

An Android in the Field

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ABSTRACT

Since most robots are not easily displayable in real-life scenarios, only a few studies investigate users' behavior towards humanoids or androids in a natural environment. We present an observational field study and data on unscripted interactions between humans and the android robot "Geminoid HI-1". First results show that almost half of the subjects mistook Geminoid HI-1 for a human. Even those who recognized the android as a robot rather showed interest than negative emotions and explored the robots capabilities.

Categories and Subject Descriptors

K.4.m [Computing Milieux]: 4 COMPUTERS AND SOCIETY – Miscellaneous

General Terms

Experimentation, Human Factors, Theory

Keywords

Uncanny valley, human-robot interaction, field study, observation

1. INTRODUCTION

Since Masahiro Mori introduced his theory of the uncanny valley (UV) in 1970 [1] the UV is widely considered as a design obstacle to overcome. The theory states that increased human likeness results in increased familiarity (and, thus, increased positive evaluation) until a certain peak is reached after which the system appears too humanlike. At that point the positive evaluation reverses: the robot is perceived as creepy, causing eerie feelings in the user. Researchers tried to emulate the uncanny valley with varying success [2, 3, 4] or investigated potential explanations for the uncanny valley, for instance, that the perception of an android results in increased salience of our own mortality thus causing uncanny, eerie feelings [3]. Although many robot scientists claimed that they have put effort into developing systems which do not fall into the UV, there is no consensus how to avoid it. In addition, as most robots are still in development and not fit for the market, only limited research was conducted to investigate users' behavior in a natural environment. In contrast, the present paper will describe an observational field study and present data on unscripted interactions between humans and the android robot Geminoid HI-1 [see also 6].

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2. METHOD

2.1 Setup

From the 10th to the 30th of August 2009 Geminoid HI-1 (G) was placed in the Café CUBUS, which is part of the Ars Electronica Center in Linz, Austria. The android sat on a chair behind a small table with a laptop in front of it to form the impression of a visitor who is working; cp. Figure 1. Next to him people could find information material about travelling to Japan. The scene was video recorded from five camera perspectives. Most of the guests enter the café by using an elevator. They then passed the robot on their way to the bar. Here the interviewer asked them for participation in a short interview.

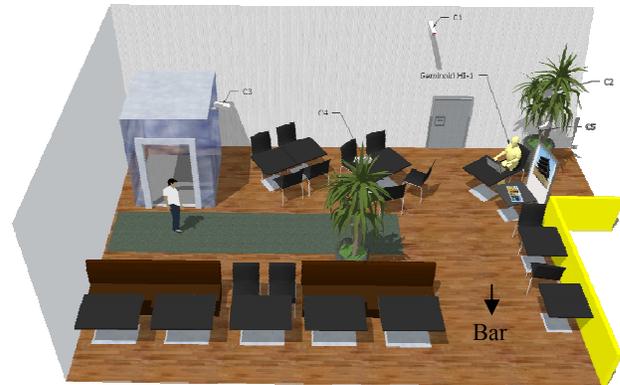


Figure 1. Setup with Geminoid HI-1 in the Café CUBUS.

2.2 Conditions and data analysis

During the 11 days of data collection for this analysis G was presented in different conditions. G was either in the *no eye contact mode* in which the robot just looked down to the laptop in front of it. In the *eye contact condition* it was looking up when the participant looked straight in its direction (or more precisely in the direction of the camera behind G). In the third condition G was *remote controlled* by a human experimenter who could control for eye contact, let it say "hello, would you like to have a brochure?" to passersby, and was able to answer questions. Furthermore, seven participants interacted with the human counterpart of G, Hiroshi Ishiguro. The video material was annotated in ELAN. We assessed the participants' eye contact with G, their verbal behavior, and different actions which attempt to test G's vividness, e.g. waving in front of the robots face. Furthermore, we assessed G's eye contact with the participants as a control variable.

2.3 Sample

We randomly asked people for an interview. In total 107 guests agreed. Ninety-eight (38 male, 60 female) of these participants were

detectable in the video material. Their age ranged from eight to 71 years ($M=38.43$, $SD=14.98$). The majority were Austrians (81) follow by visitors from Germany (12), Italy (1), Spain (1), Belgium (1) and the Netherlands (1). Nine participants were retired, 20 were pupils or students, and 61 were employees.

Table 1. Distribution of subjects over conditions

Geminoid			Hiroshi Ishiguro	
No eye contact	Eye contact	Remote; all with eye contact and speech	Eye contact	No eye contact
N=30	N=45	N=16	N=5	N=2
N=91			N=7	
TOTAL N=98				

3. RESULTS

3.1 Interviews

First, subjects were asked whether they noticed the info-table next to Geminoid HI-1. Sixty-one gave a positive answer and were subsequently requested to describe the table in detail. Thirty-six did not notice the table and were then asked whether they perceived something uncommon or special when they entered the café. From these follow-up questions we derived whether they recognized the robot or mistook it for a human being. Twenty-three subjects reported that they had noticed a (human) man behind the table (five of these saw Hiroshi Ishiguro himself). Fifty clearly stated that they had seen a robot, although 18 of these mentioned that they mistook the robot for a human in the beginning. Twenty-five subjects made no comments on that question, because they neither noticed the table nor the robot. They interpreted the questions as addressing the architecture of the café which indicates that G was not recognized as uncommon and did not become salient enough for the subjects. Most of the participants who mistook G for a human did not believe that indeed it is a robot even after they were told so by the experimenter and returned for a second interaction. Only three participants mentioned unrequested that G gave them an uneasy feeling.

3.2 Videos

Videos were analyzed using ELAN [5]. The time people interacted with (or passed by) Geminoid HI-1 was between 9.25 secs and 277.44 secs ($M=58.11$; $SD=52.07$). People tried different actions to test whether G would react to them. Only one person touched G. Seven subjects waved (partially in front of its face), one showed her tongue, one pulled a face and two persons exaggeratedly raised their eyebrows. None of the people in the no eye contact condition and 11% in the eye contact condition spoke up to G whereas 44% of the people in the remote control condition - in which the robot itself addressed them - talked to G. Five subjects took a picture or videotaped the interaction. Apart from these testing actions we coded the participants' eye contact with the system and the frequency of G looking up to the participants. We found that G's eye contact influenced the participants' eye contact ($F(1, 98)=12.166$, $p=.001$, $\eta^2=.112$). The subjects' eye contact was longer when G looked up ($M=28.132$, $SD=3.974$) than in the condition in which G always looked down at the laptop ($M=3.873$, $SD=5.708$). Furthermore, when G established eye contact, subjects tended to easier recognize ($M=1.745$; $SD=0.062$) that it is a robot than in the

no eye contact condition ($M=1.5$; $SD=0.108$; $F(1, 73)=3.884$, $p=.053$, $\eta^2=.052$). We also wanted to know which factors predict best whether people detect that G is a robot. We conducted a regression analysis with the following predictors: group situation (G is alone vs. G is surrounded by visitors), company (subject is alone vs. in company), length of subject's eye contact and length of G's eye contact. We found that only G's eye contact was predictive ($r=.267$, $r^2=.072$, $p=.027$). The more eye contact the robot showed, the easier people detected it as a robot.

4. DISCUSSION

Forty-three participants either mistook Geminoid HI-1 for a human, or even did not notice it at all, because it seemed not to appear conspicuously non-human. Those who recognized the robot as a robot rather showed interest than negative emotions. People in the eye contact condition were able to most reliably tell that it was a robot which might be caused by the robot's movements being rather influent. When subjects became aware of the robot they took a closer look and some explored Geminoid HI-1's capabilities. It seems that although Geminoid HI-1 should fall into the Uncanny Valley, people were rather relaxed when meeting it in the public.

5. CONCLUSION

Our results suggest that Geminoid HI-1 was regarded as a rather interesting than uncanny object when it was recognized as a robot. If participants had uncanny feelings they had been only short-term experiences that did not affect them sufficiently to report this in the interviews. However, we admit that the interviews did not focus on the emotional experiences during interaction.

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