Will domestic robotics enter our houses?

A study of implicit and explicit associations and attitudes towards domestic robotics

Shariff Lutfi
S0186503

Theoretical framework

Introduction

The time that robots only existed within science fiction literature and movies is over. With the use of novel technology, robots are introduced within real-life settings such as: factories, schools, hospitals and nursing homes. These developments have been picked up by businesses, since they are getting more interest on robotics. Moreover, the IRF (International Federation of Robotics) noted that the current global market value for domestic robots is estimated on a value of US$4.3 billion and still is rising. Besides the growing attention of businesses, robotics has gained parallel more attention of scientists. According to Kumar, Bekey and Zehng (2005), robots can be classified into two different categories based on their tasks and market purposes, which they are designed for. Last mentioned researchers identified two major classes of robots: (1) industrial robots and (2) service robots. When looking deeper into these kinds of robots, it can be said that industrial robots have three essentials elements. The industrial robot manipulates its physical environment, it is computer-controlled and it operates in industrial settings (Thrun, 2004). Industrial robots are relatively mature within the market, since these robots where used and sold during the early 1960's. Classical tasks of industrial robots are machining, assembly, packaging and transportation (Thrun, 2004). In general, it can be said, that industrial robots are not intended to interact directly with people. This is in contrast with service robots. Service robots could be divided in professional service and personal service robots. Professional service robots also manipulates and navigates through their physical environments, however these kinds of robots are designed for helping peoples' professional goals, and act outside industrial settings (Thrun, 2004).

Personal service robots, known as domestic robots, also act beyond the industrial setting and their main tasks are to assist and/or entertain people. However domestic robots are designed for a specific domestic recreational setting. Practical examples of personal service robots for domestic use are robotic vacuum cleaners, such as the Roomba (Forlizzi & Disalvo, 2006) and the Aibo, a robotic dog (Dautenhahn, Woods, Kaouri, Walters, Koay and Werry, 2005). Bartneck and Forlizzi (2004) denoted that definitions of robotics have been under heavily debate. The most common and most-common used definition is given by the Robot Institute of America (1979), a leading institute for robotics research within the United States, defined robots as follows ''*a reprogrammable, multifunctional manipulator designed to move materials, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks.* However, it could be argued this definition lacks the interaction with humans. Furthermore, domestic robots have the potential to become of great importance within the lives of consumers, however little is known about what people think of robots or with what they associate them or whether people are willing to accept robots within their private spaces. Since this study will fill this research gap and focus primarily on domestic robotics, the following definition will be used: ''*a domestic robot is an autonomous or semi-autonomus robot that interacts and commu*nicates *with humans by following the behavorial norms expected by the people with whom the robot is intended to interact''*. (Bartneck & Forlizzi, 2004, pp. 2).

Robot acceptance

As mentioned before, the concept of a robot may be known for a long time. However, the introduction of domestic robots to consumers for assisting several tasks within domestic environments has been relatively new. Several researchers have predicted that domestic robots will enter the homes of consumers more often, however the introduction of robots for domestic use is inherent with several challenges, which have to be overcome before domestic robots could be a success. (Dautenhahn, 2007; Young, Hawkins, Sharlin and Igarashi, 2009). Furthermore, in order to make domestic robots a success, it could be argued that consumers have to accept the robots within their private space, such as domestic settings. Young et al. (2009) argued that the acceptance of domestic robots is a specific complex socialization processes. The specific robot environment differs from existing consumer technology environments, and the problems inherent with technology acceptance are more important in a domestic environment compared with the industrial one (Eyssel, Kuchenbrandt, Bobinger, de Ruiter & Hegel, 2012). Thus, this study is proposed to investigate the acceptance of consumers of domestic robotics, which could be investigated with the use of several models (Heerink, Kröse, Evers & Wielinga, 2008). However, a commonly used acceptance model for new technology is the so-called technology acceptance model (TAM), introduced by Davis (1989). Basic principle of this model is that it proposes that usefulness and ease of use as perceived by the user are related to consumers' behavioral intentions to use a certain system. The perceived usefulness refers to the degree to which people believe that a certain system is useful for them (Davis, 1989). Furthermore, perceived ease of use refers to the degree to which people believe that using a particular system would be relatively easy (Davis, 1989). The model also proposes that consumers' behavioral intentions are a good predictor for actual use.

TAM has been extensively used within studies on new information technology, such as consumers' acceptance of e-commerce (Pavlou, 2003), cellular telephones (Kwon & Chidambaram, 2000) and online banking (Luam & Lin, 2005). Several researchers have used the TAM within the robotic research, such as Chesney (2006), who examined the acceptance of both productive and pleasurable robots or Broadbent, Stafford and Macdonald (2009), who reviewed the existing research of acceptance on health care robots. However, when it comes to existing research of the TAM on robots for domestic settings, it can be concluded this has been relatively scarce. Furthermore, existing research on robot acceptance has focused mainly on robots within healthcare contexts and, thereby explicitly used elderly people and small sample size experiments (Heerink, Kröse, Evers & Wielinga, 2006). Therefore this study is proposed to investigate TAM (Davis, 1989) on robots, which are used within domestic environments. Furthermore, a bigger sample size experiment, which is opted by Heerink et al. (2006), is used within this study. The following hypotheses are therefore formulated:

> H1: If domestic robots are perceived as being useful and easy to use within consumers' households, then consumers have intentions to use domestic robots.

Design and technical challenges

The introduction of new technology, such as robotics, is inherent with several challenges that focus on design and technical factors. Evident research within the robotics field have mainly focused on technical and design issues and has been defined as important challenges that have to be overcome, in order that consumers will adopt and use robotics. Looking at existing robotics research, one can conclude that researchers merely focused on topics such as technology issues, design and the human-robot interaction of domestic robots (Garcia, Jimenez, De Santos & Armada, 2007), which could be seen as a more robot-centered approach. Especially human-robot interaction has gained a lot of scientific attention. Fong, Nourbakhsh and Dautenhahn (2003) have discussed several theoretical approaches driven by

technological advances in order to create more natural human-robot interactions. The immense attention of researchers on human-robot interaction is basically caused by high expectations of people towards human-like capabilities of robots (Duffy, 2003). These expectations have their roots in the literature on human social interaction (Goffman, 1963).
For example, Gockley, Forlizzi and Simmons (2007) have investigated human-robot interaction extensively, and concluded that current domestic robots has little to no understanding of the social cues persons might use when interacting with a robot. This means that robots only respond to persons' speed, location, spoken or gestured command and thereby ignoring the identity or personality of the user.

Forlizzi and Disalvo (2006) posit that the introduction of new technology, such as robots, in the context of consumers' is a design and a technical challenge. However, the current research proposes that psychological factors are more pivotal for the acceptance and use of domestic robots. More specifically, this research will investigate both consumers' implicit and explicit associations and attitudes towards robots, which could act as a broader theoretical framework for the acceptance of domestic robots. This is also in addition of the work of Davis (1989) and the TAM, which uses mainly explicit measures. Furthermore, assessing both consumers' implicit and explicit associations and attitudes towards robots could act as a more comprehensive theoretical framework for businesses in order to design and manufacture their robot to be more easily adapted to their customers.

Psychological challenges
Young et al. (2009) argue that the process of accepting and using novel technology, such as domestic robots, lies largely upon the subjective perceptions and associations of consumers towards robots in terms of what robots are, how they work and what kind of tasks could be or not be performed within domestic environments. Thus, if domestic robots have to become a success, from a business and a societal point of view, it is important to investigate psychological factors for determining its relationship with attitudes concerning domestic robots. Since, Deaux and Snyder (2012) have mentioned that attitudes could be used as measures for desirable behavior of consumers, such as the acceptance and buying of robots.
One way of investigating psychological factors is administering implicit and explicit associations towards robots. Implicit associations are automatic affective reactions, which results from the particular associations, which are actived automatically when one encounters a social object (Gawronski & Bodenhausen, 2006). On the other hand, explicit associations can best be characterized as evaluative judgments, which are based on syllogistic inferences consequent from any kind of propositional information that is relevant for a judgment (Gawronski & Bodenhausen, 2006). Administering consumers' assumptions towards robots could be important since assumptions could affect the process of the construction of attitudes regarding domestic robots (Nomura, Kanda, Suzuki & Kato, 2005). And as mentioned before this results that attitudes could work as a catalyst for creating favorable behavior of consumers, such as accepting novel technology and domestic robots (Bhattachcherjee & Sanford, 2006; Nomura, Kanda, Suzuki & Kato, 2004.
Several researchers have conducted research into people's associations of robotics. For example, Ray and Mondada (2008) have examined people's associations and attitudes towards robots. The researchers concluded that people associate robots with technology, help for handicapped elderly, future and household tasks (more associations see study). Furthermore, last mentioned researchers indicate that a large proportion of the respondents have a very positive attitude towards robots. Another researcher,

namely Kahn (2008), employed a study, which assessed people's attitudes concerning robots. His main conclusion was that people are positive of the idea of having domestic robots that can be controlled and do mainly household tasks. When looking at existing research it can be concluded that existing research concerning people's associations within the robotics domain are primarily open and explorative in nature and has focused on explicit measures, since researchers mainly used questionnaires within their studies. When using explicit measures, Macdorman and colleagues (2008) argued that results could be affected by several biases. Firstly, consumers may not be aware of their attitudes concerning robots, which affect their behavior differently. Secondly, in the case when consumers are aware of their attitudes, they could choose to conceal them. When conforming into a certain desire, like pleasing the researcher, this can lead to self-presentational bias. One way of overcoming this bias is administering peoples' implicit associations. Implicit associations could reveal specific information, which is not available to introspective access even when people are motivated to express it (Nosek et al., 2007).

Several researchers such as Nomura et al. (2005), Ray and Mondada (2008) and Dautenhahn et al. (2005) have examined people's associations with robots. Last mentioned researchers indicate that people are positive towards robots and that people associate robots with common household tasks such as cleaning the house. However, as mentioned before these conclusions are based on explicit measures and results could interfere with several biases. Therefore, this study proposes to examine peoples' associations of domestic robot, measuring with implicit measures. The following hypotheses are formulated:

> H2: Implicit associations indicate that domestic robots are more strongly associated with positive words than negative words compared with humans
> H3: Implicit associations indicate that domestic robots are more strongly associated with household tasks than industrial tasks compared with humans

Nomura et al. (2004) stated that future research should focus on the relationship between psychological images of consumers and attitudes concerning robots. Furthermore, Nomura et al. (2005) found that consumers' classical view of robots, such as physically acting for humans, is different for each individual. The researchers also state that people's experience of the types of robots is related to assumptions towards robots, and as a result people's assumptions influence their construction of attitudes towards robots. Nomura et al. (2005) concluded that it is important to administer attitudes with measurements of assumptions about domestic robots. Since this could be useful for examining the relation between people's assumptions of robots and attitudes towards domestic robots. Therefore the following hypothesis is formulated:

> H4: Implicit associations about domestic robots correlate with consumers' attitudes towards domestic robots.

Beside the estimation that assumptions could influence the construction of attitudes towards robots it would be interesting to identify whether there are differences of people's implicit associations based on differences between attitudes towards robots. As far as the researcher know, identifying agreement between implicit associations and attitudes towards robots has not been studied yet. Furthermore, these results could be used for an international comparison of people's associations and attitudes towards robots and its relation, which is opted by Nomura et al. (2004). Therefore the following research question is formulated:

> RQ1: Are there differences of implicit associations towards robots of people with different attitudes towards robots?

Robot anxiety

A most common anxiety towards new technology is computer anxiety and has been studied extensively (Raub, 1981). Computer anxiety can be defined as the anxious emotion that prevents users from using and learning about computers (Nomura et al., 2004, p. 1). With the upcoming rising of domestic robots it could be argued that robot anxiety could become as important as computer anxiety. Thus, an important challenge within robotics, is to overcome consumers' anxiety to adapt and use domestic robots. Nomura, Suzuki, Kanda and Kato (2006) argued that robot anxiety is caused by anxiety to use technological products including robotics and consumers' current images of robots. In order to provide guidance and the actual measurement of people's robot anxiety, it could be useful to use assumptions as controlled variables in the measurement of consumers' anxiety concerning robots (Nomura et al., 2004 and Nomura et al., 2005). Therefore the following hypotheses are formulated:

> H5: Implicit assumptions about domestic robots correlate with consumers' anxiety towards domestic robots.
> H6: Explicit assumptions about domestic robots correlate with consumers' anxiety towards domestic robots.

This study will contribute valuable insights for domains in communication, psychology and robotic research by examining psychological factors of consumers towards domestic robots. The study is proposed to administer both implicit and explicit measures in order to overcome mentioned biases and resist self-presentational strategies of consumers. Therefore this research will fill the gap, as far as the researcher know for the first time, to explore both consumers' implicit and explicit associations and attitudes towards domestic robots and the influence of associations on the construction of attitudes towards domestic robots. With the use of the so-called implicit association method (IAT) it will be possible to reveal attitudes and associations even for consumers who do not prefer expressing them (Greenwald, McGhee Schwartz, 1998). More information about the IAT will be discussed within the research method chapter. Furthermore, measuring implicit measures for attitudes may be important for understanding consumer behavior, particularly in situations when consumers are cognitively constrained, for example when novel products and technology is introduced (Ewing, Allen & Kardes, 2008).

The findings of this study contribute both on societal and business level. From a societal point of view, it is proposed that domestic robots have the potential to assist the growing rate of elderly people and could assist households for saving time. Examining the acceptance and administering implicit and explicit measures towards robots contribute to a better understanding of domestic robots adoption. Furthermore this research contributes to business instances, since administering implicit and explicit associations combined with attitudes towards robots could be useful for effectively introducing domestic robotics adapted to their consumers.

Method

Participants

A total of 207 respondents completed both the IAT and the questionnaire regarding attitudes on domestic robots. Table 1 shows a complete overview of the demographic information from the respondents. The sample population was retrieved from the personal network of the researcher and with the use of students of the University of Twente. The respondents were selected with the use of the so-called snowball sampling. This means that respondents will be invited to participate within the research, and he or she will be asked to introduce other people who also fulfill the study inclusion criteria (Shaghaghi, Bhopal & Sheikh, 2011). Using this method, the researcher was able to recruit respondents with a variety of backgrounds, which is in line with robotic studies of Dautenhahn, et al., (2005) and Lohse, Hegel and Wrede (2008). Furthermore, the researcher was able to recruit specific sample targets, such as students (Shaghaghi et al., (2011); Heckathorn, 2011).

Arras and Cerqui (2005) emphasized the notion of a strong link between respondents' foreknowledge about robotics and their acceptance behavior. Last mentioned researchers, also noted that additional information about robotics, shifted the negative mindset of respondents. Furthermore, people could have multiple concepts of robots, such as, industrial, humanoid or domestic robots, and this could influence findings of respondents (Nomura et al., 2005). For this reason, MacDorman et al., (2008) opted to provide respondents a clear idea of the kind of robot is asking about within robotic research. Therefore, this research will include graphical material of domestic robotics, which will be presented before the respondent have to conduct the test.

Table 1. Demographic characteristics Respondents

Demographic characteristics		Frequency	Percent
Sex	Male	94	45.4%
	Female	113	54.6%
Age	15 - 24 years	131	63.3%
	25 - 35 years	61	29.5%
	35 - 44 years	4	1.9%
	45 - 54 years	4	1.9%
	55 - 65 years	7	3.4
Education	High school	1	0.5%
	Intermediate vocational education	33	15.9%
	Bachelor	71	34.3%
	Master	102	49.3%
Robot experience			
Q1: How many times in the past one year have you read robot-related stories,			

news articles or books?			
	None	66	31.9%
	Between 1 and 5 times	125	60.4%
	Between 6 and 10 times	6	2.9%
	10 times or more	10	4.8%
Q2: How many times in the past one year have you watched robot-related movies or series?			
	None	50	24.2%
	Between 1 and 5 times	136	65.7%
	Between 6 and 10 times	7	3.4%
	10 times or more	14	6.8%
Q3: How many times have you engaged with a robot during your work?			
	None	173	83.6%
	Between 1 and 5 times	25	12.1%
	Between 6 and 10 times	3	1.4%
	10 times or more	6	2.9%
	Total	207	100%

The IAT

The IAT, which is developed by Greenwald et al., (1998) has its foundations within the psychology discipline. The IAT is a method for measuring automatic evaluations among several concepts (Nosek, Greenwald & Banaji, 2007) and could be useful for diagnosing several socially significant associative structures. The most well-known and controversial example of the use of the IAT has been the study of Greenwald et al., (1998), which measured the implicit attitudes of white students regarding racial preferences. According of the data of Greenwald et al., (1998), white participants had an implicit attitudinal preference for white people than over black people with positive evaluation. Furthermore, the IAT measures (implicit) and explicit measures of the respondents were compared. As a result, the IAT measures indicated a stronger preference for white people than explicit measures did. This emphasizes the use of the IAT method for overcoming earlier mentioned biases.

Despite the controversy of the use of the IAT and criticism of several researchers, such as Blanton, Jaccard, Christie and Gonzales (2007), regarding the validity of the IAT, this method has been applied within several disciplines such as: social and cognitive psychology (Greenwald & Nosek, 2001) but also in marketing and consumer research (Gibson, 2008). The IAT is useful within this study since it is appropriate for diagnosing a multitude of socially important associative structures (Greenwald et al., 1998), such as associative measures of humans and domestic robots. Furthermore, the IAT within robotics research is applicable since, it does not require many respondents' cognitive capacity or an intention to evaluate an object, especially when it is an unknown or relatively a new object for people, such as domestic robots (Cunningham, Raye & Johnson, 2004).

In addition, this research will contribute for expanding the use of the IAT to the communication science within a robotic context. When looking at the use of the IAT within robotics research, it could be noted this has been relatively scarce. Only Macdorman et al., (2008) have used the IAT in order to examine the attitudes among Japanese and American students regarding robots. Both Japanese and American students had more pleasant associations with humans than robots and associated weapons more strongly with robots than humans. However, this study will also focus on comparing the concepts of humans and robots but will emphasize on the notion of domestic robots and is conducted within the Netherlands. Furthermore, this study will use other attribute dimensions compared with the study of Macdorman et al., (2008).

More specifically, within this research the IAT will be used in order that respondents have to identify the differential associations of two concepts (*domestic robots* and *humans*) alongside with attribute dimensions, namely: *positive* and *negative words* and *household tasks* and *industrial tasks*, which are based on response latencies of a categorization task (Greenwald et al., 1998). The IAT used within this study will consist of five categorization tasks. The procedure was as follows: in the first block respondents had to distinguish several items, which associated most with the target concept (respectively robot or human). In the second block, respondents had to distinguish several items, which associated most with the attribute dimensions, respectively positive and negative words. In the third block, the respondent had to assign the tasks of the first and the second block at the same time. The fourth block was the same as the first block, however the target concepts were presented reversed. Within the last block, the tasks of the second and fourth block were presented in interspersed form. The third and fifth blocks of categorization are important for measuring the associative factors for robots and humans. The underlying assumption is that respondents who have stronger associations of robots with positive words than humans, should perform block 3 faster than block 5, this also accounts for associations of robots with household tasks (Greenwald et al., 1998). These stronger associations can be indexed by the speed of responding generated by the respondent (Nosek et al., 2007).

Table 2 and 3 shows an overview of the categorization tasks of both the Robot positive IAT and Robot task IAT. Number of trials is in line with existing research (Greenwald, Nosek and Banaji, 2003) and the frequency of used categorization tasks are in line with the research of Macdorman et al., (2008).

Table 2: Categorization tasks for *robot vs. humans and positive vs. negative words*

Block	No. of trials	Function	Items assigned to left-key (ROBOT)	Items assigned to right key (HUMAN)
1	20	Practice	Robot images	Human images
2	20	Practice	Positive words	Negative words
3	40	Test	Robot images & Positive words	Human images & Negative words
4	20	Practice	Human images	Robot images
5	40	Test	Positive words & Human images	Negative words & Robot images

Table 3: Categorization tasks for *robot vs. humans and household vs. industrial tasks*

Block	No. of trials	Function	Items assigned to left-key (ROBOT)	Items assigned to right key (HUMAN)
1	20	Practice	Robot images	Human images
2	20	Practice	Household tasks	Industrial tasks
3	40	Test	Robot images & Household tasks	Human images & industrial tasks
4	20	Practice	Human images	Robot images
5	40	Test	Households tasks & human images	Industrial tasks & robot images

Materials

The IAT and the questionnaire were administered online and could be found via the following website: http://www.sharifflutfi.com. The IAT and the questionnaire were presented randomly. Nosek, Greenwald and Banaji (2005) concluded within their study that the magnitude and reliability of IAT effects were relatively unaffected by the number of stimulus items per category. Therefore, it was chosen to use ten silhouettes of robots, which represented the target concept ''robot'' and ten silhouettes of human beings, which represented the target concept ''human''. The used silhouettes within this study of robots and humans are in line with the research of Mcdorman et al., (2008) and can be found within appendix A. This IAT also uses silhouettes instead of photographs, since it will prevent to identify the race of human stimuli (Mcdorman et al., 2008). The robot positive IAT consisted of ten positive and ten negative words for the attribute dimension. The robot task IAT consisted of ten tasks that represent household tasks and ten tasks representing industrial ones. The positive and negative words and household and industrial tasks can be found in appendix B.

Manipulations checks (N = 10) were conducted whether the silhouettes of robots and humans, positive and negative words and household and industrial tasks were perceived by respondents, what was intended by the researcher. The robot silhouette was judged to have a more robot appearance (M = .96, SD = .20) compared with the human silhouette (M = *.04*, S = .19), t(98) = 23.36, p < .001. The human silhouette was judged to have a more human appearance (M = .97, SD = .17) compared with the robot silhouette (M = .03, SD = .17), t(98) = 27.41, p < .001. The positive words were judged for being more positive (M = .99, SD = .10) than negative words (M = .01, SD = .10), t(98), p < .001. The negative words were judged for being more negative (M = .98, SD = .14) than the positive words (M = .02, SD = .14), t(98), p < .001. Furthermore, the household tasks were judged as more belonging within the household (M = .96, SD = .20) than the industrial tasks (M = .04, SD = .19), t(98), p < .001). Lastly, the industrial tasks were judged as more belonging within the industry (M = .93, SD = .26) than household tasks (M = .07, SD = .26), t(98), p < .001.

Additionally, this study used a questionnaire, in order to measure the acceptance of robots (TAM). TAM measures were based on the work of Heerink et al. (2009). Furthermore, respondents' attitudes and anxiety of domestic robots were measured with items based on the work of Nomura et al. (2004) and Nomura et al. (2008). The used items can be found within appendix C. All the items within the questionnaire used a 7-point likert scale, since this scale had a slight positive preference compared with a 10-point likert scale (Dawes, 2008). Furthermore, existing research provided evidence that psychological ''distances'' between likert-type scale points are not equal and that questionnaires with a 7-point likert scale are the most frequent used measurement tools within academic and market research (Kennedy, Riquier & Sharp, 1996).

Reliability analysis is performed by calculating the alpha score in order to determine the reliability of the items used within this study. All the items used within this study have alpha scores of .70 or higher (see appendix C). In communication science, there is no generally agreed minimum level of reliability, however Dooley proposed a minimum alpha score of .70. Thus, this indicates an adequate reliability of the used items within this study. Factor analysis resulted in eleven components, which explained 66,5% of the total variance. The standardized factor loadings ranged from .59 to .86. According to Bartholomew, Steele, Galbraith and Moustaki (2008) loadings should meet at least .70. However, last mentioned researchers argued that studies with an exploratory focus, could use lower levels of loadings.

Open-ended questions were used in order to identify respondents explicit associations and are based on the work of Macdorman et al. (2008).

Results

Robot acceptance

A multiple regression analysis is performed, in order to examine domestic robot acceptance of people. The multiple regression analysis was conducted with the following predictor variables: perceived usefulness and perceived ease of use, with people's usage intention of robots as the outcome variable. The model produced an R square of .72, which was statistically significant ($F(2, 204) = 262,3$, $p< .001$). The variables perceived usefulness and perceived ease of use can account for 72% of the variance of people's robot acceptance. Perceived usefulness was positively related to robot acceptance ($B= .76$, $t = 17.5$, $p < .001$). Furthermore, perceived ease of use was also positively related to robot acceptance ($B = .27$, $t = 4.2$, $p < .001$). The results of the regression analysis are shown in table 4.

Table 4: Regression analysis robot acceptance

Predictor	Coefficient B	*t*	*p*
Constant	-.52	- 1.68	0.095
Perceived usefulness	.76	17.5	.001
Perceived ease of use	.27	4.2	.001

Implicit associations: Positive vs. Negative and Household tasks vs. Industrial tasks

Calculating the measure of association strength for testing hypothesis two and three was analogous the procedure described in Greenwald et al. (1998). Within this procedure outcomes of the practice blocks (blocks 1, 2 and 4, see table 3 and 4) were excluded from analysis. Furthermore, error rates and the first two trials of each block per participant were dropped because of their typically lengthened latencies responses (Greenwald et al., 1998). Within the analysis latencies were capped to a range between 0.3 seconds and 3 seconds. According to Greenwald et al. (1998) this is a recoding solution to the problem of outlying data by simply dropping trials outside the 0.3 seconds and 3 seconds. Furthermore, this recoding solution has the advantage of being relatively insensitive to (1) differences among conditions in the proportions of trials in the upper versus lower tails and (2) the choice of specific lower and upper boundaries. Furthermore, analysis were performed on log-transformed latencies, however untransformed mean latencies were reported (in seconds).

A paired-samples t-test was conducted to compare the mean latencies of the Robot positive IAT and Robot negative IAT. There was a significant difference in scores for the Robot positive IAT ($M = 1.26$, $SD = .34$) and the Robot negative IAT ($M = 1.12$, $SD = .25$), $t(206)= 6.26$, $p < .001$. These results indicate that respondents on average had stronger positive than negative associations with robots compared with humans.

Another paired-samples t-test was conducted in order to compare the mean latencies of the Robot household IAT and the Robot industrial IAT. After conducting the paired samples t-test, it was revealed that there was also a significant difference in scores for the Robot household IAT ($M = 1.17$, $SD = .24$) and the Robot Industrial IAT ($M = 1.05$, $SD = .22$), $t(206)= 8.77$, $p = .001$. Thus, these results suggest that respondents associates robots more with household tasks, relatively with industrial tasks, compared with humans.

Correlations between implicit assumptions vs. consumers' attitudes towards robots

Pearson *r* was calculated in order to test whether a statistically significant relationship was present between people's implicit associations and attitudes towards robots. In order to perform this analysis, the researcher only chooses to imply the scores of the Robot positive IAT and the Robot negative IAT, since people's attitudes towards robots were measured with NARS (Nomura et al., 2004). The NARS measures the negative attitudes towards robots, but also used positive Likert scales (reversed items).

After performing the correlation analysis, the finding was statistically significant, since $r(205) = .17$, $p < .05$. Thus, this finding indicates the presence of a statically positive relationship between people's implicit associations of robots and attitudes towards robots. The testing scores are shown in table 5.

Table 5 Correlations between implicit associations of robots and attitudes towards robots

	Implicit assumptions	Attitudes towards robots
Implicit assumptions	---	
Attitudes towards robots	.17*	---

Note: Correlations marked with one asterisk (*) were significant at $p < .05$.

Implicit assumptions vs. attitudes towards robots

In order to identify whether there are any differences between implicit associations of respondents based their attitudes towards robots, firstly respondents outcomes of the NARS were divided in three groups: a low score, modus score and a high score. Secondly, a content analysis was performed in order to classify the associations people have towards robots. The content analysis was performed only on the question: ''Where do you associate robots with?'' Therefore, it was possible to identify any differences between the associations between the different groups. A special coefficient, namely kappa, was used in order to measure agreement adjusted for chance (Cohen, 1960). Kappa has been widely used within content analysis in order to estimate the interrater reliability for categorical items. The findings of the interrater analysis are Kappa = .72, $p < .001$, and could therefore be considered as a good level of agreement. Most statisticians prefer for Kappa values most often higher than .7 before claiming a good level of agreement (Dooley, 2009).

Scores of the explicit associations divided within the three groups are shown in table 6 and findings will be reviewed within the discussion chapter.

Tabel 6 Implicit associations for each group

	Low scores of NARS	Modus NARS	High score of NARS	**Total**
Human	38	4	5	**47**
Machine	21	5	6	**32**
Technology	21	3	3	**27**
Appliance	14	1	4	**19**
Future	8	7	3	**18**
Movies	11	1	1	**13**
Autonomous	7	3	2	**12**
Negativity	5	1	4	**10**
Others	5	2	1	**8**
Robot type	5	1	1	**6**
Robot properties	5	1	0	**6**
Factories	4	1	1	**6**
Animals	2	0	0	**2**
Fantasy	1	0	0	**1**
Total	**147**	**29**	**31**	**207**

Implicit associations vs. robot anxiety

In order to identify a statistically significant relationship between people's implicit associations and robot anxiety, a correlation analysis was performed. Since, Nomura et al. (2004) argued that implicit associations, in general, might influence people's robot anxiety, the analysis was performed with the scores of both the Robot positive/negative IAT and the Robot household/industrial IAT.
After completing the analysis, the finding was statistically not significant, since $r(205) = .11$, $p > .05$. Thus, this means that there is no statistically significant relationship between people's implicit associations in general and robot anxiety. Testing scores are shown in table 6.

Tabel 6 Correlations between implicit associations of robots and robot anxiety

	Implicit associations	Robot anxiety
Implicit associations	---	
Robot anxiety	.10	---

However, a point of interest is to use the mean scores of both the Robot positive/negative IAT and the Robot household/industrial tasks IAT separately, in order to use implicit associations as measurement variables for robot anxiety (Nomura et al., 2004). Correlation analysis were therefore performed whether there existed a statistically significant relationship between the Robot household/industrial tasks and robot anxiety and the Robot positive/negative IAT and robot anxiety.

Correlation analysis showed there is no statistically significant relationship between the Robot household/industrial tasks IAT and robot anxiety, since $r(205) = .001$, $p > .05$. However, correlation analysis showed a statistically significant relationship between the Robot positive/negative IAT and robot anxiety, since $r(205) = .19$, $p < .01$.

Explicit assumptions vs. robot anxiety

To determine whether a statistically significant relationship was present between people's explicit associations of robots and robot anxiety, a Pearson r was calculated. After conducting this analysis, the finding was statistically significant, since $r(205) = .62$, $p < .01$. Thus, this indicates the presence of a strong statistically positive relationship between people's explicit associations of robots and robot anxiety. Testing scores are shown in table 7

Tabel 7 Correlations between explicit associations of robots and robot anxiety

	Attitudes towards robots	Robot anxiety
Attitude towards robots	---	
Robot anxiety	.62**	---

Note: Correlations marked with two asterisks (**) were significant at $p < .01$.

Discussion

The central theme of the first hypothesis was robot acceptance. H1 predicts that if consumers perceive domestic robots as being useful and easy to use within consumers households, then consumers have the intention to use domestic robot. Findings have shown that both, perceived usefulness and easy to use, have a positive relationship with intentions to use. Findings also suggest that the perceived usefulness was more important in determining intention to use, than perceived ease of use. This finding is also consistent with the work of other researchers who have focused on TAM, such as Keil et al., (1995) and Chesney (2006). Davis, Bagozzi and Warshaw (1989) have mentioned that an individual's perception of a particular system ease of use, such as robots, is anchored in his or hers general self-efficacy at all times. Since 83.6% of the respondents have not engaged yet with a robot (table 1), it could be argued that respondents are not aware of their skills in using a robot, which accounts less importance of domestic robots ease of use for determining intention to use.

H2 and H3 are formulated in order to identify implicit associations consumers have towards robots. H2 predicts that consumers associate domestic robots more positive than negative compared with humans. Findings indicate that consumers have stronger positive implicit associations, rather than negative compared with humans. This is consistent with the findings of Ray et al. (2008), however last mentioned researcher used explicit measures. H3 predicts that consumers associate robots more with household tasks than industrial tasks compared with humans. After the analysis, findings suggest indeed that consumers associate robots more with households tasks than industrial tasks. However, the association strength of robots between household and industrial tasks is less stronger compared with the positive and negative associations. Furthermore, the conclusion that consumers associate robots more with household tasks than industrial tasks could also be influenced by the short introduction that was given before the respondent had to make the test. A common problem is that people could have multiple concepts of a robot: a laboratory robot, industrial robot or a humanoid (Ray et al., 2008), and this could influence results of the IAT. When providing a short introduction with a clear definition of a domestic robot, respondents might have a clear idea what kind of robot was asked about within the test. This solution was provided by Macdorman et al., (2008). Another explanation is the use of mostly students within this research. Kvavik (2005) have mentioned that students use new technology, such as robots, that meets their lifestyle. Convenience is a notable desire within this lifestyle, which could be responseble for the finding that they associate robots more with households tasks rather than with industrial ones.

One of the main research efforts of the IAT is emphasizing on the differences between outcomes of implicit and explicit measures, for example the IAT and self-report scales, such as Likert scales (Greenwald et al, 1998). However, recent research have shown, that the IAT and self-report can also be strongly related with each other (Nosek, 2005). This also accounts for the used IAT and self-report measures within this study. Since, findings of this study indicates that implicit associations are related with attitudes towards robots. Thus, H4 is supported. This also emphasized the notion of the importance of implicit associations on the formation of attitudes regarding robots, which is mentioned by Nomura et al., (2005).

H5 predicts that implicit associations are correlated with consumer's anxiety towards robots. This hypothesis is partially supported. When using the scores of both IAT's (Positive vs. Negative and Household tasks vs. Industrial tasks) findings indicate no existence of a relationship between implicit associations and robot anxiety. Therefore, it was chosen to use the score of the IAT separately, in order to check whether implicit associations have a relationship with robot anxiety. The Robot Household/Industrial tasks IAT was not correlated with robot anxiety. A possible explanation is that consumers do not have anxiety when robots are introduced within their domestic environment and performing households tasks. Another possibility is that consumers are not aware of their anxiety towards robots since most of the respondents have not engaged physically with robots (Macdorman et al., 2008). A surprising finding was found when the Robot positive/negative IAT was correlated with robot anxiety. Findings indicate there is a positive relationship between the positive/negative IAT and robot anxiety. As mentioned before, consumers associate robots more positive than negative, however they may have unconscious fear regarding robots. It could be argued that people may have images of robots which consist of a mix of human and machine traits, which correspond with the personal and human identity. Thus, it could be argued that when an entity, such as a robot, interfere with these identities, could lead to any disturbance or anxiety (Macdorman et al., 2008).

H6 predicts that explicit assumptions are correlated with robot anxiety. Findings suggest that negative attitudes towards robots are correlated with robot anxiety. Nomura et al., (2008) mentioned that higher correlations between attitudes and computer anxiety are caused by the difference of images of them. It is assumed that images of computers are known as consisting of a display, keyboard and a mouse (Macdorman et al., 2008) However, it is also assumed that images of robots could vary between laboratory, industrial or domestic robots, which could cause middle or no correlations. This study used, therefore, a clear definition of a domestic robot, in order that respondents know which kind of robot was central within the test. This emphasize the notion of a short description of the type of robot, which is asked within the test, to prevent that respondents have several images of robots in mind when making the test.

Research question: Are there differences of implicit associations towards robots of people with different attitudes towards robots?

When looking at table 6, it can be concluded that most of the associations towards robots are from respondents with a low score of the NARS. As mentioned before, the NARS measures negative attitudes towards robots. Therefore, it also could be argued that most of the respondents had positive attitudes towards robots. The following sentence of a respondent will support this:

''Ik ben positief ingesteld t.o.v. een robot, ik verwacht namelijk dat dit de toekomst wordt''

Most of the associations found within this study is consistent with the studies of Ray et al., (2008) and Khan (1998). Associations such as human or humanoid, machine, technology, future and appliance are recurring topics mentioned by respondents.

Consumers wants robots, in most cases, to perform pragmatic tasks within household environments (Nomura et al., 2004; Kahn, 1998). The following sentence will support this conclusion:

''Robots moeten simpele huishoudelijke taken uitvoeren. Stofzuigen, afwassen en de was vouwen''.

Interesting finding is the fact that respondents with a low score of NARS, associate robots with humans. This implicate that respondents with a positive attitude, associate robots with humans. However, it is already mentioned that implicit associations are correlated with robot anxiety, because of the argued unconscious anxiety of robots. Therefore, the associations towards robots of people with a low NARS score are consistent with the findings of the Robot positive/negative IAT correlated with robot anxiety.

Another interesting finding is that some respondents have mentioned they associate negativity towards robots, but have low scores on the NARS. For these respondents it could be argued that their implicit associations are not consistent compared with their explicit measures. It was also expected that many respondents would mention factories when asking associations of robots, however only 6 respondents have mentioned this. This could also be accounted for the short introduction, which emphasized only on domestic robots.

Overall concluding is that there are differences between associations between robots of people with difference attitudes towards robots. Most of the respondents have mentioned associations towards robots, who have low scores on the NARS.

Theoretical implications

Previous research on robotics have primarily focused on identifying attitudes and associations towards robots using explicit measures. Furthermore, many of the questions used within other studies are in closed form and are based on researchers' assumptions (Ray et al., 2008). The present study takes another view and was aimed to assess both, implicit and explicit associations and its relationship with attitudes towards robots in a domestic environment. As far as the researcher know, this has been done for the first time. Only the research of Macdorman et al. (2008) have used implicit associations in order to assess what kind of associations people have towards robots and used American and Japanese respondents. Other studies such as the studies of Macdorman et al. (2008) and Ray et al. (2008) have also found that people have rather positive associations with robots. Thus, the present study have confirmed the results of other robotics research, which focused on consumers' associations, however extends the theoretical framework of robotics with the use of implicit measures. This could be seen as an important theoretical implication.

Another important implication is that the present study shows the influence of implicit associations on attitudes towards robots. This has been opted by Nomura et al. (2008), who mentioned that correlations between attitudes and actual behavior are influenced by the different images and associations people have towards robots. People's implicit associations represents strong and older representations that are rooted in long-term socialization processes (Gawronski, Lebel & Peters, 2007). Thus, it would be interesting to identify measurement variables of implicit associations, and therefore also attitudes towards robots, future research could investigate this assumption. On the other hand, identifying antecedents of consumers´ attitudes has been an important topic within existing research. For example, the study of Kulviwat, Bruner and Al-Shuridah (2008) who found that social influence has a positive effect on consumers' attitudes towards new technology, such as robots. Social influence is defined as the degree to which an individual believes that important others think he or she should use the system (Venkatesh, Morris, Davis & Davis, 2003). Another study of Moon and Kim (2001), suggest a model where perceived playfulness was found as one of the antecedents of attitudes of new technology. The present study expands the existing literature on attitude research by showing the influence of implicit associations on attitudes towards robots, which led to a better understanding on the formation of people's attitudes within the domestic robotics context.

Early theory have focused explicitly on the distinction between implicit and explicit measures (Greenwald & Banaji, 1995; Greenwald et al., 1998). However, there are alternative movements that suggest that implicit and explicit measures could relate with each other (Nosek, 2007). The present study is no exception of this new movement, it was found that implicit measures and explicit measures correlated with each other. Nosek (2007) suggests that these correlations are affected by numerous interpersonal and intrapersonal factors.

The present study also expands the literature on measuring robot anxiety. Robot anxiety has been developed by Nomura et al., (2004) and was developed to measure emotions deeply related to behaviors in situations of interactions with robots. Thus, the present study provide more understanding and a theoretical framework of the formation of robot anxiety, by identifying a positive relationships between both implicit and explicit associations and robot anxiety.

TAM have been used extensively within robotics research. However, most of existing studies have focused on healthcare robotics and socially interactive robots nursing purposes (Heerink et al., 2009; Dong-Hee & Hyungseung, 2011). The used sample within these studies are mostly older people and thereby focusing on a specific target sample. User acceptance of domestic robotics have been relatively scarce, thus the findings of the present study could be considered as an expanding of the existing research on acceptance of domestic robotics. When comparing the findings of the present study and the study of Heerkink et al., (2009), it can be concluded there are no surprising differences in outcomes of the TAM. This also emphasis the strong repetitive validity of the model (Tang, 2011). Furthermore, it became also apparent that consumers' perceived usefulness is more important in the determination of usage intentions compared with perceived ease of use, indicating similar results of existing studies (Chesney, 2006).

Practical implications

Besides contributing to the field of robotic research, by providing insights the way people perceive and associate robots with, it is hoped that findings of the present study could be used as a theoretical framework on both societal and business level. In an era where the economy have changed from a manufacturing and heavy industry, to one that will dominate more ''white collar'' and service industry, the introduction of a domestic robot will be soon (Robbins, 2005). Along with this new working era comes a new generation of people: Generation Y. Generation Y is a new generation of working people, who wants a good work/life balance, have a moderate until above income and embrace new technology, such as domestic robots (Alexander & Sysko, 2011), combined with the findings of the present study, this could be seen as a perfect time to introduce domestic robots. Businesses should also be aware of this. Although most of the respondents have not engaged yet with robots and know robots from movies, articles and books, they perceive and associate robots as positive and that robots perform household tasks. Therefore, firms may feature their research and development, marketing and communication and service strategies based on these findings. Since, implicit associations are important for the formation of attitudes towards robots. In turn, these attitudes could influence favorable behavior, such as purchasing and using domestic robots (Nomura, Suzuki, Kanda, Yamada & Kato, 2011).

It may be apparent, domestic robots are new products within consumer markets and have to be introduced carefully. The present study have shown that consumers perceived usefulness and ease of use are important for the intention to use domestic robots. Marketers should be aware of this, and should therefore have to focus on emphasizing the usefulness and ease of use of domestic robots, when creating marketing campaigns. Furthermore, firms have to prioritize their marketing efforts, focus their research and development on perceived usefulness and ease of use and focus on the right consumer target group. Firms could initiate the following campaign: families are given the chance to use a domestic robot for a couple of months. This campaign will have two-folded benefits. First, the families will learn how to use a robot and could therefore enhance their perceived usefulness and ease of use of the domestic robots, which eventually influence usage intentions. Second, there is a greater chance that other members of the family such as friends, will perceive the robot as favorable, since social influence is an important antecedent of behavior intentions (Venkatesh et al., 2003).

Lastly, based on the above discussion and the findings of the present study, firms have to incorporate these findings into the design of their robots. Designers of domestic robotics should emphasize the notions of TAM and implicit and explicit associations into their creations.

Concluding remarks

It could be argued that any study suffers with certain limitations, and the present study is no exception. First, the generalization of the findings have to be assessed in future studies. Since, most of the respondents used within the present study are students with a higher level of education. Therefore, it could be argued that consumers with a higher education could have other associations and attitudes towards robots compared with consumers with a lower level of education. Future research should therefore focus on consumer's education and other demographic variables such as gender when assessing both implicit and explicit measures towards robots. Furthermore, the present study is performed within the Netherlands and based on domestic robotics and should therefore be seen within this specific context. However, differences in culture could influence consumers' and it could be argued that one cannot understand the minds of individual consumers lacking their cultural context (Uhlmann, Poehlman & Nosek, 2012). Thus, findings of the present studies should be assessed within future studies focusing on comparing of both, implicit and explicit associations towards domestic robots between countries, before making any generalizations.

Second, the correlations between implicit and explicit measures within the present study are positive, however, within existing literature it still remains ambiguous about the formation process of these correlations. Furthermore, there is a wide range of research with inconsistent findings available to which implicit and explicit are correlated with each other. Research of Rudman and Kilianski (2000) and the present study have found slight correlations between implicit and explicit measures, on the other hand Asendorpf, Banse and Mucke (2002) have found strong correlations. Future research should therefore be performed in order to clarify the correlations between implicit and explicit measures towards domestic robots and within other research contexts.

Third, this TAM study uses regression analysis in order to analyze the data, the way Davis (1989) did, which is adequate for making simple path models. However, future research should use the Structured Equation Modelling (SEM) method in order to make more sophisticated path models (Kline, 2011).

However, the present study have shown that TAM can effectively explain the adoption of new technology, such as robots. Furthermore, TAM literature focusing on domestic robotics has been relatively scarce and this research fills this important research gap. Findings suggest that consumers perceive domestic robots as useful and easy to use, which have a positive effect on robotics usage intentions.

Furthermore, this research provides a theoretical framework how consumers perceive and associate robotics who will enter the specific household environment soon. Findings have showed that consumers associate more positive than negative and with households tasks rather than industrial tasks.

Weak correlations are found between outcomes of the IAT and NARS, which emphasize the relationship between implicit and explicit measures. Based on the findings of the present study, it can also be concluded that there are differences between associations between robots of people with difference attitudes towards robots. Most common associations of respondents towards robots were: human, machine, technology and appliance.

The present study also provide more understanding in the measurement of robot anxiety. Findings indicate that both implicit and explicit associations could be used as control variables in the measurement of robot anxiety. Finally, this study merely presents a preliminary research stage aiming to provide more insights and understanding of implicit and explicit associations of robotics and its relationship with attitudes towards domestic robotics. Moreover, it is needed to expand the TAM literature within the robotic context and other topics, such as robot anxiety. Therefore, it is hoped the present study will generate future research to expands robotic research, specifically domestic robots.

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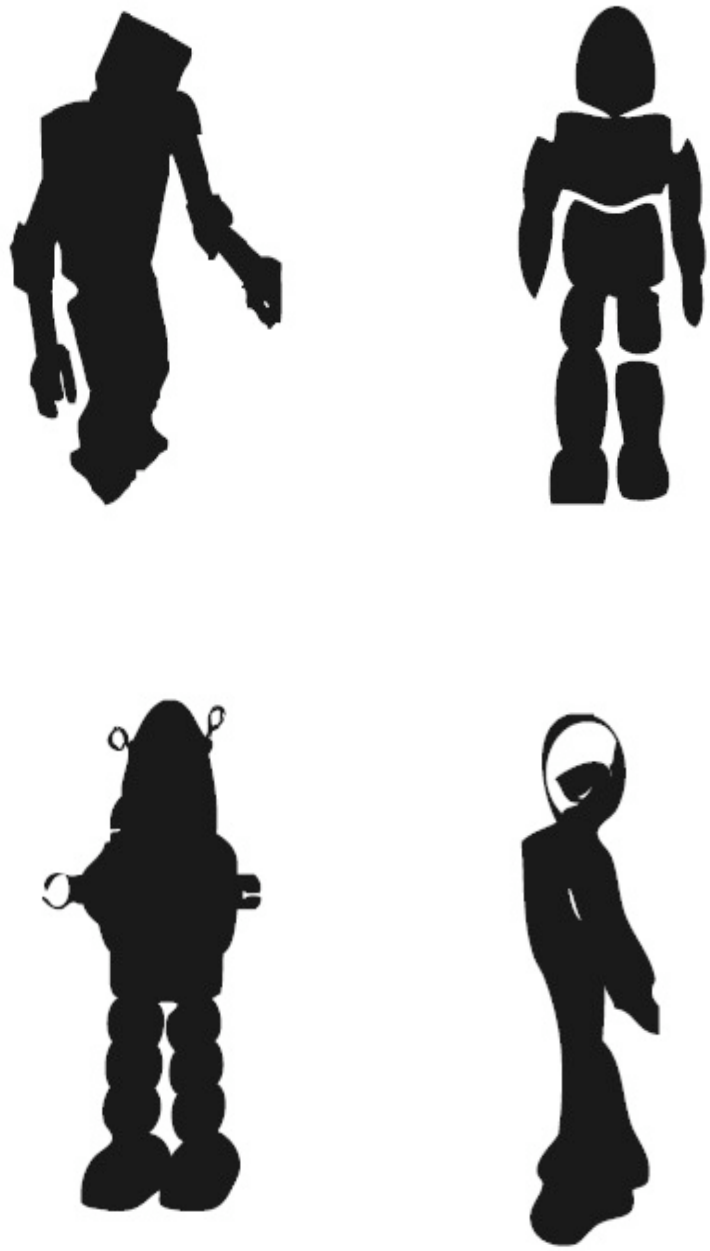
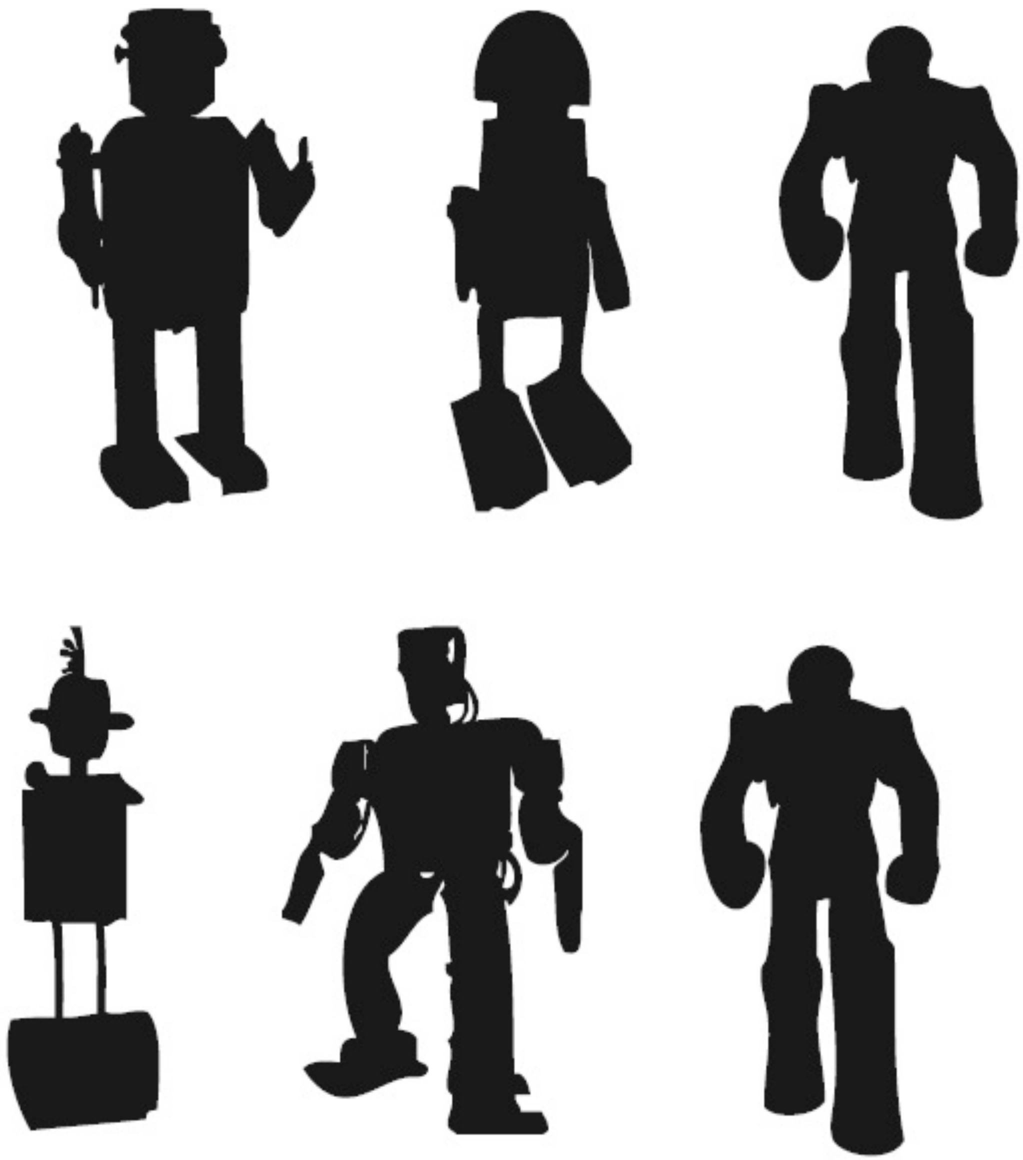
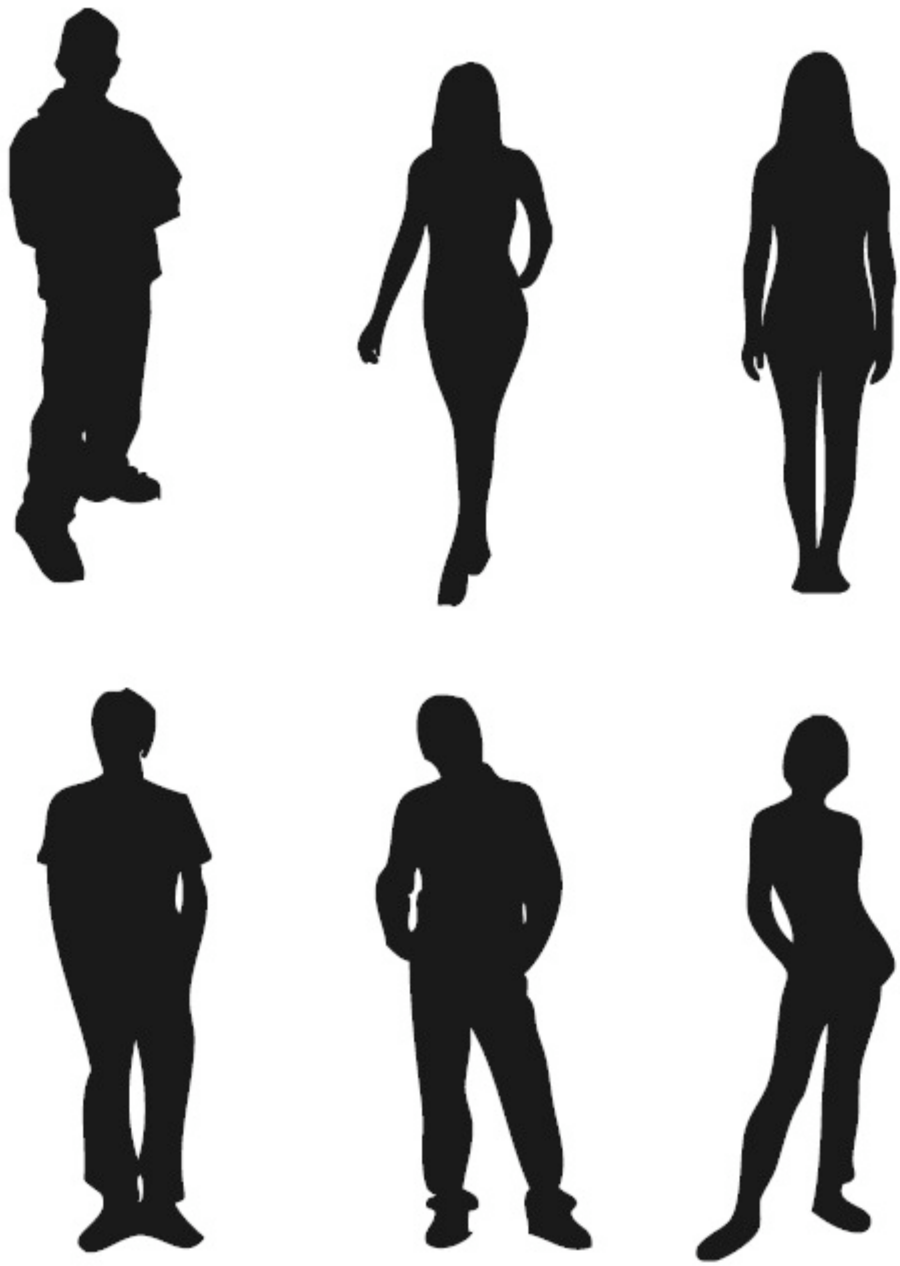
Appendixes A: Silhouettes of robots and humans

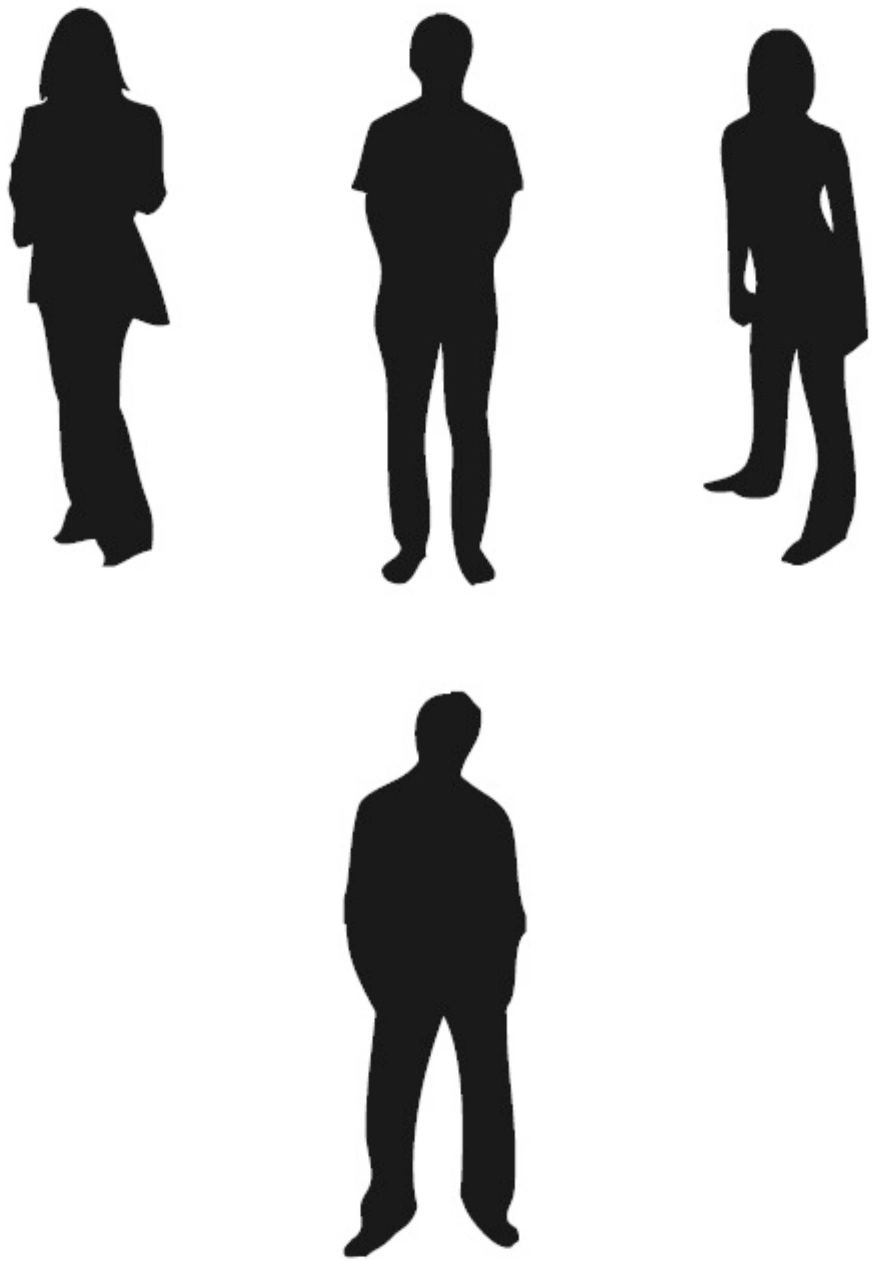
Robots





Humans





Appendix B

Positive and negative words (in dutch)

Positive words	Negative words
Leuk	Slecht
Goed	Lelijk
Fijn	Onaardig
Beter	Saai
Lekker	Onjuist
Juist	Verschrikkelijk
Mooi	Vreselijk
Lief	Afschuwelijk
Prachtig	Pijnlijk
Aardig	Haat

Household and industrial tasks

Household tasks	Industrial tasks
Stofzuigen	Assembleren
Afwassen	Monteren
Tuinieren	Demonteren
Afdrogen	Lopende band
Strijken	Automatisering
Ramen lappen	Orderpick
dweilen	Transporteren
Grasmaaien	Heftruck
Koken	Fabriek
Kleding wassen	Montage

Appendix C Used items and Cronbach's alpha

Construct	Items	CA
Usefulness	Ik denk dat robots nuttig zijn.	.79
	Het zou handig voor mij zijn om een robot te hebben.	
	Ik denk dat een robot mij met veel dingen kan helpen.	
Ease of use	Ik denk dat ik in korte tijd door heb hoe ik de robot moet gebruiken.	.74
	Ik denk dat een robot makkelijk te gebruiken is.	
	Ik denk dat ik een robot zonder hulp kan gebruiken.	
	Ik denk dat ik de robot kan gebruiken als er iemand in de buurt is die mij helpt.	
	Ik denk dat ik de robot kan gebruiken als ik een goede handleiding heb.	
Usage intention	Ik zou deze robot aanbevelen aan mijn vrienden.	.92
	Deze robot zou zeer goed verkopen.	
	Ik zou deze robot aanschaffen, er vanuit gaande dat ik de robot kan betalen.	
	Ik zou deze robot in de toekomst regelmatig gebruiken als ik er een zou hebben.	
	Ik zou deze robot vaak gebruiken als ik er een zou hebben.	
	Ik raad anderen sterk aan deze robot te gebruiken.	
Attitude towards robots	Ik zou me ongemakkelijk voelen als robots echt emoties hadden.	.70*
	Er zouden nare dingen kunnen gebeuren als robots zich ontwikkelen tot levende wezens.	
	Ik zou me ontspannen voelen wanneer ik met een robot praat. (reversed)	
	Ik zou me ongemakkelijk voelen als ik een baan zou hebben waarbij ik een robot moet gebruiken.	
	Als robots emoties zouden hebben, zou ik in staat zijn vrienden met ze te worden. (reversed)	
	Ik zou me gesteund voelen door de aanwezigheid van robots die emoties hebben. (reversed)	
	Het woord ´robot´ betekent niets voor mij.	
	Ik zou me zenuwachtig voelen als ik in bijzijn van anderen een robot moet gebruiken.	
	Ik zou aanstoot nemen aan het idee dat robots of kunstmatige intelligentie dingen zouden moeten beoordelen.	
	Ik zou me erg zenuwachtig voelen enkel en alleen al als ik voor een robot zou moeten gaan staan.	
	Ik heb het gevoel dat als ik te afhankelijk van robots ben er iets vervelends zou kunnen gebeuren.	

	Ik zou me paranoïde voelen als ik met robots praat.	
	Ik maak me zorgen dat robots een slechte invloed op kinderen zouden hebben.	
	Ik heb het gevoel dat de maatschappij in de toekomst wordt gedomineerd door robots.	
Robot anxiety	Ik ben bang dat de robot over irrelevante dingen zou kunnen praten midden in een gesprek.	.81
	Ik ben bang dat de robot niet flexibel zal zijn in het volgen van de richting in ons gesprek.	
	Ik ben bang dat de robot moeilijke gespreksonderwerpen niet zal kunnen begrijpen.	
	Ik ben bang voor het soort bewegingen de robot zal maken.	
	Ik ben bang voor wat de robot zal gaan doen.	
	Ik ben bang voor de kracht die de robot zal hebben.	
	Ik ben bang voor de snelheid waarmee de robot zal bewegen.	
	Ik ben bang voor de manier waarop ik met de robot zal moeten praten.	
	Ik ben bang voor de manier waarop ik zal moeten reageren wanneer de robot tegen mij praat.	
	Ik ben bang dat de robot niet begrijpt waarover ik praat.	
	Ik ben bang dat ik niet begrijp waarover de robot praat.	

* after deleting NARS05: If robots had emotions, I would be able to make friends with them