The effect of an avatar in natural interaction

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Abstract. In order to examine the effect of an avatar in natural interaction, we performed an empirical study with young and elderly people not only on subjective but also on objective measures.

Keywords: Interface evaluations, interaction for elderly users, virtual characters

Introduction

The avatars are starting to be widely used in user interfaces in order to improve the human-computer communication. Avatars are virtual characters, which make communication between user and machine more natural and interactive. The main advantage of using avatars within interfaces is to enable the user to interact intuitively with the system by giving him/her the illusion of communicating with a real human.

The use of virtual reality as evaluation and rehabilitation tool in cognitive impairments has experimented a great peak in the last years. However, as it was pointed by Gaggioli [1] there is a lack of discussion of the role that such autonomous virtual humans could have in VR-aided psychotherapy. Since we do not find any information about which kind of interface fits better with the needs of elderly people and whether they are capable to interact with the avatars, we centred our research in these issues. Regarding to young people, we found some previous evaluations [2] which concluded that avatars allow social interaction with computers, they attach the user attention, they can increase the user trustworthiness and credibility in the system, they allow to transmit more information in a message through verbal language and they can also increase the user commitment.

In spite of these advantages, there is still a great controversy about whether the best way of interact with the ambient is by mimicking human communication using virtual

characters. In order to clarify this controversy we implemented some prototypes in order to evaluate the effect of an avatar in elderly and young people.

Another interest field is the capacity of elderly and young people in recognising emotions since many studies underline that elderly adult are poor at recognising certain emotions.

As Mülken [3] we consider very important to realize an evaluation not only on subjective, as the most evaluations, but also on objective measures, above all when we are working with users with cognitive impairment, who cannot express fluency themselves. In the research we performed, we were mainly interested in the following aspects:

- Finding which kind of interface fits better with the necessities of elderly people with cognitive impairment and without it.
- Analyzing whether this kind of users are capable to interact with avatars.
- If the virtual character motivates to performance a specific task
- If the fact that the virtual character presents the information helps on the recall
- Analyzing whether elderly people with cognitive impairment and without it are capable to recognize the emotions in the avatars facial expressions.

Method

Subjects

29 subjects participated in the investigation. The trial was carried out in Spanish and the time spent by each participant was 30 minutes. As usual in this kind of trials an informed consent guarantying their voluntary participation was signed by the participant or the legal tutor in the case of moderate Alzheimer's disease patients. Subjects were distributed in groups taking into account two variables: age and cognitive impairment:

Group 1: Age range between 61 and 80: The sample consisted of 15 elderly people, 9 females and 6 males distributed in three different groups. The first (n=5) was composed of elderly people without cognitive impairment, in short, those experiencing normal aging. The second group (n=5) was made up of elderly people with mild cognitive impairment, which means that a person has memory problems greater than expected with normal aging, but does not show other symptoms of dementia, such as impaired judgment or reasoning. Finally the third group (n=5) consisted of elderly people in the moderate stage of Alzheimer's disease. The average age was 72.33 years.

Group 2: Age range between 24 and 47: It was composed by 14 young people. They were 8 male and 6 female. The average age was 34.14 years and the range oscillated between 24-47.

Experimental Design

In order to answer all the questions mentioned above we divided the experiment in two parts.

Interface evaluation: In this experiment we presented three kinds of interfaces individually to each subject. In the first interface, the main interaction element was a conversational virtual character. The second one consisted of text and voice and the last

one consisted of only text. For each kind of interface the subject had to performance two tasks. The first task was to write in a paper the answer to a question made by the interface. The second task was to visualize some images presented by the interface. This images was organized in three kinds of objects (daily, non-daily and pictograms) in sequences of three images each one. Its appearance is shown in Figure 1.

Figure 1 Interfaces appearance

Emotion recognition evaluation: In this experiment we presented an interface composed by six buttons and the avatar zone individually to each subject. First of all, the avatar showed a neutral expression. When the experimenter clicked one button, the avatar showed one of the basic emotions: joy, sadness, angry, disgust, surprise and fear. Its appearance is shown in Figure 2.

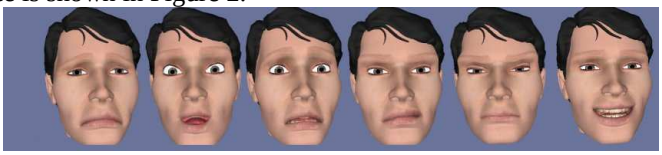

Figure 2 Emotions appearance

Questionnaires

Each participant was administered a neuropsychological assessment in which several questionnaires were passed before the beginning of the trial. First of all a participant form was passed in order to collect the personal data and their experience with TICS. Concerning the neuropsychological tools two scales were administered, the Rey Auditory Verbal Learning Test [4] and the Texts of the Weschler Memory Scale-R Logical Memory [5]. The first one evaluates the ability to learn word lists. It is the forerunner of other tests of verbal learning using lists of words. The second, evaluates the ability to recall logical stories. Finally, with the goal obtaining information related to the interfaces two questionnaires were specifically developed for both parts of the experiment.

Results

Objective measure 1: Understanding and execution Group 1: in the first trial, the different interfaces asked the participant to develop a task, we found that the task was develop in the 92% of the times asked by the avatar, the 75% when it was asked by the audio and text and only in the 66% of the times was carried out when asked by the text interface. We conclude that elderly people interact better when the request comes from the avatar.

Objective measure 2: Understanding and execution Group 2: In this group, when the task was asked to be done by the avatar the 85.7% of the times was completed with

success, the 92.9% of the times when asked by the text and audio interface and the same percentage (92.9%) when requested by the text interface. Those result point out that the young people interact better with the text and audio and only text interface.

Objective measure 3: Memory Group 1: We found statistically significant results ($p<.05$) in the group composed by mild cognitive impairment when the objects were presented by the text interface. These data show that this group recalls better the information when presented by the text interface. Anyway, we should be careful with them because they can be caused by the recency effect.

Objective measure 4: Memory Group 2: In the second group information was better recalled when presented by the avatar, average score 7.21, when presented by the text and audio interface the average score was 6.28 and finally with the third interface, only text, the average score was 5.07.

Emotion Recognition: Group 1 and 2

Group	Joy	Anger	Sad	Disgust	Fear	Surprise
Normal aging	100%	60%	80%	20%	20%	60%
Mild cognitive impairment	100%	40%	60%	0%	20%	80%
Alzheimer's disease	50%	0%	100%	0%	0%	50%
Total elderly	92%	42%	17%	8.33%	17 %	67%
Total young	92.9%	85.7%	92.9%	35.7%	35.7%	85.7%

Subjective measures: Group 1: The three interfaces were assessed according the following variables: likeability, pleasantness, entertainability, ease and complexity. In likeability, pleasantness, entertainability and ease the best valued interface was text and audio followed by the avatar and finally the text. When assessing the complexity there are some differences. The more complex interfaces was the text, followed by the avatar and finally the text and audio interface. At last, all the subjects were asked about their willingness to have an avatar in further informatics applications. The average score in the two groups in this question was 8.1, and even higher in the mild cognitive impairment group compared with the normal aging (average scores of 8.4 and 7.8 respectively).

Subjective Measures: Group 2: The three interfaces were assessed according the following variables: likeability, pleasantness, entertainability, ease and complexity. In likeability, pleasantness and entertainability the avatar obtained the higher score. The text and audio was perceived like the easiest interface followed by the avatar and the text interface correspondingly. The most difficult interface was the text, followed by the avatar and finally the text and audio. At last, all the subjects were asked about their willingness to have an avatar in further informatics applications. The average score was 6.8. The same question in the group 1 achieved a higher score particularly in the mild cognitive group. The appearance of the avatar was very important as the woman obtained a higher average score than the man (8.21 and 6.35 in that order).

Discussion and conclusion

We performed an empirical study with young and elderly people (normal aging, mild cognitive impairment and Alzheimer's patients) to examine the effect of the avatar not only on subjective but also on objective measures. The first objective measure we took into account was user feedback to the avatar questions. The data obtained (92%) supports the fact that subjects followed some instructions much better when interacting with the avatar.

The second objective measure was concerned with recall. We found several differences between elderly and young users. Elderly users with mild cognitive impairment were better able to remember objects when they were presented by the text interface rather than by the other interfaces. This data could be explained by the recency effect, which means that they could better recall the last information presented. We did not find any significant statistical differences in the other elderly groups. However, the results of young people show that they remember better when the avatar presents the information. This difference between young and elderly may have been obtained because the elderly users were not used to interacting with virtual characters and therefore their attention was focusing on the particular characteristics of the avatar and not on the presentation itself. Hence, the avatar plays a distracter role in the recall task, something frequently found in people with cognitive impairment.

Regarding the capacity to recognize emotions, we observed that joy was the emotion identified best and also that the subjects scored it as being the most realistic (as subjective measure). However we found that young users can recognize better the other emotions than elderly. For elderly, the most difficult to recognise and the least was disgust. A great deal of consistency is apparent in this regard and many studies underline that elderly adults are poor at recognising certain emotions. Hargrave [6] developed an evaluation with Alzheimer's disease patients, healthy elderly volunteers, and elderly non demented psychiatric outpatients. Compared with both control groups Alzheimer's patients were significantly impaired on all three measures. Those results are consistent with our study in the sense that Alzheimer's patients have deficits in recognizing facial emotions. We found that healthy elderly people and elderly people with mild cognitive impairment are capable of recognizing the emotions in the facial expressions of the avatar and that they found the experience of having an emotional avatar in the interface as pleasant.

During the process of designing a natural interface we decided to mix text, speech and virtual characters depending on the request task. According to this research, if it is desired that a user carry out a task, the user will perform better if the avatar makes the request. However, if it is required that the user remember some information, having an avatar in the interface is something that should be considered carefully because the effect of an avatar does not affect objectively and, if the user is not used to interacting with an avatar, it would play a distracter role. Moreover, since the users consider the experience of having an emotional avatar in the interface as pleasant and elderly people can recognize them, we consider it to be very important to give emotional capacities to the avatar.

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