Do Underlying Attitudes Affect Users' Subjective Experiences? The Case of an Empathic Agent

(Extended Abstract)

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ABSTRACT

In this paper, we present evidence that underlying attitudes, i.e., preconceived ideas about applications or domains, affect users' experience of social support by an empathic virtual buddy that provides emotional support and practical advice to victims of cyberbullying. This effect might be a (partial) explanation for the inconclusive and contradictory results reported for the impact of emotional agents on user attitudes, perceptions, and behavior.

Categories and Subject Descriptors

I.2.1 [**Artificial Intelligence**]: Applications and Expert Systems

General Terms

Experimentation

Keywords

Pedagogical, companion, and coaching agents, Verbal and non-verbal expression, Empirical studies

1. INTRODUCTION

There is a growing interest in employing embodied agents as companions and coaches, for instance to reduce feelings of loneliness in older adults [3], or to improve adherence to diets [2]. Increasingly, this type of embodied agents is equipped with emotional capabilities. As the impact of emotions in embodied agents on user's attitudes and behavior are inconclusive and contradictory, a fine-grained approach is required to understand which aspects of emotional agents used in which domains influence which aspects of the users' attitudes or performance [1]. At the same time, embodied agent applications are being developed for sensitive domains such as health care; therefore, it is important to understand how users' attitudes towards specific applications and domains can affect users' experiences when interacting with this type of systems.

In order to investigate how embodied agents can provide social support to users, we implemented a prototype of an empathic virtual buddy that gives emotional support and practical advice to victims of cyberbullying[1] [4]. Cyberbullying is a sensitive topic and the target audience of children aged 10–14 can be characterized as being vulnerable. When people learn about our project, they either strongly support the idea of a virtual buddy, or they strongly disapprove of it. These extreme and opposing views are expressed without having hands-on experience with the system or understanding how the system works.

Based on this anecdotal evidence, we hypothesize that people have 'underlying attitudes' that may affect users' subjective experiences when using the system. The effect of underlying attitudes on users' subjective experiences might be a (partial) explanation for the inconclusive and contradictory results reported for emotional agents. In this paper, we investigate whether underlying attitudes have impacted ratings of the prototype that were gathered during an experiment. To this end, we started from the assumption that the ratings have been affected by underlying attitudes and tried to find support in the data.

2. METHOD

Recently, we performed an experiment to determine how variations in the virtual buddy's emotional expressiveness affect users' subjective experience of social support. There were four conditions: in the control condition the buddy did not express emotions, in the non-verbal only condition the buddy expressed emotions by changing its facial expression, in the verbal only condition the buddy expressed emotions verbally, and in the verbal and non-verbal condition the buddy expressed emotions both verbally and non-verbally. We used a between subjects design and participants were randomly assigned to one of the four conditions.

After interacting with the buddy, participants filled out a questionnaire consisting of eight Likert statements on a 7-point scale. The statements referred to different aspects of social support; items *Support attempt*, and *Perceived support* refer to the sum of support skills; *Understood emotions* and

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[1]We would like to emphasize that our research is focused on designing supportive interactions between embodied agents and users. The virtual buddy is not intended as a replacement for professional help or human support. Also, the question of whether the virtual buddy can help to reduce cyberbullying is beyond the scope of our project.

Compassion refer to emotional support; *Understood problem* and *Understood emotions* refer to the buddy's capacity to show understanding; and *Advice general*, *Advice situation*, and *Persuasiveness* refer to informational support (advice). The survey was completed by 100 students from different universities in the Netherlands (25 participants per condition); 32% were female and the average age was 19.5 (SD=2.0).

There were no statistically significant differences between participants' ratings in different conditions for each of the eight social support statements as determined by Kruskal-Wallis tests (*Support attempt*: $H(3) = 1.641$, $p = 0.650$; *Perceived support*: $H(3) = 2.118$, $p = 0.548$; *Understanding of problem*: $H(3) = 1.184$, $p = 0.757$; *Understanding of emotions*: $H(3) = 1.284$, $p = 0.733$; *Compassion*: $H(3) = 4.962$, $p = 0.175$; *Advice general*: $H(3) = 3.733$, $p = 0.292$; *Advice situation*: $H(3) = 0.939$, $p = 0.816$; *Persuasiveness*: $H(3) = 3.370$, $p = 0.338$).

However, in each of the four conditions, we found large differences in the ratings with scores ranging from 1 or 2 to 7. Furthermore, in the comments left by the participants at the end of the questionnaire, many participants expressed strong opinions, either in favor of the virtual buddy or against it. These different views are in line with our anecdotal evidence for the existence of underlying attitudes. To test whether we could find support for our assumption that the results have been affected by underlying attitudes, we performed a cluster analysis on the social support ratings. The goal of cluster analysis is to divide a set of objects into homogeneous and distinct groups.

3. RESULTS

Hierarchical cluster analysis using Ward's method produced three clusters. Kruskal-Wallis tests revealed a significant effect of cluster membership on the ratings for all social support values (*Support attempt*: $H(2) = 27.570$, $p = 0.000$; *Perceived support*: $H(2) = 31.220$, $p = 0.000$; *Understood problem*: $H(2) = 15.636$, $p = 0.000$; *Understood emotions*: $H(2) = 46.586$, $p = 0.000$; *Compassion*: $H(2) = 29.998$, $p = 0.000$; *Advice general*: $H(2) = 12.542$, $p = 0.002$; *Advice situation*: $H(2) = 29.190$, $p = 0.000$; *Persuasiveness*: $H(2) = 28.373$, $p = 0.000$).

Post-hoc tests using Mann-Whitney tests with Bonferroni correction showed significant differences between cluster 1 and 2 for all items except *Support attempt*, *Understood problem*, and *Advice general*. Between cluster 1 and 3 significant differences were found for all items except *Persuasiveness*. For clusters 2 and 3, the differences were not statistically significant for *Perceived support*, *Understood problem*, *Understood emotions*, and *Compassion*.

Based on their ratings, participants in cluster 1 ($n = 31$) can be characterized as people that are unimpressed by the buddy's emotional capacities (mean scores < 3.52) and by it's understanding (mean scores < 4.29). They are, however, positive about the advice (mean scores > 5.70). This corresponds to a more traditional view of computers as expert systems (finding the best advice given the characteristics of the current situation) and using an interface agent to present the pieces of advice.

Participants in cluster 2 ($n = 25$) gave similar scores to all three types of social support (emotional support, showing understanding and giving advice; mean scores > 4.5 and < 5.5). Regarding emotional support and showing under-

standing the scores of participants in cluster 2 are between the scores of participants in cluster 1 and 3. Generally, they are more positive about emotional support and showing understanding than participants in cluster 1 and more negative than participants in cluster 3. However, regarding advice, participants in cluster 2 are on average more negative than participants in cluster 1 or 3 (mean scores < 5.50 vs. mean scores > 5.70).

Participants in cluster 3 ($n = 44$) are on average the most positive about the buddy's support skills (mean scores > 5.55). Their ratings are higher for emotional support skills, showing understanding and giving advice than the ratings of participants in cluster 1 and higher for giving advice than the ratings of participants in cluster 2.

4. CONCLUSION

The results of the cluster analysis are consistent with the assumption underlying attitudes affect users' subjective experience of social support. Corresponding to our anecdotal evidence, we found participants with negative attitudes towards the buddy's social support skills, in particular its emotional support skills and showing understanding (cluster 1), and participants that gave high ratings to the buddy's social support skills (cluster 3). Additionally, we found a group of participants whose opinions were between the participants in cluster 1 and 3 (cluster 2).

Embodied agent researchers should be aware of the potential effects of underlying attitudes, in order to be able to take them into account when developing applications and/or setting up experiments. By anticipating underlying attitudes, their effects can be reduced or might be used to create more efficient applications for different types of users. To this end, more research is required on the occurrence and effects of underlying attitudes.

5. ACKNOWLEDGEMENTS

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