The Interaction between Human and the Home Service Robot on a Daily Life Cycle

Hsiu-Ping Yueh[1] and Weijane Lin[2]

[1] Department of Bio-Industry Communication and Development
[2] Department of Library and Information Science
National Taiwan University
No. 1., Sec. 4., Roosevelt Rd., Daan Dist., Taipei 10617, Taiwan, R.O.C.
`vjlin@ntu.edu.tw`

Abstract. The objective of this paper is to explore the perceived roles of home service robots between different cultures. Human preferences on interaction modes and features of a home service robot were investigated in this ongoing study. Results of the study indicated a complicated issue related to the acceptance and reliability of a social robot. And participants from Taiwan and Japan reflected their preferences on communication matters in function, service, interaction, appearance, likability, and trust issues. Participants from both cultures preferred home service robot to provide information over social services, while Taiwanese participants possessed significant preference on scheduling/planning function. For the future needs of home service robots, Taiwanese participants preferred entertainment service robots, and Japanese participants preferred caretaker robots.

Keywords: culture, human robot interaction, communication, home service robots.

1 Introduction

A home service robot is a social-service robot used in people's home to provide convenience by having features such as cooking, providing care, being a companion, to areas which may relate to providing news, providing house security, sharing stock market information, checking the weather forecast, and others people can get hold of easily through the use of a robot. To understand a better linkage between human and robot relations, we wanted to observe what type of interaction and communication method affects human's likability and acceptance towards robots through a cultural view as we believe robots should be different for each culture.

Through this survey, we believe a better understanding of social robots will be given by interpreting human value to enhance robotic likability as social robots are not looked upon positively as we hoped. With the growing studies and the idea of having robots in every home, such as South Korea between 2015 and 2020 (CBC, 2007), we

hope to grow and push the home service robot project forward for future developments around the world.

2   Literature Review

2.1   Robotic Interaction and Communication

People communicate with other people through its personality, characteristics, speech pattern, voice style/tones, gestures, or body movements (O'Neill-Brown, 1997), while robots on the other hand needs to be programmed in order to facilitate these actions like a human, which many studies and research have been taken to enhance these areas of interaction in various developments. Non-verbal communications such as expressions in gestures, eye contact, and other social behaviors are user frequently while conversing or doing specific tasks, which makes human-human interaction a specialty compared with a robot. This human-human interaction (Nass & Moon, 2002) is a key to contribute a good human-robot relation, where computer's manner or character should follow the same style of characteristics a human being would to another human being.

When discussing about "appearance" in robotic term, people tend to refer this as a physical entity, thinking about its aesthetical form, forgetting to interpret the socially psychological side of robotics; where the idea of 'judging a book by its cover' can be used in relation with the concept of "appearance" of robots. Just because a robot may look dumb does not mean it does not have skill or is stupid. A robot that may look smart may not be intelligent as well. These questions raise studies in what "appearance" in both physical and psychological interpretation can lead to. Mori's research about robots physically appearing like a human is frowned upon, having people back away from having a robot. This uncanny valley (Mori,1970) would be an area we will try to avoid as many people may perceive a home service robot may look scary or uncanny.

Ethical robots (roboethics) (Veruggio, & Operto, 2006) come in play to understand relational-respect to humanity issues of likability, trust, and privacy. We believe by understanding communicational response, perception of social likability, and also considering physical appearance, a robot will be better understood for a closer approach in people living with a robot on a daily level. This ethnographical approach into the study will also link back to cultural aspects of the research as well.

2.2   Home Service Robots in the Market

Currently, there are several home service robots out in the market. Robosapien by WowWee Robotics for personal entertainment use inside a home, Nabaztag who connects to the Internet by Wi-Fi to check and notify and remind people of certain information's or event's, an instant message notifier by iKnock for social and personal messaging use, a polar bear-like robot named RIBA (Robot for Interactive Body Assistance) who performs as a nurse or a caretaker by RIKEN-TRI Collaboration Center

for Human-Interactive Robot Research (RTC), GUARDROBO by Sohgo Security Services Company who provides security measures and also acts as a greeter, and Roomba for vacuum cleaning by iRobot Corporation. We believe these robots provide different service for different culture as the degree of robotic acceptance plays its role in appearance, likability, and trust towards a robot.

2.3   Culture and Robots

To understand a better linkage between human and robot relations, we wanted to observe what type of interaction and communication methods affect human's likability and acceptance towards robots. We feel a future for cultural robot can be studied through differences of opinion, where a connection between each culture may exist to have a culturally accepted robot in place.

   As Western people are more independent, and Eastern people are more interdependent (Markus & Kitayama, 1991; Rau, Li, & Li, 2009), our research were explored amongst different nationality and culture to gain a better understanding of what a universally accepted robot may or may not be, and how the idea of robots are thought and are different compared between the Western and the Eastern world. With different ethnography between each culture, we predict a robot made in a Western geography may not be well accepted in the Eastern geography, vis versa, a robot developed in an Eastern geography may not be well accepted in the Western geography.

2.4   The Nature of a "Home" Environment

For a home service robot, one of the few challenges is to realize or become conscious of a home as a private area or sector rather than a public area. Private area also means privacy and confidentiality is considered, where a public robot are programmed for doing one thing well, such as a robot inside a museum, security robots, and tour guide robots although the task might be similar. These private robots are personalized for each user, whereas interaction and communication between family members, roommates, maid or domestic helper, owners, and pets should be quite different from relationships between classmates or co-workers. In cultural perspective, the communication level, freedom of control of a robot, and personal space will be few issues a user may experience different compared with the Eastern and Western geography as lifestyle and personal values differ greatly for both geography.

3   Methodology

A survey was conducted to understand what robots should have as its feature or service, physical appearance, likability, sincerity, trust and privacy issues, and to see a general view of what robots are being thought as today. The survey has a total of 19 questions, available both in English and Chinese. We currently started by doing an Asian overview first, where the research will still continue by collecting data from overseas aspect for the study. The survey was divided into 6 main sections.

Section 1 includes personal information about the surveyor by identifying its nationality, age group, gender, occupation, and to analyze their position and understanding of robots and their buying behaviors. We believe some answers to the question may refer to their style of buying behaviors as a survey safety issue.

Section 2 includes service and function questions, ranging from features and values a robot may provide humans with. This section was also used to provide information of what home service robots may be as people who may not know about robots may take the survey and understand what robots are little by little. This part of the survey was completed by asking the surveyor how strongly they need or don't need a certain feature that may exist in a robot.

Section 3 asked questions regarding the robots style traits, body structures, and size. The style traits questions were arranged with questions such as which style they like more: a modern or a futuristic robot, machine like or human like, have low character or high character… to see their preference of robots (Fig. 1). The response section was for them to mark the range of how they felt more comfortable in associating a robot with. Seven ranges were provided for this question. The body structures section asked questions related to if it should have a feet or use a wheel, have a palm to grab things or a finger to grab things, have or don't have facial features, virtual face vs. visual face, and more to see what type of robot will fit well for a home service robot.

Section 4 raised issues related to likability, sincerity and trust and privacy through human robot interaction (HRI) questions, where some were direct and indirect questions for the surveyor. The idea here was to see how home service robots can be improved or have in consideration when developing it. General questions here were related to personality, behavior, to attitude and ethical questions to see and relate it towards human-human interaction. We measured this by having the surveyor mark answers regarding how strongly they disagree or agree to each questions. For question on "trust" issue in question 14, we copied a study from Rau's study.

Section 5 and 6 were more of future ideation of what robots are being thought as today with current technology and science people may or may not know of. These 2 sections were more to open their mind and see what they know about robots and what they may or may not want to see in the future. By seeing this degree of acceptance of a robot, we wanted to seek information regarding the future of robots through their eyes. Lastly, section 6 was an optional comment area to gain feedbacks or suggestions they may want to share with us.

4   Preliminary Results

In total, 19 responses were received from Taiwan and 27 responses were received from Japan. We tested if there were some culture differences in robots' services, appearances and HRI factors.

Section 1: The 46 surveyors were all males and their ages were above 18 years old. They all bought new products after products were sold in several months. When we asked the willingness to own any home ISRs, 53% said they will and 42% were not

sure in Taiwan's surveyors; 22% said they will, 37% said they will not and 41% were not sure in Japan's surveyors.

Section 2: No matter in Taiwan or in Japan, the requirement of services were house chore related function, caretaker/nurse function, schedule/planner function, security function, detecting emergency phenomenon such as earthquake and typhoon, remotely turn appliances, providing information and find stuff function. These functions were all evaluated above 4 score (somewhat need) in both cultures. Only in schedule/planner function, we found significant higher evaluation in Taiwan than Japan (t(44) = 2.14, p < .05). The social factor service, charting service, networking service and greeting all evaluated near or below 3 score (somewhat don't need).

Section 3: The higher scores represented the surveyors were more comfortable in associating home ISRs with futuristic, machine-like, looks complicated, female figure, brighter color, looks thin, organic and high character. The opposite were modern, human-like, looks simple, male figure, darker color, looks strong, geometric and low character. The score 4 meant neutral or both not in the two opposite dimensions. Taiwanese and Japanese all liked robots be futuristic, looks simple, female figure and brighter color. The Taiwanese emphasized more on high character and significantly more on organic (t(44) = 2.60, p < .05). There were no preference of machine-like/human-like and looks strong/looks thin traits. The evaluated scores of them were closing to the middle score 4.

Considering the body structures, we conducted chi square to examine the proportion differences in each body structure question. We only found significant culture difference in wheel vs. feet character ($\chi 2$ = 7.26, p < .01). For Taiwanese, they preferred wheel than feet and we got reversed preference for Japanese. In other structures, Taiwanese and Japanese preferred finger, no facial feature, arm and body screen. Taiwanese more liked virtual face than visual face and there was only minor reversed preference for Japanese. But we did not find significance in this structure ($\chi 2$ = 3.0, p = .08). Lastly, the medium size of home robots (66.7%) was most popular in Taiwanese and Japanese.

Section 4: In Taiwan surveyors, the Cronbach's α for likability, sincerity and trust and privacy were 0.87, 0.90 and 0.86. And in Japan surveyors, the the Cronbach's α for the three scales were 0.86, 0.88 and 0.84. The evaluation of robots in these HRI factors, Taiwanese significantly evaluated higher than Japanese (Likability: t(44) = 2.90, p < .01; Sincerity: t(44) = 2.82, p < .01; Trust and Privacy: t(44) = 2.26, p < .05).

Section 5 and 6: Table 1 and 2 show the surveyors' percentage in each rank. Most surveyors in Taiwan thought the most popular robot was entertainment service robot in the future. The second were the labor robot, safety/security robot or information providing robot. The following sequence was assistant/servant robot, remotely accessed robot, and caretakers/nurse robot. The last one was social companion robot. In Japan, the first one was caretakers/nurse robot. The following sequence was safety/security robot, assistant/servant robot, remotely accessed robot, information providing robot. Counting back second place was entertainment robot and labor robot. The last one was also companion robot.

5   Discussion

The services of robots: In both cultures, the following services should be first implanted: house chore related function, caretaker/nurse function, schedule/planner function, security function, detecting emergency phenomenon such as earthquake and typhoon, remotely turn appliances, providing information and find stuff function. However, in the section 5's popularity sequence arrangement, the second to seventh rank of robots' functions corresponded to the section 2's requirements investigation. Our surveyors wish the home ISRs which relate to services in labor, secure, servant or information providing dimensions are popular soon. The interesting thing is caretaker/nurse robots are required but doesn't think should be popular first in Taiwanese. And the entertainment robot is in the seventh popular rank in Taiwanese. But in Japan, the caretaker/nurse robots are ranked in first place. The social companion robots are the lowest required and most unpopular.

The appearance of robots: In Taiwan and Japan, the physical structures of the robots are finger, no facial feature, arm and body screen. Taiwanese more like virtual face and wheel robot. Japanese liked feet robots but no difference in preference of virtual or visual face. On the other hand, we can follow the questionnaire's results to design our robots for different countries. The only consideration is designed a more organic and high character robots for Taiwanese. Lastly, medium size robot is well accepted for all surveyors no matter their cultures.

The HRI dimensions: HRI factors of likability, sincerity and trust and privacy are thought more important in Taiwan. This might relate to degree of acceptance of robots' information. In Japan, the development of robots is more emphasized and robots are more accepted. Japanese might more confident and reliable to interact with robots than Taiwanese. As a result, the psychological factors for Japanese to evaluate in agreement degree are lower than Taiwanese.

Our current goal is to provide future studies into cultural aspect of robotic development in the field of home service robots. The questions about what robots can do, how they look like and how the interaction between human and robots can all be found out in our study. Further testing, experiment, and exploration will be continued to bring in the Western geography into our test results. Further studies may include a topic related to culturally accepted robots and how they can be developed.

References

1. CBC, Ethical code for robots in works, South Korea says (2007),
   http://www.cbc.ca/technology/story/2007/03/07/
   tech-robot-ethics.html
2. Markus, H.R., Kitayama, S.: Culture and the self: Implications for cognition, emotion, and motivation. Psychological Review 98(2), 224 (1991)
3. Mori, M.: The uncanny valley. Energy 7(4), 33–35 (1970)
4. Nass, C., Moon, Y.: Machines and mindlessness: Social responses to computers. Journal of Social Issues 56(1), 81–103 (2002)

5. O'Neill-Brown, P.: Setting the stage for the culturally adaptive agent. In: Proceedings of the 1997 AAAI Fall Symposium on Socially Intelligent Agents, pp. 93–97 (1997)
6. Rau, P.L., Li, Y., Li, D.: Effects of communication style and culture on ability to accept recommendations from robots. Computers in Human Behavior 25(2), 587–595 (2009)
7. Veruggio, G., Operto, F.: Roboethics: a bottom-up interdisciplinary discourse in the field of applied ethics in robotics. International Review of Information Ethics 6, 2–8 (2006)