Gender Difference in Expectations for Domestic Robots

A Survey in Japan

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Abstract. To explore what types of tasks robots are expected to perform in domestic fields, and the gender difference in these expectations, an online questionnaire survey was conducted in Japan, where traditional gender role assignments of breadwinning primarily by husbands and housework by wives are still prevalent ($N = 400$). The survey design consisted of items corresponding to 24 tasks to be performed by robots and 14 skills needed for robots to achieve the tasks. The results showed that women tended to expect robots to perform physical tasks and have human-like thinking capacity, in comparison with men. Moreover, there was a tendency for younger men to have lower expectations for domestic robots than younger women and older men. This paper discusses the implications from the perspective of gender difference in terms of the burden of housework.

Keywords: Domestic Robots, Expectation, Gender Difference.

1 Introduction

As robotics technology has advanced, expectations for robots acting in domestic fields (domestic robots) have been increasing. For example, in a white paper published in 2015, the Ministry of Internal Affairs and Communications in Japan, which is one of the most advanced countries regarding robotics, mentioned the importance of domestic robots in the future society [1].

There have, however, only been a few studies that strictly investigated what people expect for robots in domestic fields. Oestreicher and Eklundh [2] clarified some domestic tasks that robots were expected to do based on interviews. Loshe et al., [3] found that the appearance of domestic robots influences how well they are accepted. Takayama et al., [4] investigated the suitability of robots for a variety of jobs from the U.S. Department of Labor's o*NET occupational information database, and found that people preferred robots to be employed for occupations that require artistry, evaluation, judgment and diplomacy. Ezer et al., [5] examined the expectations that younger and older individuals have about domestic robots, and how these expectations relate to acceptance of robots. Scopelliti et al., [6] clarified age differences in the acceptance of domestic robots. However, these existing studies did not clarify what types of domestic tasks people really expect robots to perform.

Some studies have investigated specific domestic tasks that robots were expected to perform. Ezer [7] conducted a questionnaire survey including 15 tasks assumed to be performed by robots, and found three types of task groups ("interactive tasks", "infrequent tasks", and "service tasks") through factor analysis. The results of a survey conducted by Ray et al., [8] suggested that tasks typically involving some kinds of relationship, such as playing with children, were poorly rated compared with simple household tasks such as cleaning. However, these studies did not take into account the potential gender difference in people's expectations for robots.

There is a possibility that men and women will have different expectations for domestic robots. For example, Tsuya et al., [9] clarified that in some countries, including Japan, traditional gender role assignments of breadwinning primarily by husbands and housework by wives are still prevalent, affecting the wives' employment patterns. These traditional gender role assignments may cause differences in awareness between men and women regarding what types of domestic tasks both genders should share or any of them should shoulder, and as a result may lead to gender differences in what types of domestic tasks they expect robots perform.

To explore what types of tasks robots are expected to perform in domestic fields, and the gender difference in these expectations, an online questionnaire survey was conducted. This paper shows the results of the survey, and discusses the implications.

2 Method

2.1 Study Period, Participants, and Procedure

The survey was conducted from November to December 2016. Respondents were recruited via the Internet by a survey company that has approximately two million Japanese registrants. The homepage of the online survey was accessible during the above period for these candidates. A total of 400 persons, 40 men and 40 women in each of five age brackets (20s, 30s, 40s, 50s, and 60s), responded to the questionnaire.

2.2 Survey Design

The questionnaire of the online survey consisted of the following items.

Domestic Tasks to Be Performed by Robots. There were a total of 24 tasks in domestic fields. Each item was scored on a seven-point scale: 1 indicating that the task should be performed by humans, 4 indicating "undecided", and 7 indicating that the task should be performed by robots. The tasks were extracted from the homepage of an agency company for housework (http://www.kajipro.com/service/) and the o*NET occupational information database, and then selected through a pilot survey. Participants were asked to answer each item while envisioning that robots had skills equal to humans to carry out the task indicated by the item. Table 1 shows these task items.

Skills Needed to Perform the Tasks. There were a total of 14 skills needed to perform the 24 domestic tasks. These items were extracted from the o*NET occupational information database. Respondents were asked to answer whether they preferred humans or robots to perform the tasks that required the skill indicated by each item (coded as 0: humans, 1: robots). Table 2 shows these skill items.

3 Results

3.1 Types of Domestic Tasks to be Performed by Robots

To extract what types of domestic tasks respondents expected robots to perform, an exploratory factor analysis with the maximum likelihood method and Promax rotation was conducted for the item group of 24 tasks. Two factors having eigenvalues greater than 1 were extracted, and the cumulative contribution of these items was 56.1%. Moreover, the factor loadings were greater than .4 for all the items. Table 1 shows the results of this factor analysis.

Table 1. Items of domestic tasks to be performed by robots and results of factor analysis

	Factors	
	I	II
Washing dishes	**.910**	-.192
Sweeping	**.888**	-.202
Throwing out trash	**.859**	-.080
Installing and repairing electronics / communication circuits	**.809**	-.067
Keeping a record of household expenses	**.782**	-.041
Sewing	**.782**	-.085
Setting a table	**.757**	.063
Installing furniture / redecorating a room	**.731**	.011
Weekend carpentering	**.702**	.042
Shopping	**.676**	.104
Driving a car	**.657**	.100
Giving a haircut	**.538**	.251
Cooking	**.527**	.324
Answering the telephone	**.472**	.221
Choosing and coordinating clothes	**.462**	.340
Raising and educating children	-.151	**.943**
Caring for infants	-.196	**.924**
Nursing a baby	-.227	**.838**
Playing with children	-.039	**.765**
Education and learning	.115	**.665**
Nursing	.220	**.631**
Counseling for care of the elderly	.144	**.598**
Writing / making an album	.169	**.596**
Caring for pets	.304	**.439**

I: physical tasks, II: family care

Cronbach's α-coefficients of the two item groups corresponding to the factors were .944 and .907 for the first and second factors, respectively. Since these values showed sufficient internal inconsistency, the average values of item scores in the factors were used for the analyses. Since the items included in the first factor indicated domestic tasks requiring physical activities, such as washing dishes and sweeping, the average score of the 15 items in this factor was interpreted as "expectation for robots performing physical tasks" (scores range from 1 to 7). Since the items included in the second factor indicated tasks related to care for family members, such as raising children and nursing, the average score of the nine items in this factor was interpreted as "expectation for robots performing family care" (scores range from 1 to 7).

3.2 Types of Skills Needed to Perform Tasks

To extract what types of skills respondents expected robots to have for performing domestic tasks, another exploratory factor analysis with the maximum likelihood method and Promax rotation was conducted for the item group of 14 skills. Two factors having eigenvalues greater than 1 were extracted, and the cumulative contribution of these items was 39.4%. Moreover, the factor loadings were greater than .4 for all but one item. Table 2 shows the results of this factor analysis.

Cronbach's α-coefficients of the two item groups corresponding to the factors were .848 and .706 for the first and second factors, respectively. Since these values showed sufficient internal inconsistency, the total values of item scores in the factors were used for the analyses.

Table 2. Items of skills needed to perform the domestic tasks and results of factor analysis

	Factors	
	I	II
Problem solving / problem examination	**.718**	-.013
Strategy / education	**.710**	-.043
Creativity / originality	**.670**	-.098
Decision making	**.668**	-.093
Indication	**.642**	-.049
Understanding others' ideas and interacting with them	**.582**	.091
Reading comprehension	**.562**	.025
Social knowledge	**.526**	.089
Actively exploring ways to help others	**.409**	.295
Speaking	*.294*	*.264*
Management and analysis of material resources	-.125	**.801**
Repetitive actions	-.151	**.725**
Active information collection for problem solving	.304	**.460**
Manual dexterity	.154	**.402**

I: human-like thinking capacity, II: coordination and data processing functions
(Italicized item: reduced based on the criterion of factor loadings less than .4 for all factors)

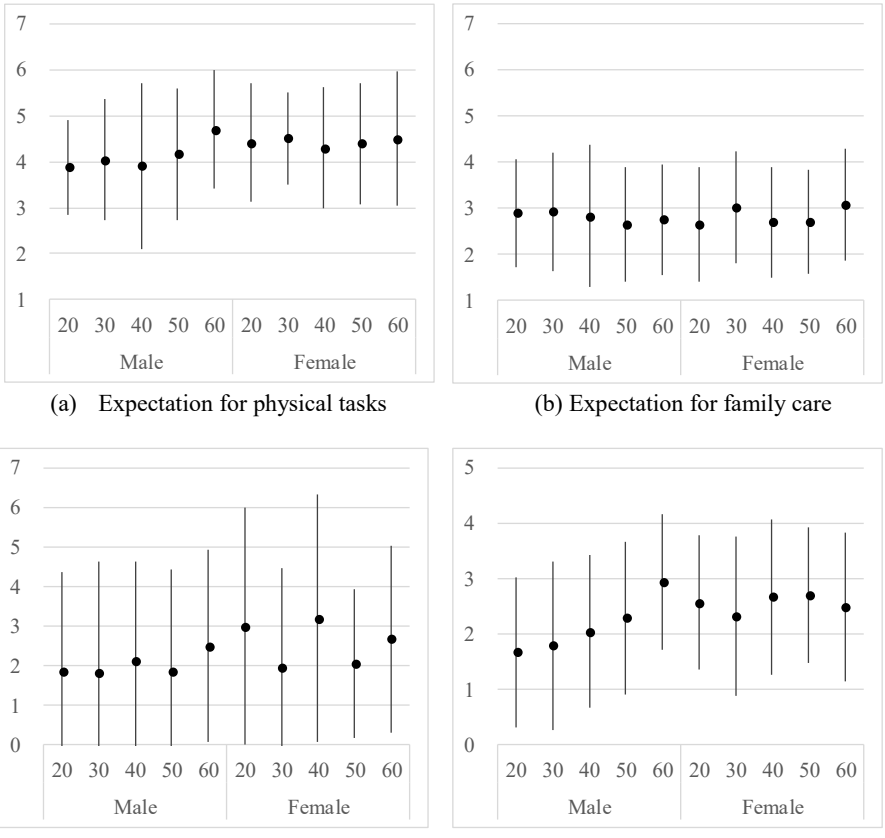
Since the items included in the first factor indicated skills of thinking equal to humans, such as critical thinking and strategies, the total score of the nine items in this factor was interpreted as "expectation for robots having human-like thinking capacity" (scores range from 0 to 9). The items included in the second factor indicated skills not requiring deep thinking compared with those in the first factor, but needing coordination and data processing functions, such as being able to perform repetitive actions and have manual dexterity. Thus, the total score of the four items in this factor was interpreted as "expectation for robots having coordination and data processing functions" (scores range from 0 to 4).

3.3 Gender Differences in the Task and Skill Scores

Fig. 1 shows the means and standard deviations of the task and skill scores mentioned in 3.1 and 3.2, based on age bracket and gender. Table 3 shows the analysis of variance results with age bracket × gender for these scores.

Except for expectation for family care, the main effects of gender were statistically significant for the three scores. The scores for female respondents were higher than

Fig. 1. Means and Standard Deviations of Task and Skill Scores Based on Age Brackets and Gender



(a) Expectation for physical tasks

(b) Expectation for family care

(c) Expectation for human-like thinking capacity

(d) Expectation for coordination and data processing functions

those for male respondents. The interaction effect was statistically significant for expectation for coordination and data processing functions. A simple main effect test using Bonferroni's method revealed that gender differences were statistically significant or had a statistically significant trend for the respondents in their 20s, 30s, and 40s (p = .003, p = .083, and p = .039, respectively). Moreover, the male respondents in their 60s had higher scores than the male respondents in their 20s, 30s, and 40s (p < .001, p = .002, and p = .031, respectively), although there were no such differences between the age brackets in the female respondents.

Table 4 shows the Pearson's correlation coefficients between the scores. There was moderate correlation between the two task scores and between the two skill scores for both male and female respondents. There was also moderate correlation between the expectations for family care and human-like thinking capacity, and between the expectations for physical tasks and coordination and data processing functions for both male and female respondents. On the other hand, the correlation between expectations for physical tasks and human-like thinking capacity for the female respondents was lower than that for the male respondents. A test of equality between the two correlation coefficients revealed that this difference was statistically significant (Z = 1.985, p = 0.048).

4 Discussion

4.1 Findings

The results of the factor analyses showed that Japanese people expected robots to perform two types of domestic tasks, physical tasks and family care, and have two types of skills to achieve these tasks, human-like thinking capacity and coordination and data processing functions. Moreover, compared with male respondents, female respondents tended to expect robots to perform physical tasks and have human-like thinking capacity. Younger men tended to have a lower expectation for the robots' coordination and data processing functions than younger women and older men. Moreover, men tended to expect that robots had human-like thinking capacity when they performed physical tasks, compared with women.

The traditional gender role assignments in which women tend to do housework still exist in Japan, and yet the employment of married women has been encouraged. Thus, women may perceive that they have a "double burden" [9]. The results of the survey in the present study reflect this perception. Japanese women expect robots to decrease their burden concerning domestic tasks, which is typically greater than that of Japanese

Table 3. Analysis of Variance Results for Task and Skill Scores

		Tasks		Skills	
		Physical tasks	Family care	Human-like thinking capacity	Coordination and data processing functions
Age bracket	F	1.654	.719	1.538	3.252
	p	.160	.579	.190	.012
	η^2	.016	.007	.015	.031
Gender	F	4.608	.019	4.261	8.775
	p	.032	.890	.040	.003
	η^2	.011	< .001	.011	.021
Interaction	F	.947	.599	.794	2.848
	p	.437	.664	.529	.024
	η^2	.009	.006	.008	.027

Table 4. Pearson's Correlation Coefficients Between Task and Skill Scores

		Family care	Human-like thinking capacity	Coordination and data processing functions
Physical tasks	Male	.558**	.455**	.596**
	Female	.418**	.272**	.544**
Family care	Male		.488**	.205**
	Female		.447**	.159*
Human-like thinking capacity	Male			.505**
	Female			.466**

(*p < .05, **p < .01)

men. Moreover, the results of the survey suggest that this expectation is particularly weaker in younger men.

4.2 Implications

The above findings and suggestions lead to the following implications:

- Developers of domestic robots should be sufficiently aware of people's expectations for robots in their home.
  - As suggested by the correlations found in the present study, there is a possibility that male and female family members have different assumptions on the combination of tasks to be performed by robots and the skills robots will require to achieve the tasks. Robots based on designs that take into consideration both the expectations of family members and a corresponding balance of task capabilities and skills may contribute to greater parity in domestic tasks in societies where gender differences in housework still exist.
- Developers of domestic robots should explicitly show whom their robots target in homes.

— It may make an opportunity that people in the society know who has been shouldering housework and discuss about whether the burden has been valid. Then, the essential problem, the traditional gender role assignments and its influences into employment, will explicitly be discussed in the society.

4.3 Limitations

First, while the results of the survey may reflect the burden of housework on Japanese women, the survey did not measure how female respondents really perceived their burden. A future survey should include this perception and analyze its correlation with expectations for domestic robots.

Second, the participants in the survey were limited to Japanese men and women. As shown in [9], however, South Korea and the Unites States have similar issues concerning traditional gender role assignments and their influence on employment. However, each country has culturally unique aspects to these issues, such as family structures and employment styles. Thus, a future survey should clarify how the common and different factors among these countries influence expectations for domestic robots, similar to what has been done in cultural studies on robotics (e.g., [10]).

Third, the survey did not consider factors of robots, such as appearance, or human factors other than gender and age, such as educational backgrounds and experiences with robots that can affect humans' attitudes toward robots [11]. A future survey should include these factors in the design.

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