that best met our requirements happened to be female, the Cantoche character 'Julie'.

To maximize the similarity between human and agent, we then made a final recording of the human guide, mimicking the agent and dressed in the same clothes. The agent used the speech soundtrack of the human guide, because a synthetic voice would be too distracting. This resulted in two versions of the guide that acted, sounded and looked similar, the main difference being that one was human and the other an embodied agent (see Figure 1).



Figure 1: The human guide (left) and the agent (right)

Participants

Participants in the first experiment were 78 undergraduate students following a course in Media Psychology, which was obligatory for most of them. The average age of this group was 21, ranging from 18 to 27; 60% of them were female. The second experiment had 49 participants. This group partly consisted of teachers from a technical college, and partly of older people asked at random for cooperation in a public library. All had at least one year of higher education so that differences in educational level could not influence the results. The average age of the participants in the second experiment was 51, ranging from 40 to 64; 60% of them were male.

To compensate for the difference in gender ratios between experiments, females were weighed heavier than males in the second experiment. In both experiments, participants were randomly assigned to one of the conditions, with age and gender approximately balanced across conditions.

Procedure

The movies with the route descriptions were integrated in a computer questionnaire. The participants could not see the movies twice, or return to their earlier answers. Depending on the group they were assigned to, participants watched a movie with either the agent or the human guide presenting the route. Both movies started with a short introduction by the guide, so that the participants could get used to the voice and appearance of the guide before the actual route description started. After having seen the route description, the participants had to rate the guide's trustworthiness and presentation style, and the quality of the route description. They also had to write down the route they had heard in their own words, naming as many landmarks and turns as they could. Finally, they were shown the route description by the alternative version of the guide and had to indicate which of the two they preferred, the human or the agent.

Dependent variables

The participants in the experiment had to fill out a questionnaire, scoring several properties of the agent or the route description on a nine-point scale. The various items

¹ www.cantoche.com

were grouped together into different categories. To find out whether the participants trusted the guide, they were asked to rate it on expertise, reliability, etc. We also wanted to compare perceived differences in presentation style, which was rated in terms of contrasting properties such as good-bad, pleasant-unpleasant, and polite-impolite. Finally, we wanted to know how participants perceived the quality of the route description as it was presented by the guide. This category comprised pairs such as concise-tedious, simple-complex, easy-difficult, etc. Full lists of items for each category are given in the Results section.

RESULTS

In this section, the results for the seniors and the students who judged the agent (condition one) are presented. T tests for independent samples were performed to compare the means on the items in the questionnaire. Due to space limitations, the results for the human guide (condition two) are only referred to in the Discussion section. More detailed results for the younger age group, comparing agent and human guide, are given in [6].

Guide trustworthiness

As shown in Table 4, the students rated the agent higher on most items that were used to measure trustworthiness of the guide. They found the agent more convincing, friendly and likeable than the senior subjects. The only item on which the seniors rated the agent higher than the students did (but not significantly) was dominance.

Presentation style

Several significant differences between younger and older people regarding the agent's presentation style were found (see Table 5). The seniors found the agent's style more polite, relaxed, accurate, energetic (as opposed to lethargic) and calm (as opposed to excited) than the students, while the students found its style better and more exuberant (as opposed to apathetic) than the seniors.

Route description quality

The results for the quality of the route description given by the agent are shown in Table 6. It is striking that although the seniors found the route description significantly more difficult (to remember), less interesting and less useful than the students, they did find the route to be much more structured and slightly less complex.

Task performance

As expected, the senior participants could remember significantly less than the students. Interestingly, the number of correctly reproduced landmarks did not differ much. The overall effect was caused by the fact that students remembered more correct turns ($F=1.24, p<0.05$).

Preference

Of the senior subjects, 80% preferred the real person over the agent, against 52% of the students. This is a significant difference ($p<0.01$).

Table 4. Agent trustworthiness (* $p<0.05$, ** $p<0.01$)

	Seniors	Students
Competent	5.11	6.03
Convincing	5.12	6.45*
Realistic	4.82	5.42
Reliable	5.90	6.05
Friendly	5.01	6.71**
Likeable	4.81	6.21**
Dominant	5.69	5.47

Table 5. Agent presentation style (* $p<0.05$, ** $p<0.01$)

	Seniors	Students
Good	4.09	5.21*
Pleasant	4.38	4.92
Polite	6.49	3.61**
Natural	5.04	4.53
Flowing	5.60	5.82
Relaxed	5.68	3.95**
Energetic	5.53	4.71**
Dynamic	3.86	4.47
Accurate	6.77	3.58**
Exuberant	3.75	5.74**
Calm	6.43	3.16**
Interested	5.00	4.47

Table 6. Agent route descript. quality (* $p<0.05$, ** $p<0.01$)

	Seniors	Students
Concise	4.66	4.05
Simple	3.68	3.82
Easy	4.12	6.03**
Interesting	3.47	6.05**
Structured	6.65	4.08**
Useful	3.25	4.45**
Clear	5.34	4.66
Comprehensible	5.44	5.63

DISCUSSION

Our hypotheses that the older adults would be more negative than the students about agent trustworthiness, presentation style and route description quality were only partially confirmed. With regard to trustworthiness, our data show that compared to the students, the seniors found the agent less friendly and likable, but not significantly less realistic or competent. With regard to presentation style, on several items the agent was rated higher by the older users than by the students. Among other things, the seniors found the agent to be more polite, relaxed, and accurate, which are important aspects to measure presentation quality by.

It is interesting to see that although the agent was not trusted as much by the older as by the younger participants, the seniors were more positive about its presentation style in terms of politeness, accuracy and calmness. Inspection of the older adults' ratings of the human guide revealed that it scored higher on these items as well. This suggests that older people have a general tendency to give high ratings for qualities such as politeness, presumably because they attach greater weight to them than younger people do.

The outcomes for route description quality are also remarkable: the older adults considered the route more difficult, less interesting and less useful, but also more structured than the students. Possibly, a higher appreciation for structure played a role here as well.

With regard to task performance, as expected the older adults did worse than the students. To see whether this effect should be ascribed to their working with the agent or to a general decline in memory capacity, we looked at their task performance with the human guide (condition two in the experiment). Since we found no significant differences in performance between the older adults working with the agent or the human guide, working with an agent evidently did not affect their task performance.

Finally, the results provided strong statistical support for the hypothesis that seniors would prefer the human guide over the agent. Over all conditions, 84% of the older subjects and 52% of the students preferred the real person. Students who preferred the agent commented that it was less distracting than a real person, and more modern and professional. Those who preferred the real person generally noted that it made the experience more personal. Older users simply said they found a real person more pleasant, with one of them remarking, "It's probably my age."

CONCLUSION

In our experiment, we compared older and younger adults' perceptions of an information presentation by an embodied agent. Our results showed that the seniors found the agent less friendly and likeable than the younger participants, and had a strong preference for the human presenter. On the whole, they appeared to be less open to the new agent technology than the younger participants, and to have a stronger preference for dealing with a real person. On the other hand, the older adults were more positive on several aspects of the agent's presentation style, and their task performance was not significantly worse with the agent than with the human guide. So, although seniors may prefer (a video of) a real person because they are not into novelties such as embodied agents, this does not mean they cannot work with them. Several researchers have found that the initial negative attitude of older people to computers disappears given sufficient training and time [8,10], and this can be expected to hold for embodied agents as well. This suggests that embodied agents can be acceptable substitutes for interacting with a real human in information-giving applications, not only for young but also for older users.

ACKNOWLEDGEMENTS

We thank Cantoche for the use of their agent, Ria Verleur for her help with the first experiment, and Jan Oosterhuis for technical support. Thanks are also due to our three anonymous reviewers for their comments. This work was carried out in the context of the ANGELICA project, which is sponsored by NWO (Netherlands Organization for Scientific Research).

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