# Don't Bother Me: Users' Reactions to Different Robot Disturbing Behaviors

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## ABSTRACT
When living together in a household with a socially assistive robot, it can happen that the robot disturbs its owner by offering a service. One might argue that a social robot should act according to the social norms people expect of each other, but still then disturbances of daily routines are a challenging endeavor to address. We conducted a preliminary user study in which we explored four different disturbing behaviors the socially assistive robot HOBBIT showed, while the user was focusing on a different primary task. We used the BEHAVE measurement set to evaluate the attitudinal and behavioral responses of the users, which disturbance distracted the user the most from his/her primary task and how the disturbance affected the overall attitudinal response towards the robot. Interestingly, our results showed that the disturbing behavior did not heavily negatively impact the assessment of the robot and that not all types of disturbance did distract the users with the same intensity.

## Categories and Subject Descriptors
J4 [**Computer Applications**]: Social and Behavioral Sciences – *Psychology. H5.2 [Information Systems]: Information Interfaces and Presentation – User Interfaces.*

## General Terms
Design, Experimentation, Human Factors.

## Keywords
Socially Assistive Robot, distraction, user study.

## 1. INTRODUCTION & RELATED WORK
Socially assistive robots that live together with a user at home have the utmost goal to support the user in daily activities of life, such as reminding him/her to take medicine or to fetch and carry objects [1]. However, we have to consider occasions when the robot pro-actively approaches the user, while he/she is currently focused on something else. In human-human interaction disturbances follow specific social norms to be acceptable [2]. In this paper we present a preliminary user study, conducted with ten participants and the care robot HOBBIT [3], which had the aim to explore people's attitudinal and behavioral responses to four different disturbance behaviors. Our main research objective was to explore how people react, when the HOBBIT robot (a socially assistive care robot intended to support older adults to maintain independent living at home, for details see [3], [6]) is approaching or pro-actively interacting with a user, while people are actually focused on something else.


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## 2. USER STUDY
Our user study was setup as a small observational study, in which participants were asked to focus on a specific primary task, to explore their reaction when being interrupted by the robot. This primary task followed the study design of Sardar and colleagues [5], where participants were asked to search on a "Where's Wally - The Gobbling Glutton's-poster" for the main characters. Participants were told that they have ten minutes in total to find all the characters in the picture and that this is their main task that they should solve in this study. To avoid the participants completing the task early, two of the five characters were photoshopped out of the poster and could not be found. Additionally, participants were told that it might happen during the ten minutes that they get help offered and that they can decide by themselves if they want to accept this help or not.

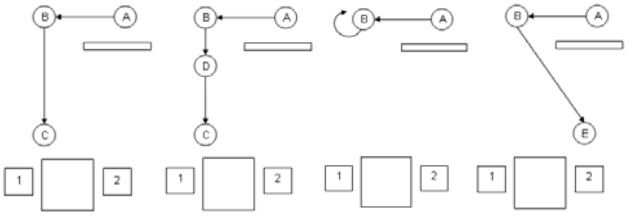


**Figure 1. The 4 approach directions: (1) participant, (2) facilitator, (A) robot starting position, (B) and (D) robot stopping positions, (C) and (E) robot ending positions**

After the first two minutes the HOBBIT robot approached the participant and disturbed him/her during and then again three times, always after two minutes, with four different behaviors. HOBBIT was always behind a room divider before it approached the participant and the participant was seated at a table with the study facilitator sitting opposite to him/her; see Figure 1 and 2. Having the facilitator present during the whole study was necessary to convincingly demonstrate disturbance behavior (4). The robot was remote-controlled from a different room and the debriefing revealed that all participants considered the robot as being autonomous. The four different disturbance behaviors were:

(1) HOBBIT approached the user and directly told him/her: "Oh this is a difficult task, 2 out of 10 minutes are already over".

(2) HOBBIT approached the user, cleared its throat and said: "Can I maybe somehow help you finding Wally?"; if the user answered "no" HOBBIT said "ok" and disappeared again; if the user said "yes", HOBBIT said: "Please move the picture towards me, so I can see it", then HOBBIT moved the head to watch the poster and then said the user: "Sorry unfortunately, I also cannot find Wally" and left.

(3) HOBBIT appeared, rotated around its own axis and made a whistling sound twice and said "I am bored" and left again.

(4) The facilitator asked the participant to switch to the other side of the table. Then HOBBIT appeared at the right side of the table and said to the participant: "Oh, you switched seat, should I help you again?" Then the same procedure as in (2) started.

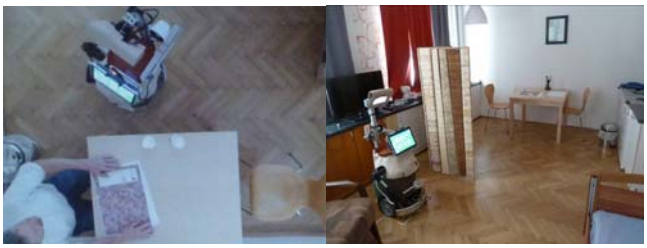

**Figure 2. HOBBIT approaching the participant. HOBBIT behind the room divider**

## 3. METHOD & MEASURES

We used the BEHAVE measurement set for attitudinal and behavioral measures. This measurement set consists of a behavior coding scheme and standardized questionnaires to assess the social normativity on an attitudinal level. The behavior coding scheme consists of nine categories. (1) looks at robot, (2) looks pleasant, (3) looks uneasy, (4) looks surprised, (5) leaned towards the robot, (6) leaned away from the robot, (7) looks anxious, looks restless, which all have to be rated on a 5-point Likert scale from 1=not very much to 5=very much. The coding was performed by a single researcher who was aware of the study design. For the attitudinal measures we gave participants the BEHAVE questionnaires (translated from English to German), after the 10 minutes were over. In total 10 participants took part in our study (students and employees of the informatics department; 7 male/ 3 female; approximated age range: 18 to 50 years). After filling in the questionnaire a short final interview with open-ended questions and a debriefing was done (explaining that the main task was not solvable and that the actual goal was to measure their reactions on the robot). Participants were recruited on-the-fly at the department and did not receive any compensation.

## 4. RESULTS

As expected the robot distracted participants from their primary task. In behavior (2) nine people accepted the help of the robot and in behavior (4) eight, even though the robot failed to help participants in the first place. One participant stated that he did not want further help because the robot failed beforehand, the other two mentioned they wanted to solve the primary task and not lose too much time due to the robot. A Kruskal-Wallis test revealed, that the behavior category "distracted" *(H(3)=12.11; p<0.05)* "leaned towards the robot" *(H(3)=16.28; p<0.05)* and "surprise" *(H(3)=9.36; p<0.05)* were significantly affected by the different disturbing behaviors of HOBBIT. Man-Whitney U-Tests were used to follow-up on this finding and it appeared that the scenarios in which the robot offered help were - as expected - more distracting than the "information scenario" *(scenario 2: $z = -11.50$; $p < 0.05$; scenario4: $-11.45$; $p < 0.05$).*

However, the second (and last) "help-offering" was also more distracting than the "whistling" *($z = 12.60$; $p < 0.05$)*. This could be due to the fact that participants really wanted to solve the primary task and therefore focused more on the robot and its potential help in the end of the study. Moreover, this is also an indicator that participants still trusted the robot to help them, even though it failed in the first attempt. For the "leaned towards the robot" category the subsequent Man-Whitney U-Tests revealed that in the 4th scenario, people had the least fear of contact with the robot and were willing to lean close to it to show it the picture. This finding is also supported by the findings for the category "surprise" which showed a significant difference between scenario (1) and all the other scenarios, indicating that participants only seemed surprised by the robot in the beginning, but that this effect vanished immediately during a period of only 10 minutes. These positive effects are also represented in the attitudinal data. All the scales were rated around the midpoint or even above, whereby "trust" *(mean=4.96; SD=0.51)* and "attractiveness" *(mean=4.66; SD=0.98)* were rated best, but "human-likeness" *(mean=3.24; SD=1.07)* and "likability" *(mean=3.4; SD=1.28)* were rated lower. These findings were also reflected in the final interviews; one participant for instance stated "you really tried hard to make the robot human-like with behaviors such as whistling and being bored, but I know that it is no human so I had to rate it low".

## 5. CONCLUSION & OUTLOOK

Our results indicate that necessary distracting behaviors (e.g. the robot has to remind the user of something) can be designed in a socially normative manner and that a robot not necessarily bothers the user, but only distracts him/her from a primary task. We will continue our research on this topic with field trials in which the HOBBIT robot will live together with older adults for two to three weeks to investigate long-term effects of our behavior strategies.

## 6. ACKNOWLEDGMENTS

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