Influences of Concerns toward Emotional Interaction into Social Acceptability of Robots

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1. INTRODUCTION

It is widely believed that there will be social robots in the future working in our daily life, and researchers have started to study human-robot interaction. It seems that ordinary people in many industrialized countries are waiting for such robots; Japan is believed to be one such country. Researchers in robotics have already started to develop various technologies toward such robots. Meanwhile, researchers wonder what kind of robots might be accepted. One intuitive dimension is concerned with immediate acceptance, including field trials, observational studies for a real use-case with robots in our daily lives, and marketing surveys asking people about functions and prices of a possible product. Moreover, laboratory studies with a real robot in a use-case scenario of a near future can contribute to predicting human behaviors in facing robots which not yet exist.

However, these studies do not provide us a long-term vision toward a future daily life with various social robots. We believe that social surveys are more important and useful to model and predict the process of increasing/decreasing acceptability of future robots in social levels. This paper investigates factors influencing social acceptance of robots. In particular, we studied contexts of robot activities and psychological factors which the existing research did not take into account.

Categories and Subject Descriptors

K.4.2 Social Issues; Assistive technologies for persons with disabilities

General Terms: Human Factors

Keywords

Human-Robot Interaction, Social Acceptance, Negative Attitudes

2. Related Work and Research Focus

One type of studies for future acceptability is about expectation for the context of use. This type of studies often asks people about their image (assumption and expectation) toward the word "robot" (e.g., [1]). Another type of studies focuses on human attributes influencing acceptance of a specific type of robot applications, such as home and commercial facilities (e.g., [2]).

However, there are some important aspects missing in the previous studies. First, these existing studies focused on either limited scenarios of robot actions or ambiguous contexts such as domestic use of robots. As a result, they did not take into account concrete contexts in which robots really perform for humans. Second, these existing studies did not include human psychological factors such as anxiety, apprehension, and attitudes dealt with in the research focusing on immediate acceptability.

In our research, we assume that attitudes toward robots are prior to acceptance of robots, and the former influences the latter through people's feelings about the impact of robots on society and the quality of life. Some social research studies suggested that negative attitudes toward robots were affected by cultures, gender, and assumed types and tasks of robots. Thus, it is important and useful to investigate relationships with negative attitudes toward and social acceptance of robots.

Based on the above consideration, we focus on the following research questions:

- [**Q1**]: What are the typical contexts of robot activities that people expect?

- [**Q2**]: Can negative attitudes toward robots affect acceptance of robots and if so, which type of negative attitudes or concerns does so?

3. Survey

To investigate research question Q1 in a variety of ages, firstly, a pilot survey was conducted in December, 2007, at a commercial facility located in the southern part of Kyoto, Japan. A total of 371 people participated in the survey (male: 124, female: 245, not-answered: 2, age: mean = 32.5, $SD = 20.3$). Results show that many

adults and elderly people had an opinion that robots would be applied to fields of elderly care and service trades in the future. Thus, we focused on these two contexts of robot activity, "assistive robots at home" and "service robots in public places".

Then, to investigate the effects of negative attitudes toward robots on the acceptance of robots under the two contexts of robot activities extracted from the pilot survey (Q2), the main survey was conducted as follows.

3.1 Subjects, Measures, and Procedures

A total of 100 Japanese participants (male: 50, female: 50) were recruited through a survey company. Their ages varied from 21 to 67, the mean was 44.5, and *SD* was 13.9. They were general public who did not have specific interests with robots.

The questionnaire administered in the main survey consisted of the following items. The face sheet included demographic items of sex and age. It included the item asking whether respondents had family members to be cared. The definitions of "assistive robots at home" and "service robots in public places" were introduced with texts in the questionnaire. Then, the following items were provided for each robot context:

- Acceptability item: It was straightforwardly asked to what extent respondents want such robots ("assistive robots at home" or "service robots in public places of their cities"). Each item was scored on a five-point Lickert-type scale (1: I do not want it at all, 2: I do not want it, 3: I do not decide it, 4: I want it, 5: I absolutely want it).

- Negative Attitudes toward Robots Scale (NARS): Lickert-type scale measuring human negative attitudes toward robots [3]. Each item was scored on a five-point scale (1: Strongly disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly agree).

Data collection was conducted during March, 2008. The questionnaire was sent to each respondent's home by mail, and then he/she returned the completed questionnaire. Two thousands yen was paid for each respondent.

3.2 Results

To validate research question Q2, linear regression analysis for the scores of degrees of acceptability was performed for each context of robot activity. Table 1 shows the statistically significant regression models in the analyses. The results revealed that NARS-Emotion had statistically significant effects on acceptability, which we believe an interesting finding. Moreover, the existence of family members to be cared significantly contributed to the acceptability of "assistive robots at home", which confirms our initial intuition.

4. Discussion

On research question Q1 "What are the typical contexts of robot activities that people expect?" it was found that "assistive robots at home" and "service robots in public places" were expected by many adults and elderly people in Japan.

On research question Q2, the survey results suggest that negative attitudes toward emotional interaction with robots affected the degrees to which respondents wanted "assistive robots at home" and "service robots in public places", although negative attitudes toward interaction with and social influences of robots had no effect. Some existing studies suggest influences of all these three kinds of negative attitudes toward robots on behaviors toward robots [3].

Table 1. Statistically Significant Regression Models for Degrees to Which Robots Were Wanted

Assistive Robots in Home ($F(6,88) = 3.855$**)		
Independent Variables	β	T
NARS-Interaction	-.036	-.329
NARS-Social-Influence	-.121	-1.048
NARS-Emotion	-.322	-3.159**
Age	-.191	-1.870†
Gender	-.010	-.107
Family member to be cared	.248	2.517*
R^2	.154	
Service Robots in Public Places ($F(6,91) = 3.515$**)		
Independent Variables	β	T
NARS-Interaction	-.146	-1.259
NARS-Social-Influence	.000	-.001
NARS-Emotion	-.355	-3.546***
Age	-.027	-.273
Gender	.013	.135
Family member to be cared	.198	1.948†
R^2	.135	

($†p < .1$, $*p < .05$, $**p < .01$, $*** p < .001$)

Although the low R^2 values of the regression analyses in table 1 show that the degrees to which robots were wanted could not be explained only by negative attitudes toward robots, the results of the survey suggest that under the contexts of "assistive robots at home" and "service robots in public places" only negative attitudes toward emotional interaction with robots---i.e. a kind of concern toward human-robot interaction associated with emotions in humans and robots---affected the respondents' acceptance of robots.

On the other hand, our survey has some limitations, such as the sample size and sampling bias to Japanese people only. Furthermore, the results of the regression analyses failed to show that negative attitudes toward emotional interaction with robots could predict future social acceptance of robots. These limitations must be tackled in future surveys by extending the design.

5. Acknowledgement

6. REFERENCES

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