Subjective Experience of Interacting with a Social Robot at a Danish Airport

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Introduction

This study originates from a social robot research project at Aalborg University with the aim of developing and implementing robots in a variety of contexts. This raises questions as to how social robots should behave and which variables are important when implementing a social robot in a public setting. Important variables can be elicited via user interaction and tested via scales. The study consists of two tests, one where variables are elicited and one where the scales are used to evaluate the experience the human robot interaction (HRI).

Methods

Two tests were set up in Aalborg Airport (AAL) to investigate which variables are important for the HRI with a social robot and to develop scales based on them. Both tests were conducted on Danish Travellers who interacted with a *Double* robot shown on figure 1.

- **Subject recruitment** was done by the robot which approached potential subjects (travellers) and presented a wireframed interface asking if it may help with wayfinding. If the traveller accepted they were led towards their chosen destination until an experimenter stopped them. The *Double* robot was remotely controlled via a computer by a present researcher. This approach was similar in both tests and was done to provide a more ecological and undisturbed interaction between robot and subject.
- **Test 1**: Subjects were asked to participate in a semi-structured interview about their first impressions after the interaction while observational data was gathered during the interaction.
- **Test 2**: Subjects were asked to rate their interactions on the developed scales on a PC after their unsolicited interaction.

Figure 1. *Double*'s front and profile.

Results - Elicitation of variables

From the first test an affinity diagram was made, see figure 2, where one of the 10 categories are shown.

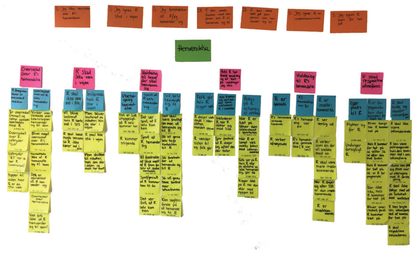

Figure 2. The category, approach, from the developed affinity diagram.

24 variables were elicited, where 23 of them are used to evaluate the HRI and one is used as demographic information about subjects. All 24 variables are evaluated on a Visual Analogue Scales (VAS). The 23 used to evaluate the interaction is shown on figure 2.

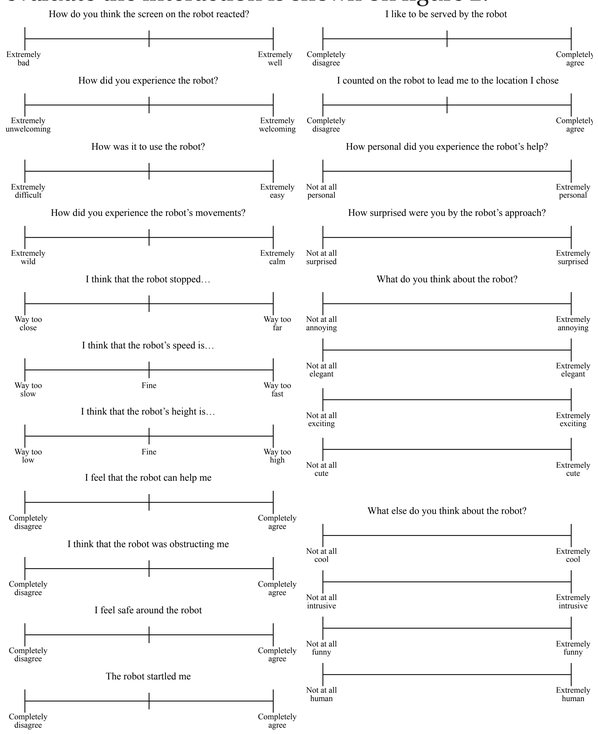

Figure 3. The 23 VAS developed from the elicitated variables.

The 24th variable has the scale question "How fond of technology are you?" and is evaluated on a unipolar VAS with anchor points: *Not at all fond* and *Extremely fond*.

Results - Scale Testing

A boxplot is made (see figure 4) and shows the ratings on SQ when interacting with the robot.

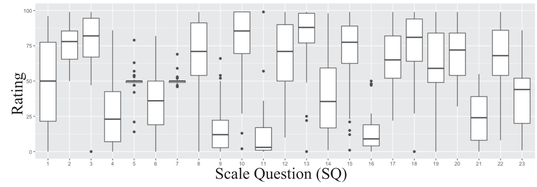

Figure 4. Boxplot with median and box ranging from 25-75 % based on the rating from answers on the 23 scales.

Results from the second test is analysed with Principal Component Analysis (PCA) with groupings relating to the robot's height, distance from subject and approach direction. Figure 5 shows a biplot from PCA.

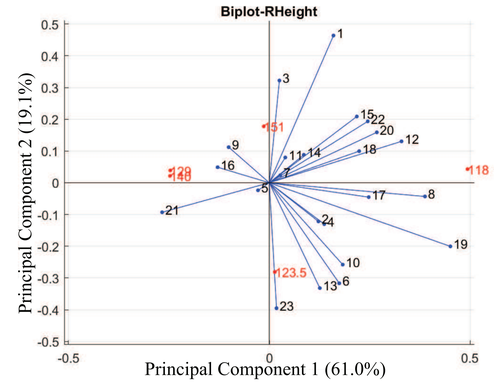

Figure 5. Biplot showing how the different variables contributes to components and which variables correlates. The black numbers relates the the SQ and the red to the different heights.

From the PCA positive and negative correlations is found. This is done relating to the robot's height, distance and direction, respectively, and are as follows:

- **Height (pos):** SQ10-SQ13, SQ12-SQ18, SQ14-SQ15, SQ8-SQ17
- **Height (neg):** SQ12-SQ21, SQ18-SQ21, SQ2-SQ9, SQ4-SQ9, SQ16-SQ19
- **Distance (pos):** SQ1-SQ12, SQ7-SQ17, SQ10-SQ22, SQ8-SQ21
- **Distance (neg):** SQ2-SQ9, SQ14-SQ16, SQ10-SQ13, SQ13-SQ22, SQ5-SQ21, SQ19-SQ20
- **Direction (pos):** SQ8-SQ10, SQ9-SQ14, SQ5-SQ7
- **Direction (neg):** SQ1-SQ12, SQ9-SQ10, SQ10-SQ14, SQ6-SQ23, SQ13-SQ21

After checking for correlation, plots comparing the correlating variables are made. Figure 6 is one of these comparison and shows that when subjects like to be served by the robot they also found it exciting.

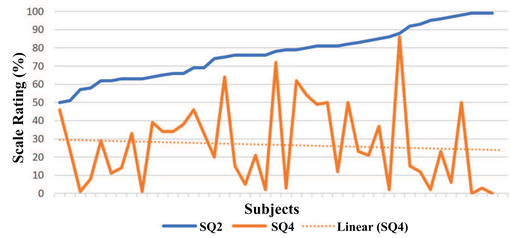

Figure 6. Comparison between ratings on SQ12 and SQ18.

Conclusion

This research conducted in this study reveals that there are at least 24 variables that Danish travellers find important when interacting with a social robot. Scales and scale questions are devoped based on these variables and results show that subjects are able to understand these with a few exeptions. Furthermore some of these variables have positive and negative correlation, which can mean that some of the questions are redundant and covers the same areas or that variables depend on each other such that subjects like to be served by the robot when they find it exciting.

Key references

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