

First Impressions in User-Agent Encounters: the Impact of an Agent's Nonverbal Behavior on Users' Relational Decisions

(Extended Abstract)

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ABSTRACT

We present an empirical study that investigates whether the first impressions that users form of a virtual agent have an impact on attitudes and subsequent relational behavior. Subjects experienced brief approaches to several embodied agent guides in an immersive 3D virtual museum environment. Each guide exhibited two levels (low vs. high) of extraversion and friendliness towards the subjects by using nonverbal immediacy cues of smile, gaze and proxemics. We found that the nonverbal behavior exhibited by our guides in these 12.5 second encounters, had significant effects on subjects' relational decisions in terms of how likely and how often they would like to spend time with the guides on virtual tours. In particular, guide friendliness, expressed by smiling and gazing more at the subjects, had a positive main effect for all our measures.

Categories and Subject Descriptors

I.2.11 [Distributed Artificial Intelligence]: Intelligent Agents

Keywords

First impressions; Personality traits; Interpersonal attitude; Nonverbal behavior; Relational agents

1. INTRODUCTION

First impressions matter. The judgments we form of others based on a brief first encounter often have enormous staying power, with our initial perceptions continuing to be influential months later and determining important relational decisions such as the likelihood and frequency of subsequent encounters [4]. We often quickly decide if a person is likable and approachable by observing nonverbal immediacy cues such as smiles, eye contact or proxemics in the greeting process of an interpersonal encounter [1, 4].

Virtual agents are not immune to users' judgments, particularly, when they have human appearance and engage users in real-time multimodal interactions such as greeting rituals [3]. This has even greater importance for relational agents: autonomous, embodied

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agents specifically designed to build long-term, social-emotional relationships with their users [2]. No relationship can be built if users reject those agents and refuse any further interaction after encountering them for the first time. Engaging users and making favorable impressions by exhibiting the proper nonverbal cues is a primary requisite for a relational agent.

In previous work [3], we mapped certain nonverbal cues to judgments of personality and attitude. Subjects, represented by an on-screen avatar, approached a series of greeting agents in a 3D virtual museum displayed on a 19" monitor. The main results suggested that agent's proxemic behavior significantly influenced judgments of extraversion: agents stepping towards the subject's avatar were rated higher in extraversion, whereas gazing and smiling agents were judged as more friendly.

In the present study, we investigate whether users' first impressions of an agent has an impact on their relational decisions in terms of how likely they were to interact with the agent again and how often they would interact with it. We also study possible effects of concordance between the user's own personality and the agent's personality and attitude.

2. EXPERIMENTAL DESIGN

Subjects observed approaches (in first person perspective) towards a series of life-sized agents presented as guides of a 3D virtual museum. The subjects interacted with our guides standing still in front of a screen as shown in Figure 1. The touch screen tablet computer was used to give subjects the ability to start the interaction and to administer self-report questionnaires at the end.

As independent variables the guides exhibited two levels of personality (low vs. high **Guide Extraversion**) and attitudes (low vs. high **Guide Friendliness**) towards the subjects during initial greeting approaches of 12.5 seconds.

The different levels of extraversion and friendliness were obtained by manipulating agents' nonverbal immediacy cues of smile, gaze and proxemics according to results of our previous findings [3]. Since we discovered that agents that stepped towards approaching users were judged more extraverted, our guides did the same when **guide extraversion** was *high*, and did not step towards the subjects when *low*. On the other hand, we found earlier that smiling and gazing agents were judged more friendly, therefore more smiling and gazing were used by guides with *high guide friendliness*. To control for ordering and carryover effects, we showed

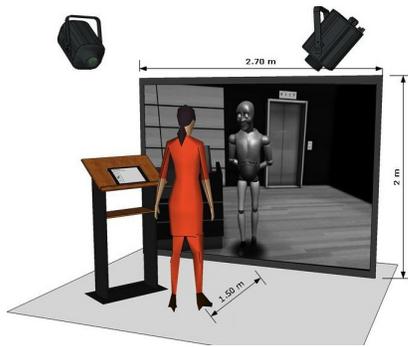


Figure 1: The setting of our study showing the user in front of an animated view of the guides.

the resulting four different conditions with a full counterbalanced treatment order in a within-subjects design.

Subjects were told they were approaching various guides to exchange contact information and to be offered virtual tours. After meeting each guide, we assessed subjects' relational decisions by asking them to express (1) how many guided visits they would sign up for (**Number of Visits**, ranging 0-10) and (2) the overall likelihood of showing up for those visits (**Guide Likeability**, ranging 1-5 with anchors *No, definitely not* - *Yes, definitely*). After meeting all the guides, we asked subjects to choose their preferred one (**Guide Preference**). Finally we assessed their **Extraversion** and **Agreeableness** personality traits (**Subject Personality**).

We had 24 participants, there were 15 males and 9 females representing 8 nationalities and they were aged 21-60 with 54% in the 21-30 range. Subjects were led to believe that the number of visits signed up for represented an actual time commitment. The following is an excerpt of the consent form that we used:

"By signing this document, I agree to come back in these facilities and be guided in one or more virtual tours of the museum according to the particular guide that will be assigned to me and the preference (number of visits) that I expressed for him. The guided tours (if any) will be scheduled over a period of two consecutive months at my earliest convenience. The start date of this period and all appointments will be scheduled in concordance with the investigator. Every visit will require approximately 15 minutes and different area of the museum will be shown if more than one visit is scheduled."

We explained to our subjects that the assignment of the guide was random. This was introduced to prevent subjects expressing realistic preferences for only the most preferred guide and giving zero or a low number of visits to the others.

We did separate mixed-design ANOVAs for the two dependent variables **Number of Visits** and **Guide Likeability**, with guide extraversion and guide friendliness as within-subjects factors and subject extraversion and agreeableness as between-subjects factors. In order to use the two subject personality traits as between-subjects factors, for each measured trait we split our population at the median into "low" and "high" groups.

Number of Visit: We applied an aligned rank transform (ART) for non-parametric factorial data analysis and the analysis of the transformed values revealed a significant main effect of guide friendliness on the number of visits, $F(1, 20) = 14.22, p \leq .001, \eta_p^2 = .416$; subjects preferred to take a higher number of visits with *high* friendly guides compared to the *low* friendly ones in agreement with our hypothesis.

Guide Likeability: A similar analysis, without any transformation, revealed a significant main effect of guide friendliness on the guide likeability, $F(1, 21) = 21.91, p = .000, \eta_p^2 = .51$; subjects liked more, in terms of doing business with them later, the *high* friendly guides compared to the *low* friendly ones in support of our hypothesis.

Guide Preference: All the subjects, except one, had a preference for a specific guide type among the four ones presented. Subjects showed a highly significant preference for the guides with *high* level of friendliness, $\chi^2(2, N = 23) = 12.56, p < .001$, as we expected.

We also expected that subjects own personality, either the extraversion or the agreeableness trait, would positively interact with the guide extraversion level for the two measures Number of Visit and Guide Likeability. However, no significant interaction effects were observed.

3. DISCUSSION AND FUTURE WORK

Our major finding is that the impressions of our virtual guides, exhibiting the proper nonverbal immediacy cues at specific points during only 12.5 seconds of a first greeting encounter, had significant effects on users' relational decisions in terms of choosing for how often and how likely they would spend time with the guides later. The *high* friendliness guides received a higher number of signed-up visits than *low* friendliness ones, subjects had greater desire to do business with them later, and were the most preferred ones regardless of personality. Contrary to what we expected, we did not observe any interaction effect between a user's own personality and the guide's level of extraversion, when measuring the number of visits and the likeability.

Future work will continue to investigate the role of user's personality and will deal with a real application setting. The subjects' interaction was limited to observing the approaches in the 3D environment while they were physically standing still, we plan to apply our findings to a real museum agent. The idea is to detect users approaching the installation and have the agent exhibit cues of friendliness when the users get closer. The goal is to evaluate whether users forming a friendly impression of the agent (a) are more attracted by the installation and encouraged to interact, (b) spend more time interacting with the agent and (c) are more likely to return to see the agent again.

4. ACKNOWLEDGMENTS

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5. REFERENCES

- [1] M. Argyle. *Bodily communication*. Methuen, New York, 2nd ed. edition, 1988.
- [2] T. W. Bickmore and R. W. Picard. Establishing and maintaining long-term human-computer relationships. *ACM Transaction on Computer-Human Interaction*, 12(2):293–327, 2005.
- [3] A. Cafaro, H. Vilhjálmsón, T. Bickmore, D. Heylen, K. Jóhannsdóttir, and G. Valgarðsson. First impressions: users' judgments of virtual agents' personality and interpersonal attitude in first encounters. In *Proceedings of the 12th international conference on Intelligent Virtual Agents*, pages 67–80. Springer-Verlag, 2012.
- [4] R. Miller, D. Perlman, and S. Brehm. *Intimate Relationships*. McGraw-Hill, Boston, 2007.