Cultural differences in perception and attitude towards robots

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ABSTRACT

This study examines the assumptions, perceptions, and attitudes towards contemporary robots in different cultures. As culture affects the way technology is perceived, it is essential to explore the psychological reactions through different cultures towards different designs of robots. Only a few studies have examined attitudes towards robots or dealt with the assumptions in a specific culture. The present study determines the influence of crucial factors like culture, prior exposure to robots through the media, and personal experiences of the emotions towards robots and examines the cultural differences between Europe and Japan.

Keywords

Human robot interaction; Cultural differences, Assumption about robots, Attitude towards robots

INTRODUCTION

Robots have only recently been commercialized for use in daily life. With the soaring number of robots in use, the question of people's attitudes towards robots becomes increasingly important, especially in common applications of socially interactive robots like entertainment, education, and healthcare, including assistance of handicapped or elderly people. The emotions towards robots are influenced by culture, exposure to robots through the media, and personal experiences.

In addition, the diversity of robot designs rapidly grew to an immense number. Therefore, the term *robot* is being applied to an ever-widening range of artifacts and image and assumption of robots widely vary from android robots to service robots and robotic pets. In contrast, computers have a rather fixed image. Hence, although the field of computer anxiety has been studied in great detail, the effects of robot anxiety are still largely unknown.

Therefore, the term robot has not always the same association and also, initial association might change through experiences with a special type of robots. The psychological reaction may differ between different nations. The investigation of the assumption of the term robot in different cultures is important not only from a psychological perspective but also from an engineering perspective focusing on design and marketing of robotics for daily life applications. In addition, the change of assumption and the attitude after exposure through media or personal contact with either positive or negative character might reveal some important aspects of human robot interaction. Thus, it is advisable to investigate the people´s assumption about the term robot before discussing the attitude and the differences on emotions towards robots.

People do not only have a different assumption about robots, they also have a different attitude towards robots because of their personal experiences. Dorman et al. (2008) describe in addition a country´s economy, its technological development, historical and religious context as well as national funding priorities as factors shaping the individual attitudes. In Western cultures, the first idea of using a machine may be traced to Blaise Pascal´s adding machine in 1642. Nowadays, the scenario of robot`s world domination is reflected in countless movies, especially in Hollywood blockbusters like *Terminator* or *I, Robot*.

In the eastern culture of Japan, the perspective on robots has developed quite different. From the early Edo period on with the performance of clockwork *karakuri* puppets till on of the world´s most famous *manga* (comics) *Astro Boy*, a fictional robot, Japanese culture had an other exposure to the image of robots. Therefore it´s not surprising, that Japan is mostly assumed being the Robot Nation and also pioneering entertainment, robotic pets and humanoid robots such as the Sony Aibo, Sony Qrio, Honda Asimo and AIST Paro.

Problem statement

The study of assumption and attitude towards modern robots contains a wide variety of challenges, some of them of basic research nature, dealing with general concepts, and others of domain-specific nature exploring interaction with robots in particular contexts or specific robot types. The number of different robot types, the variety of purpose as well as design and human factors highly increase the research challenges. The robot's physical embodiment, form and level of anthropomorphism, dynamic behavior, motion, imitation of human motion like walking, grasping or dancing, emotions like face expressions or voice, and simplicity or complexity of design, are some of the key research areas which lead to interesting questions in term of perception by the users.

The cultural differences between the West and Japan are quite complex due to historical and philosophical differences. Explicit measurement (e.g. questionnaires) is a good tool to ask directly for the opinion people have

and collect the results on an index or scale.

Due to the high complexity and variety on this field, research has to focus on some key aspects to bring forward the overall understanding of attitude towards robots. Our work focuses on the assessment of assumption about robots in general and the comparison between of attitudes between different nations.

Previous work

Cultural studies about the psychological impact of technology revealed that cultural differences on technophobia, particularly in the field of attitude towards computer and computer anxiety, exist (Weil & Rosen, 1995).

Purpose of the study

Our study aims to reveal new aspects about the assumption and the perception of the term *robot*, to investigate what Japanese people expect from robots and to compare these results to the expectation of European people. In addition, the expectation, not only in general, but also towards selected types of robots, is examined.

REVIEW OF THE LITERATURE

Cross-cultural

Preliminary studies have already revealed that there exists some kind of impact of different cultural background on the perception, assumption and the attitude towards robots. Bartneck (2007) found some cultural differences in negative attitude towards robots, but his study had some sampling problems like self-selection bias. MacDorman, Vasudevan, and Ho (2008) used explicit and implicit measurements of attitudes towards robots and found, apart from the experience with robots, more striking cross-cultural similarities in attitude towards robots than differences. Nevertheless, these studies did not take into account what people assume with the word *robot*. Shibata et al. (2004) reported international research results on psychological reactions towards robots of a robotic pet. Although the study revealed that the nationality of the subjects affected their reactions towards the seal-type robot called „Palo“, it was limited to only one specific type of robot.

Attitude towards robots

Nomura (2006) reported a connection between assumptions and negative attitude towards robots for Japanese. This study was limited to Japanese data samples only and not applicable for cross-cultural comparison as the questionnaire was not designed for this purpose. However, the common presumption assigns Japan a more positive attitude than the Western “robots will take over the world” scenario, an effect which could not be found that strongly in the conducted research.

Assumption about robots

The study of Nomura (2005) to investigate what people in different cultures assume when they encounter the word „robot“ showed, that Japanese assume more autonomy and emotional capacity of human-size robots than Korean or American cultures. Also, they have a less ambivalent image of robots. Ray et al. (2008) found that European tend to assume robots as pragmatic assistants for certain tasks, especially in their households.

METHODOLOGY

The goal of this research is to reveal assumption and attitude towards modern designs of robots regarding the difference between Japanese and Western cultures. It will examine further what kind of psychological reaction robots evoke in humans.

The conducted research consists of two parts. First, the cultural background, notion of the term *robot* and prior passive and active experience with robots is examined. Second, a questionnaire is developed and given to Japanese participants in order to reveal the expectations from robots with a Japanese data set. The validity of the categorization used in this questionnaire has been previously assessed by Ray et al. (2008). This part will show the cultural differences between the European and the Japanese nationalities.

PRELIMINARY RESULTS

A preliminary study through a Google image search revealed that for all countries, the term *robot* is mostly associated with humanoid robots, but with different frequency of occurrence. Arabic and African countries show a high percentage of robot-related images like comics, toys and others (e.g. United Arabic Emirates 58%, Egypt 70%) whereas countries associated as technological highly developed countries like the US, Japan or Germany not only show more “real” robots (Japan and US 71% humanoid robots) but also a wider diversity of robots. Robots that look almost exactly like human beings are mainly particular for Japan, although they exist and are also developed in other countries.

In accordance to these results, a preliminary poll was generated asking participants from various cultural background for their attitude towards a humanoid health-care robot and a human-like android. The participants were asked what they think about the robots and had to tick a box with a statement they agreed on. Multiple answers were not allowed.

Both types were considered as a good start for the future but still inferior to humans and no threat for employment. As the android was regarded as more impressive, very realistic, doll-like, the health-care robot was absolutely not.

	Actroid	**Ri-Man**
looks more like a doll	15%	2%
not capable of same physical tasks as humans	12%	
very realistic	12%	0%

could easily used for evil things	10%	2%
a human would be better	10%	15%
impressive	8%	2%
weird	10%	9%
good start for the future	8%	11%
would lighten the burden	-	17%
would let the robot carry me	-	13%
would let the robot carry a family member	-	9%

Table 1: Results of the online survey and the statements participants agreed with (in percent). Multiple answers were not allowed. In total, 57 participants answered for the Android Actroid and 46 for the health-care robot Ri-Man.

HYPOTHESES

The hypotheses follow the preliminary studies and are meant to compare cross-cultural, implicit and explicit measurements. The dependent variables in this study are the rating and the nature of response of the participants. For the general questionnaire, these results will be directly compared to a similar study conducted with exclusively European participants. Independent variables are the term „robot“ and the pictures of the different robot types which determine the participants reaction.

H1: Japanese have more experience with robots than European cultures

H2: Japanese have a more positive assumption about robots than European

H3: Japanese have a more positive attitude towards robots than European

H4: Japanese have less fear concerning robots

H5: Japanese prefer more human-like robots than European

Data collection

The data collection will be conducted through a survey in Japanese. The questionnaire is similar to the examination of Ray et al. (2008) to enable a direct comparison of the European and Japanese data.

Background examination

The examination of the participants background includes the nationality, country of residence, gender, age and education level. All the participants are residing in Japan and completed the questionnaire in Japanese. The sample characteristicsa listed in table 2.

Nationality	Japan	26
	Korea	2
	China	3
Country of residence	Japan	41
Gender	Male	25
	Female	16
Mean age		22,4
Education	In education	33
	University degree	7
	others	1

Table 2: Sample characteristics

Prior exposure to robots is measured similar to the participants examination of MacDorman (2008) with on a 1 to 5 scale (1 - not at all; 5 - nearly daily), testing for the contact to robot related topics and the nature of exposure to robots.

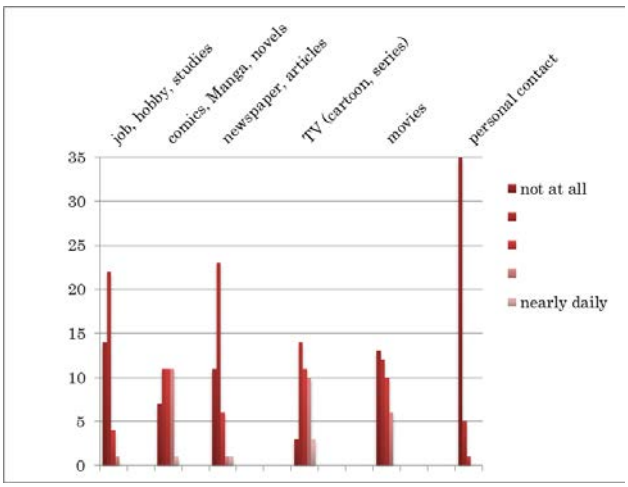

Figure 1: Exposure to robots in Japan

None of the participants owns or programs a robot. The European study revealed, that the percentage of subjects who previously came in contact with robots is very high, mainly through TV (70%), movies (65%), in reality (50%), journals and magazines (38%), and literature (23%). The majority of the Japanese subjects also had contacts to robots before, but very rarely. Around 65% come sometimes in contact with robots through theirs job and studies, 80% through manga and comics, 75% see them in the newspapers, 85% in TV and 68% in movies. Over 85% of the subjects stated, that they never had any personal contact to a robot. This is quite the opposite of the European study where only 50% have not seen a robot in reality. We suspect, that this might be explained by the different aspect of robotics in Japan. Some drawings of the Japanese subjects revealed the quite humanoid aspect of robots in Japan.

Assumption and attitude

The second part of the questionnaire is based on the work of Ray et al. (2008) and Nomura (2005). In their study, a basic survey was developed and their

hypotheses were tested with a questionnaire on a non-robot related home and art exhibition in Geneva, geographically situated in the center of Europe and therefore very restricted to one specific area. Here, a similar questionnaire is used and launched in Japanese.

Associations with the term "robot"

Preliminary results were used to give the participants a big variety of random sorted answers to the questions what they associate with a robot, which includes a variety of positive, negative and neutral attributes of robots and the associated impact and influence on daily life.

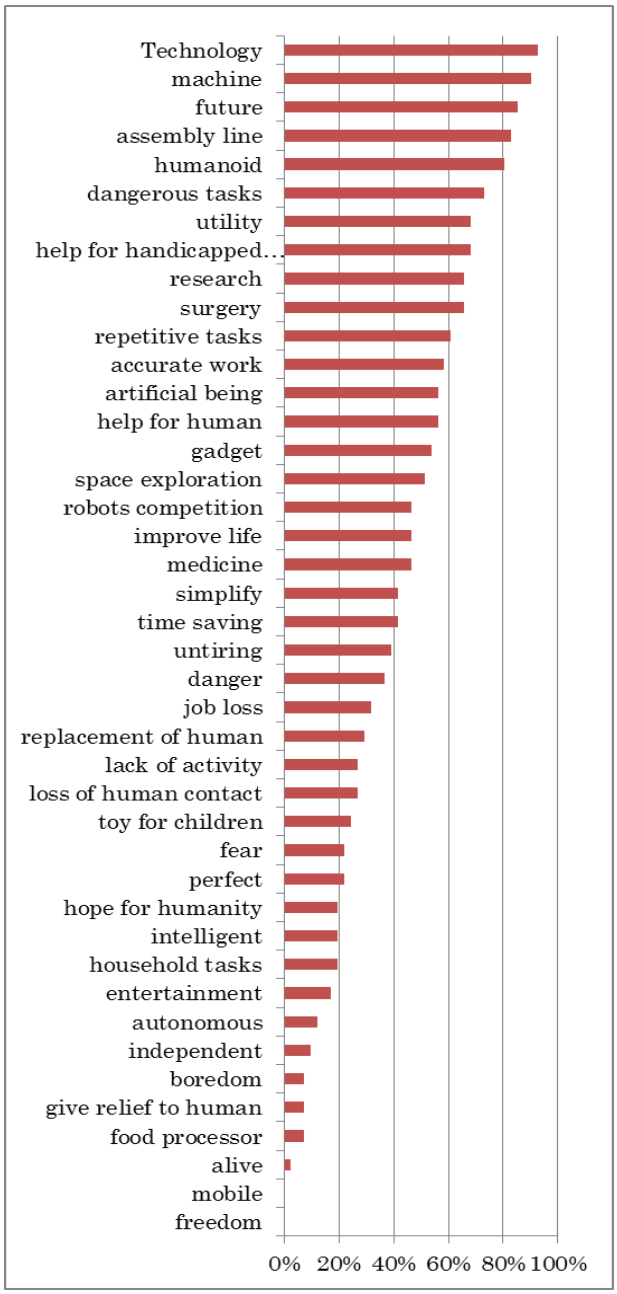

Figure 2: Associations with the term "robot"

The overall appareance of elements as shown in fig.1 is similiar between Europe and Japan, but there are some outliers. The keyword „machine" is ranked second under the Japanese subjects, but only 10th by the Europeans. Followed by 5th for „humanoid", which is for European with 16th rank far out of the Top Five. This suggests, that Japanese are much more aware of the robots attributes (and also consider a robot more of a machine than a humanoid). Other higher ranked keywords were utility, research, gadget, robots competition but also negative attributes like danger and fear. This might imply, that Japanese being more aware of robots also being more aware of their shortcomings, as suggested by Bartneck et al. (2007). Japanese associate robots less with improve and simplify of life and time savin as well as household taks. This might be due to the data collection of the European sample, which took place on a exhibition for home devises. A huge gap shows the ranking a robot as a food processort, ranked 5th in Europe but 53rd in Japan.

Negative elements appear for both samples only in the second paret of the list. Even if Japanese are more aware of the danger a robot might be, the overall tendency is a positive association with robots.

Attitude towards robots

Participants are asked directly, what positive or negative role a robot could play in their personal daily life and for the society. European participants have a widely positive perception of robots and so do Japanese. A selection of answers on positive elements investigated the attitude towards robots on personal and societal level. The results are shown in figure 3.

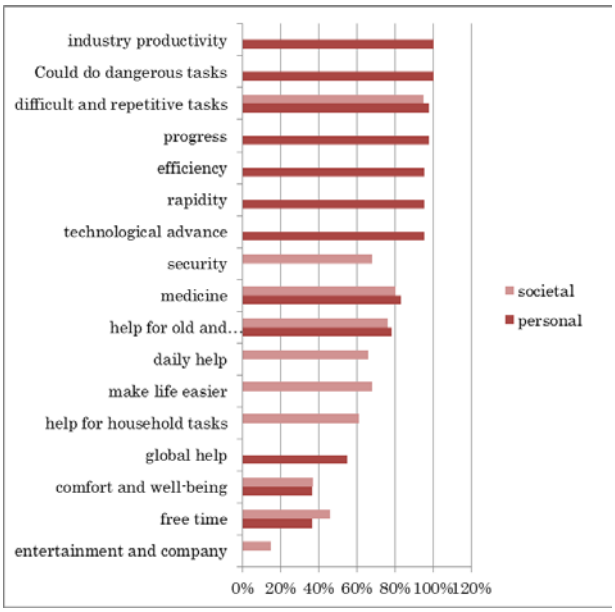

Figure 3: Positive elements of robots by the Japanese subjects

Both subject groups agree on personal level on the pragmatic help for difficult and repetitive tasks. Cultural differences are found by the Japanese who can see robots in medicine, as help for handicapped people much and security more than Europeans. On the other hand, daily help, help for household tasks, free time and comfort and well-being seems to be more appreciated by the European subjects. For both samples, entertainment

and company is ranked very low.

On a societal level, the less private elements like technical progress, industry and so not take place in the own household involving daily tasks, again practical elements like dangerous, difficult and repetitive tasks, efficiency, rapidity and technological advance are perceived the same by both groups. The difference here is, that Japanese rank industry productivity higher, but help for old and handicapped, global help, comfort and well-being lower than the Europeans.

According to this, Japanese might see the help for older and handicapped people as a personal and not a societal task where they could be supported by a robot whereas Europeans rather see the overall welfare for society but might be less willing to let a robot interfere on a personal level.

Negative Elements and Robot-related fears

Fears are not necessarily negative attitudes, so participants are directly asked, if they fear anything special related to robots. 44% of the European and 32% of the Japanese gave a positive answer.

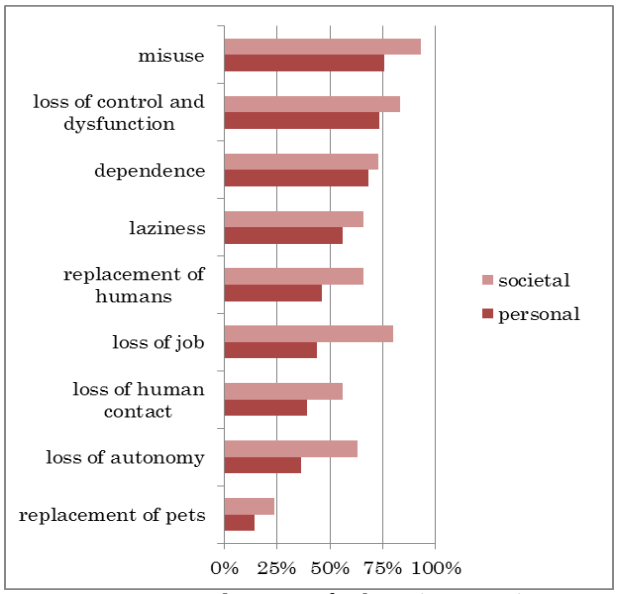

Figure 4: Negative elements of robots (Japanese)

The comparison of the negative elements shows some significant differences. Japanese perceive on the personal as well as on the societal level the misuse of a robot as the most negative aspect. Misuse is a minor concern in Europe, whereas the loss of job is a major one. These are the two outstanding differences between the two groups. In general, elements like dependence, laziness, replacement of humans and loss of human contact are mentioned by both. The Japanese questionnaire asked for a replacement of pets, which was a minor element. The European questionnaire asked explicit for fears, where loss of control and dysfunction was ranked far ahead first. The Japanese questionnaire did not ask directly for fears, but the same element was ranked high on both, personal and societal level. This suggests that robots are not perceived as safe, matter to dysfunction, and potential harm to humans.

Expectations from robots

This question examines the notion of a term "robot" in more detail. The expectations people name when asked what task a robot in general should do implicitly reveals what sort of robot they have in mind when talking about "robots".

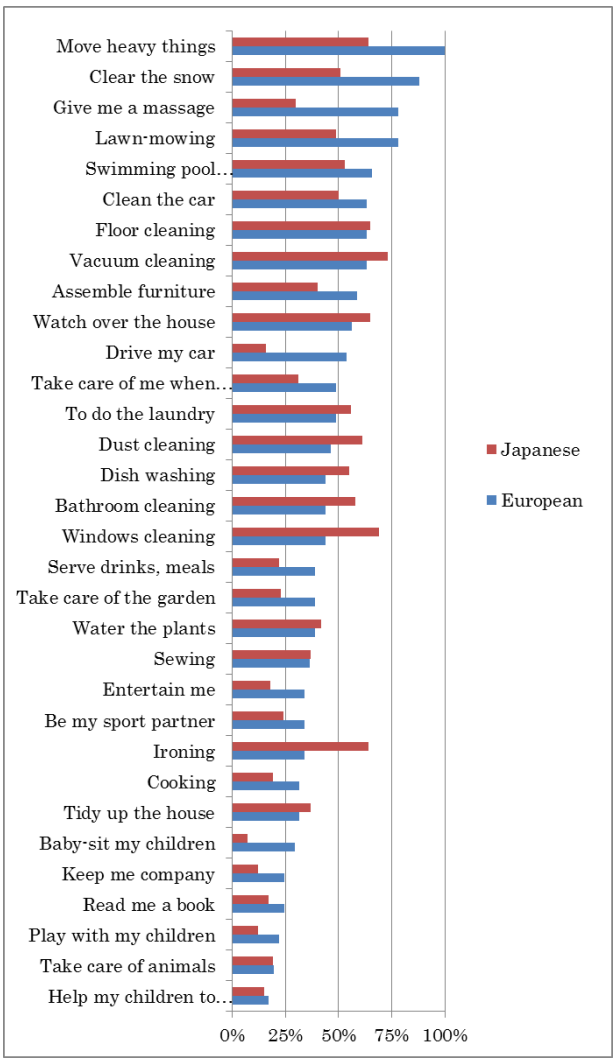

Figure 5: Expectation from robots

Figure 5 shows, what the Japanese subjects think, a robot should do in direct comparison with the European results. These results are consistent with the previous findings of the robot seen as a machine and helper and also overall consistent with the European data as well as the findings of Dautenhahn (2005), showing that people prefer a robot to be an assistant rather than being a friend. For the looks of this assistant, the tendency is towards the look of a machine, big or small while surprisingly the famous pet-type robots gathered only a small percentage. This also supports the theory of the uncanny valley, a hypothesis stating the more human a robots acts or looks, the more endearing it would be for humans. At the point, where the likeness seems to be too strong, it causes a response of revulsion among human observers. The uncanny valley was first stated by Masahiro Mori as *Bukimi no Tani Genshō* (不気味の谷現象) in 1970.

Yet, there are some surprising differences. Japanese participants would like a robot to give them a massage, while the European ranked this only in the second part of the list. A massage is a very interpersonal task which includes the direct touch of the robot and Japanese seem much more likely to let a robot touch them than Europeans. Surprising is also, that the data suggest that Japanese would rather let a robot baby sit their children than take care of animals. Overall, both studies suggest, that people would like robots to support them in their daily life, especially in the household.

Perception of the near future of robotics

In relation to the expectation, participants answer a question about their perception of the near future of robots and if these robots will fulfill their expectations and soon be available on the free market and increase in daily life.

The first question asked if the robot fulfilling the tasks the subject wishes will arrive soon on the market. For 15% of the Japanese, this was Science Fiction, 39% believed that it will happen one day and they are looking forward, 37% were not looking forward. Only 5% stated this will happen soon and they are looking forward, another 5% were not looking forward. Same as the majority of the European sample, they believe that the robot of their dreams will one day arrive on the market, although Japanese had more doubts in it at all than European (only 4% thought its Science Fiction).

A second question about the number of robots in cities and households were answered pretty similar buy both subject groups. Only 2% thought it is Science Fiction, and 44% were convinced that is will happen soon and that they are looking forward to it (while 17% were not looking forward). Japanese were slighty more convinced that we are not there yet and also, 37% were not looking forward to robots in cities and households, 24% were more positive about this.

Appearance of a robot

Also along with the expectation of a robot is its appearance. This is examined over two questions. First, how a robot should look like, and second, how it should not look like.

Europeans results show, that robot should look like a machine, be it big or small and the same accounts for Japanese. Also, both samples are consistent that a robot should look less like a human, animal or a creature. For this item, no significant cultural differences are shown in the data.

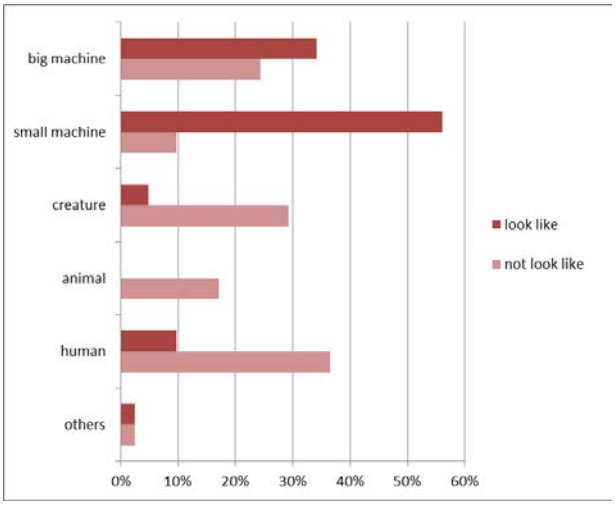

Figure 6: Appearance of a robot

Communication with the robot

The integration of a robot in daily live is highly dependent on its communication with humans. With the progress of technology, most of the human-like skills of communication are theoretically possible, but what would be preferred?

European participants would mainly (77%) like to interact with the robot through speech, which is considered to be the most natural and instinctive was for humans to communicate, even if a robot is perceived more like a machine. The options touch screen (34%), autonomous (12%), pressing buttons (10%), and use a computer (9%) did not convince many people. This was different in Japan. Japanese seem to prefer a robot which knows what to do from a list of tasks without any intervention and also do not reject the touch screen as shown in figure 7.

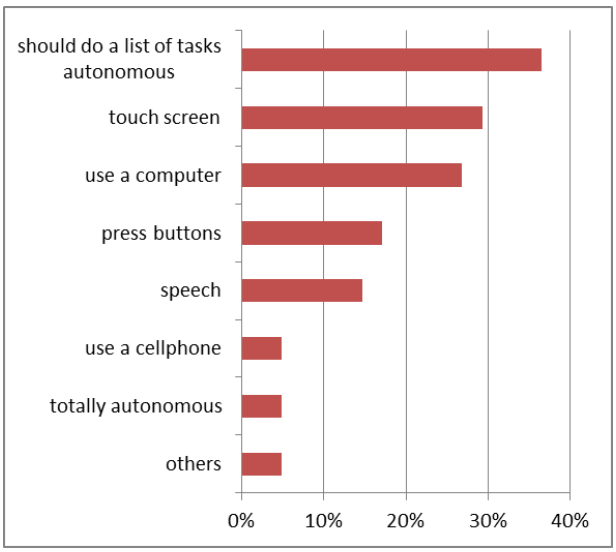

Figure 7: Appearance of a robot

RESULTS

This study shows the assumption and attitude of different cultures towards contemporary robots from a psychological perspective and might give a deeper insight from an engineering and design perspective.

The results from both subjects groups give a good overview of the general tendency of the attitude towards robots. As expected, the results to similar questions in another culture, specially the Japanese one, are different in some areas, but not as different as the general anticipation of Japanese as "robot maniacs" might suggest.

The hypotheses that Japanese have a higher exposure to robots through TV, movies and especially through manga (comics) and be verified, although the personal contact to a robot was reported to be less in Japan than Europe. Japanese were not found to have a significantly more positive assumption or attitude towards robots. Here, both groups showed similar tendencies. Also, Japanese are not more or less afraid of robots. The statement, that Japanese accept a human-like robot more than the Europeans was found to be true, even though they still see a robot more as a machine than a robot.

Japan is also anticipated with a less pragmatic approach to robots than European, which could not be verified here. Japanese seem to have a very pragmatic view of robots as a helper in daily life, same as the Europeans. The stereotype of Japan as robot-nation is fed by the famous developments like the Sony Aibo or the very human-like androids like the Geminoid, but these seem to be technical outstanding innovations not seen by the Japanese themselves entering their daily life.

OUTLOOK

The development of robots for commercial use in daily life just has begun. If in the near or far future, robots will become more present around people and will be object to various technical and design issues.

For further investigations, explicit measurement (e.g. questionnaires) is a good tool to ask directly for the opinion people have and collect the results on an index or scale. This kind of explicit measurements can be biased. Therefore, further investigation measuring a subject`s underlying implicit attitude, compare it to their explicit attitude and so overcome the self-presentational bias.

ACKNOWLEDGMENTS

We wish to thank Karl MacDorman for his insightful comments and sugestions on the abstract.

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