Exploration of Basic Images about Robots in Adolescents

A Survey Based on Drawings in Japan

ABSTRACT

To explore basic images of robots in adolescents, a survey was conducted for ninety-seven Japanese students in the first-year at a university in Japan. In the survey, the participants were asked to draw pictures of entities that they first imaged when they heard the word "robots". The paper presents analysis results of classification of these drawings, and discusses about implications on what images are dominating young people's ideas of robots.

CCS CONCEPTS

• **Human-centered computing** → **Human computer interaction (HCI)** → Empirical studies in HCI

KEYWORDS

Robots, basic image, adolescents, drawings

1 INTRODUCTION

As robotics technologies have recently been widespread in daily life, the exploration of factors influencing people's acceptance of robots has become one of the issues to be tackled rapidly in the research field of human-robot interaction (HRI). A lot of studies suggested several types of these factors, such as appearances of robots [1], robots' social abilities [2], task structures under where humans and robots co-exist [3], and humans' attitudes and anxiety toward robots [4].

On the other hand, individuals may image different entities when they hear the word "robots", and there is a possibility that these differences lead to differences on acceptance of a specific robot. Nevertheless, it has still not been clarified what basic images of robots people have. Although Nomura et al [5] measured people's assumptions about robots such as functions and roles, their survey was limited to humanoid and animal-type robots.

To explore humans' basic images about robots, the research adopted drawing tasks, a method for measuring in psychology (e.g., [6,7]). This method is effective for measuring primitive concepts of robots, and some existing studies in HRI adopted this method. Khan [8] found that the Swedish adults' images of robots tended to be associated to robots in films and literature. Obaid, et al., [9] explored Portuguese children's images of robots while comparing between children without knowledge of robotics and those with it.

The research focused on the Japanese adolescents' basic images about robots since these persons are the central consumers of robots in the near future of this nation and their images about robots can influence social acceptance of robots in the world. As a preliminary attempt, the research conducted a survey based on drawings about robots by university students in Japan.

2 METHOD

Participants were ninety-seven Japanese students in the first-year at a university in Japan (mean age = 18.3 (SD = .5), male: N = 82, female: N = 15). Although they belonged to a department on informatics, they entered the university just one month ago and had still not learnt about sciences or technologies sufficiently.

The survey was conducted in a lecture time for the students, and the students were required to participate with the survey as a task in the lecture. The participants were instructed to draw pictures of entities that they first imaged when they heard the word "robots", within a rectangle of height 6cm and width 15cm on the questionnaire.

3 RESULTS

Manual classification of the drawings into several categories was determined by two coders. First, one coder created coding categories and classification rule based on a part of the collected drawings. The drawings were basically classified into humanoid-type and non-humanoid-type. Humanoid-type was defined as follows:

- Entities having objects looking like a body and head
  - ➢ Definite if they have arms or legs.
  - ➢ When they have no arm or leg,
    - ✧ Definite when they look as if they separately have a head and a body

Non-humanoid type was as follows:

- All the entities not conforming to the definition of humanoid-type

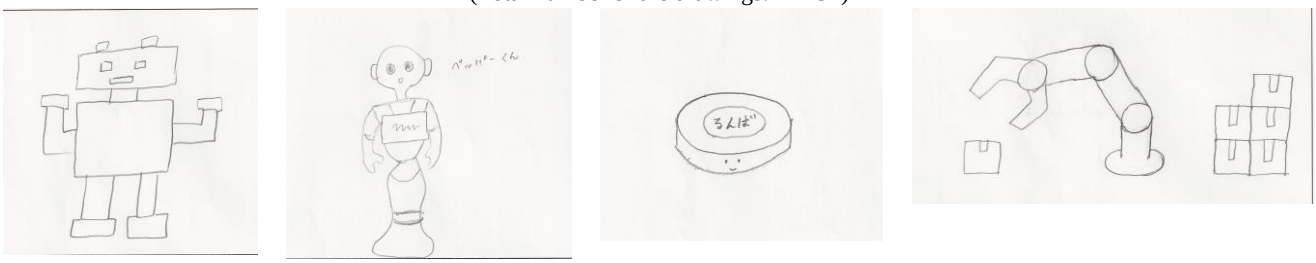
Then, drawings of robots classified into each category were classified in more detailed as shown in Table 1.

Second, the two coders independently categorized the drawings, and κ-coefficient showing degree of equality between the two

Table 1: Classification Categories of Drawings about Robots and the Numbers of Classified Drawings

Basic classification	Detailed classification		*N* of drawings (%)
Humanoid-type	Robots appearing in specific animations	Doraemon in Japan	18 (18.6%)
		Weapon robots in Japanese SF animations such as Gandom	1 (1.0%)
		Baymax in the USA	1 (1.0%)
		Anything else	3 (3.1%)
	Robots appearing in specific films:	Robots in "Star Wars"	0 (0%)
		Robots in "Terminator"	0 (0%)
		Anything else	0 (0%)
	Robots not appearing in animations or films	Typical mechanical robots having a square body and head	47 (48.5%)
		Robots that have already been appearing in the society like "Pepper"	6 (6.2%)
	Anything else		12 (12.4%)
Non-humanoid-type	Vacuum robots such as "Roomba"		4 (4.1%)
	Arm robots acting in factories		4 (1.0%)
	Anything else		1 (1.0%)

(Total number of the drawings: $N = 97$)



(a) Typical mechanical robot having a square body and head

(b) Robot that has already been appearing in the society like "Pepper"

(c) Vacuum robot such as "Roomba"

(d) Arm robot acting in factories

Figure 1: Representative Drawings of Images about Robots in the Survey

categorization results was calculated for validating the reliability of these coding categories. As a result, the κ-coefficient was .840, and showed sufficient reliability of the coding categories. Furthermore, the two coders discussed the contents of the drawings and categories until they reached a consensus about each classification. Finally, each drawing was classified into one of these categories.

Figure 1 shows representative drawings of some robot images. As shown in Table 1, more than 90% of the drawings were classified into humanoid-type, and more than half of them (53.7%) belonged to the image of "robots not appearing in animations or films". Moreover, the image of "typical mechanical robots having a square body and head" dominated about a half of the whole drawings, and more than half of the drawings classified into humanoid-type. Other drawings belonging to the image of "robots not appearing in animations or films" included the image of the existing robots such as "Pepper". The image of "Doraemon in Japan" dominated 18% of the drawings. No drawings had images from specific films such as "Star Wars" and "Terminator". Almost all of the drawings classified into non-humanoid-type were related to the existing robots such as vacuum robots like "Roomba" arm robots in factories.

4 DISCUSSION

The most dominant image in the participants was a classical one consisting of robots having a mechanical square body and head as shown in Figure 1 (a), of which frequency was about 50%. Robot images from fictions such as animations and films were less dominant in the participants and the frequency of these images was about 23%. On the other hand, the frequency of the images of the existing robots such as "Pepper", "Roomba", and arm robots in factories was about 15%. In other words, there was not variety of basic robot images in the participants of the survey.

The participants in the survey belong to the generation familiar with several types of information sources like the Internet. Nevertheless, the variety of basic robot images they have is not large. On the contrary, it suggests ample room for several types of robot designs to be widespread in robot images of this generation. One of these novel robot designs may lead to a novel type of social acceptance of robots in the world.

On the other hand, the survey was limited to the Japanese adolescents. Thus, it should be extended to adolescents from other cultures while taking into account several educational backgrounds. Moreover, the survey focused only on basic robot images based on drawings, and did not measure other psychological constructs such as attitudes and anxiety toward robots [4]. Future surveys should include these measures.

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