

# **Influences on the Intention to Buy a Sex Robot**

## **An empirical study on influences of personality traits and personal characteristics on the intention to buy a sex robot**

**Abstract.** Research in the field of sexual aspects of human-robot-interaction is nearly non-existent, even though the topic represents an emerging field of application for humanoid robots. The present study aimed to investigate not to investigate personal characteristics (e.g. relationship status or personality) and personality traits (just as loneliness) would influence the intention to buy a Sex Robot. An online survey with 263 male participants showed that 40.3% would buy such a robot now or within the next five years. We could show that the relationship status or sexual fulfilment has no impact on the intention to buy a sex robot, rather, negative attitude towards robots and anthropomorphic tendency seem to have a significant impact.

**Keywords:** Sex Robots · Intention to buy · Personal Characteristics

## **1 Introduction**

With the rise of humanoid robots, more and more companies focus on building android robots (robotic replications of humans). One imaginable and quickly progressing field of use is the satisfaction of sexual needs. It is imaginable that the technological progress in the field of sex robots will increase strongly, since the adult industry is known for driving technological developments, just like the internet applications or virtual reality [1]. Sex dolls already have a hyper realistic outer appearance. Companies, such as True Companion or Real Doll, already work on different robotic solutions in order to make the human replications move and talk. David Levy, one of the first researchers who discussed love and sex with robots in detail, predicted that by the year of 2050, robots will be capable of being “perceived as being similar to biological creatures” (p. 303) and that this will make robots appealing in terms of sexual and affectional purposes [2]. While the media coverage often associates the usage of sex dolls or sex robots with being lonely (e.g. “Lonely men to get guide on building a sex robot” [2]), a study by Schuetz and Arnold revealed (N = 103, 57 males) that more than two thirds of the male participants could imagine to use a sex robot [4]. This demonstrates that the topic, as futuristic as it might seem, could be of interest for more than only a fringe group. And

indeed, theoretical considerations based on social psychological insights on the mechanisms of physical attractiveness as well as communication science assumptions such as media equation (the process of applying social rules to computers) would suggest that the attraction to sex robots could be a universal phenomenon [5]. However, other concepts, such as the uncanny valley (negative reaction if robots are too human like) or sexual and social norms would predict that sex robots will not be appealing for masses.

While research in different fields of human-robot-interaction are on the rise (e.g. human-robot-interaction in healthcare), empirical research on sexual aspects of human-robot-interaction is nearly nonexistent. It needs to be highlighted that there are some scientific papers on sex robots, but they mostly discuss ethical concerns (e.g.[6]). These considerations are indeed of special importance as the development of sex robots might be related to diverse negative societal outcomes (e.g. objectification of people), but still empirical studies focusing on the users' acceptance are needed in order to discuss sexual aspects in human-robot-interaction profoundly.

In line with this, the present paper aimed to investigate the intention to buy such a robot and how personal characteristics, just as relationship status or the degree of loneliness influences this evaluation. In order to be able to answer both questions, an online study was conducted

## **2 Theory**

### **2.1 Sex robots**

Sex robots can be understood as android robots (robotic replicated women or men) that are built to satisfy sexual needs. For this purpose, the robots do not only provide replications of some secondary sexual characteristics (e.g. breasts), but also external genitals (e.g. labia). As this description would also be suitable for hyper realistic sex dolls, sex robots are also capable to move (especially with respect to movement that are important with regard to the fulfilment of sexual needs) and speak. This aspect refers to the possibility to implement an artificial intelligence, but as Schuetz and Arnold argue, the AI of a sex robot would possibly be much weaker than the ones needed for other robots, such as robots which are built to assist in the field of education [4]. Still, affective computing will be an important aspect of sex robots, since having sex is one of the most intimate interactions, in which reacting and acting like a human will be perceived as quality attribute. At present, there is no sex robot available that is suitable for masses and that provides all the features listed above. However, there are first approaches, such as the sex robot Roxxy by the company True Companion or the first moving body parts created by the company Realdoll. With regard to the outer appearance there is a difference between android without salient mechanical body parts and robots with salient mechanical body parts. The salient mechanical body parts come with the consequence that humans can instantly categorize them as robots, as their human like outer appearance is disturbed by for instance plastic components.

Research on sex robots is nearly non-existent, but there are first scientific papers, which mostly cover ethical concerns (e.g. [6]). Schuetz and Arnold conducted one of the first and only empirical studies focusing on the users' acceptance of sex robots [4].

Besides other results, they showed that using a robot “instead of prostitutes” was the most appropriate reason to use a sex robot, followed by “for disabled people” and “to reduce the risk of sexually transmitted diseases”. David Levy predicts that, by that by 2050, technological achievements will make it possible to fall in love, have sex and even get married with a robot [2]. On the other hand, there are, as mentioned above, ethical concerns raised with regard to those new developments. Among other aspects, the possible process of objectification (especially with respect to prostitutes) needs to be kept in mind, as well as the illusion of love (caused by the illusion of interaction with a person) that can lead to various ramifications [6-7].

## **2.2 Media equation**

Reeves, Naas and colleagues demonstrated in different studies that people behave the same way in interactions with computers as they would do with humans (e.g. they behave polite, they apply gender stereotypes) [5]. The effect of media equation (media equals real life) was also already shown with regard to robots (e.g. showing empathy or keeping interpersonal distance) [8-9]. With regard to intimate interactions with robots, Li, Ju, and Reeves conducted a study in which the humanoid robot NAO told the participants to either touch or point on different body parts (low and high accessible) [10]. The results showed that people experienced an increased physiological arousal and an increased reaction time when touching regions of the robots’ body with lower accessibility (e.g. buttocks or genitals). The authors discussed this result in the context of media equation. As the study did not focus on the question why the arousal increased, the authors assumed (among other reasons) that touching a human like robot on low accessible body parts could evoke a feeling of discomfort, based on social norms or the increased intimacy. Even though Li, Ju, and Reeves do not discuss this in particular, it is assumable that the increased arousal cannot be compared to sexual arousal as the study was conducted with the humanoid NAO, which is 57,3 cm/ 22,6-inch-tall, made of white plastic. However, it is an important finding as it shows that touching even human shaped robots evokes arousal. It is possible that androids could evoke even stronger reactions, meaning sexual arousal, since anthropomorphism (in design and behavior) is an important aspect in media equation. This points out to the importance of the robot’s appearance in media equation. Ferrari stated that human appearance in robots is not only important on a functional level (some things can simply be better done having human features, e.g. raising a glass), but also on a physiological level, as we tend to interpret anthropomorphic features as “human” features [11]. For instance, Bartneck, Bleeker, Bun, Fens and Riet could show that the degree of anthropomorphism (here moving lips, eyes, eyebrows) had an influence of feelings of embarrassment in an interaction with a medical robot [12]. The authors discuss the result in the context of media equation and point out that there are certain situations in which a less human like appearance could be helpful, but they also remark that highly anthropomorphic robots could have benefits with regard to human-robot-interaction.

### 2.3 Social and Sexual Norms

Thinking about aspects that could influence the evaluation of sex robots, sexual norms could be of particular importance. Nowadays, technology plays an important role in sexuality [13]. The term technosexuality describes sexual activities that are combined with technology. There are technosexual behaviors, such as sexting or internet pornography, that are more common than others. So far, sexual activities involving robots have been described as deviant and termed as robot fetishism. It is defined as “fetish attraction to humanoid or non-humanoid robots, or to people behaving like robots, or to people dressed in robot costumes” (p.66-67) [13]. Even though possible users might not be aware of the fact that such a sexual behavior could be labeled as fetishism, it is obvious that sexual activities with an object is deviant of statistical sexual norms, which in turn could be evaluated negatively [14]. Moreover, the sexual norms could lead to difficulties in the context of empirical research, as participants have the tendency to respond in ways that they believe to be socially accepted (social desirability).

Another aspect that could lead to negative attitudes towards sex robots is that having sex with a doll, instead of a human, is associated with being lonely or desperate [13]. Even though a robot is more lifelike compared to a doll, it is still a machine and therefore it can be assumed that this stereotype could transfer to sex robots, as both are non-human. However, it needs to be highlighted, that sex dolls (ranging from cheap inflatable versions to expensive ones made of silicone) and also technology that is used of sexual stimulation are already part of the present sex toy industry [13]. The latest technological developments in the field of virtual reality also point in the direction, that replications of human torsos can be synchronized with a virtual porn environment so that the users see the virtual person they are interacting with based on the position of the torso (Virtual reality game known as “Space Battleship Girlfriend” – presented at the OcuFes (Convention on virtual reality, 2015). Those examples illustrate that technology and replications of the human body (or specific parts) already are used for sexual stimulation.

### 2.4 Influence of personal characteristics in HRI

The perception of robots can be influenced by different personality traits and pre-existing biases towards robots. In the following personality traits and their influence on robots will be discussed.

**Loneliness and Affiliation in the context of (sex) robots.** Loneliness is a topic that is often associated with sex robots by the media [3], but also David Levy addressed this topic in his book “Love and Sex with Robots” by stating in his conclusion “Many who would otherwise have become social misfits, social outcasts, or even worse will instead be better-balanced human beings.” (p. 304) [2]. A documentation named “Guys and Dolls” produced by Flintoff and Raphael portrayed owners of real dolls and one thirty-two-year-old man confirmed Levy’s conclusion by saying: “I can tolerate being alone, but not loneliness” [15]. And indeed, research in the field of human-robot-interaction could already show that lonely people do benefit of contact with robots [16]. Eyssel

and Reich demonstrated that lonely people tend to anthropomorphize (with respect to their characteristics) humanoid robots more strongly, which is an important finding, since people have a fundamental motivation to affiliate with others which in turn could be satisfied by interactions with robots [17]. On the other side, it is imaginable that people with social anxieties could benefit from interactions with robots. They could provide safety with respect to aspects or behaviors that could be controlled in a robot, such as fear of rejection [18]. This aspect could be of special importance for sex robots, since people suffering from social anxieties have problems to engage in interactions with the opposite sex and consequently they have less sexual experiences in their lives [19]. In line with this, Suzuki, Yamada, Kanda and Nomura showed that people having higher scores for social avoidance and distress would prefer robots over humans as communication partners in different situations (e.g. asking directions at a station or on a street) [20].

**Pre-existing Attitudes.** Another aspect that needs to be kept in mind with regard to attractiveness in robots is that robots, as a concept, are associated with certain pre-existing positive and negative biases [e.g. 8]. In this context, Nomura, Suzuki, Kanda and Kato investigated anxieties people have towards robots with regard to situations in which people have to interact with robots, towards the social influence of robots and towards emotions robots could have [21]. In this context, they developed the negative attitude towards robots scale (NARS), which is an important measurement in the research on human-robot-interaction. Different studies showed that the NARS has an influence on different evaluations in human-robots-interactions. For instance, the NARS has an influence on the distance people keep between robots and them and the willingness to engage in physical contact with robots [20-21]. As important as this aspect is, it has to be noted, that this state anxiety (evoked in certain situations) is strongly connected to the task robots are performing [21]. Here, no research has been conducted so far that focusses on sex robots and pre-existing attitudes.

**H1:** Loneliness, importance of social contacts, fear of rejection, the individual degree of interaction deficits, anthropomorphic tendency and the negative attitude towards robots are predictors of the intention to buy a sex robot now or within the next five years.

**RQ2:** Is there a difference between singles and males in relationships with regard to the intention to buy a sex robot?

**RQ3:** Is there a difference between males who rate their sex life to fulfilling and those who rate their sex life to be unfulfilled with regard to the intention to buy a sex robot?

### 3 Method

#### 3.1 Sample and procedure

To investigate the explicit evaluation of sex robots, a total of 263 heterosexual male participants between the age of 18 to 67 ( $M = 25.89$ ,  $SD = 6.80$ ) took part in an online survey. Nine participants were excluded from the analysis. The decision of exclusion is statistically based on the analysis of the corresponding boxplot. 52.9% ( $N = 139$ ) of the participants indicated that they were in a relationship while 124 were single. With regard to their sexual life, 135 participants (51.3%) named that they had a fulfilling sexual life, while the other 128 males (48.7%) rated their own sexual life to be unfulfilling.

The present study focused on male participants only, which is based on three important aspects. (1) Attitudes related to sexual activities differ strongly in men and women, (2) an empirical study conducted by Schuetz and Arnold showed that men were significantly more in favor with sex robots, respectively the idea of using one, compared to women and (3) the product sector focusses more on the male consumer by producing mainly female sex dolls or (first) sex robots [4, 22].

The survey was composed of three parts. First, they had to watch a video of two minutes showing female robots, such as Sophia (by Hanson Robotics) and HRP-4C (Miim; by the National Institute of Advanced Industrial Science and Technology (AIST)). This was important in order to create a mutual understanding of what state-of-the-art robots do look like (e.g. facial expressions, secondary sexual characteristics), what their abilities are (e.g. standing and walking) and in which fields of application they can be used in (e.g. domestic worker or training object for dentists). The second block was composed of different personality measures which will be explained in more detail in the next section. In the last section the participants had to rate the attractiveness of four pictures of women in underwear, four pictures of female robots in underwear with salient mechanical body parts and four pictures of female androids (biologically correct replication of women) in underwear. There was a note under every picture clarifying whether the picture displayed a woman or a robot. After that, the males were asked whether they would buy such a robot for themselves now or within the five next years and to indicate why and what they evaluated to be attractive and unattractive with regards to the female robots in underwear with salient mechanical body parts and the female androids (biologically correct replication of women) in underwear via text field. Finally, each participant received a debriefing and had the chance to win 3 x 50€ gift certificate.

It has to be noted that the presented Hypothesis and research questions are only one aspect of the study and that there were more hypotheses and research questions, which are not addressed in this paper.

### 3.2 Stimulus material

In order to ensure comparableness of the pictures of the female robots in underwear with salient mechanical body parts, the female androids (biologically correct replication of women) in underwear it is important to mention that the displayed robots all wore black and white basic underwear, that they were all shown against a white background, that all the pictures showed the same image section and that they all had a neutral to sexy look on their faces. Moreover, the pictures were selected based on a pretest ( $N = 10$ ) in order to exclude the pictures of robots who were rated unrealistic and particularly attractive/unattractive. Figure 1 shows examples of the stimulus material.



**Fig. 1.** Examples for the stimulus material of the robots without salient mechanical body parts (left) and the robots with salient mechanical body parts (right).

### 3.3 Measures

In the following, all dependent and independent variables are explained. Please note that all used scales had to be answered on a 5-point Likert scale (1 = “disagree strongly” to 5 = “agree strongly”). Moreover, there were two more used measurements (a self-provided scale measuring the concept of suspension of disbelief and a self-developed scale measuring the importance of the social aspects of sex) which could not be used in further analyses due to an unsatisfying level of internal consistency ( $\alpha \geq 0.5$ ).

**Anthropomorphic tendency.** To assess whether the participants have the “tendency to ascribe human characteristics to non-human objects” (p. 214) the Anthropomorphism Questionnaire by Neave, Jackson, Saxton, & Hönekopp was used [23]. Even though the scale was originally developed to measure the influence of anthropomorphic tendencies on hoarding, the 20 items, just as “Part of the reason why I picked

a new car/electrical item was because when I first saw it I felt that it had a friendly personality” are worded neutrally and could therefore be used in the present study. The internal consistency was  $\alpha = .891$ .

**Negative attitudes towards robots.** The NARS scale by Syrdal, Dautenhahn, Koay and Walters covers negative attitudes towards situations and interactions with robots, social influence of robots and emotions in interactions with robots [24]. The 11 items (e.g. “I would feel uneasy if robots really had emotions”) had an internal consistency (Cronbach’s alpha) of  $\alpha = .819$ .

**Loneliness.** The revised UCLA Loneliness scale by Russel, Peplau and Cutrona was used to assess one’s subjective feelings of loneliness [25]. The 20 Items (e.g. “People are around me but not with me”) had an internal consistency of  $\alpha = .914$ .

**Need to belong (Importance of social contacts).** The subscale “importance of social contacts” of the need to belong scale by Krämer et al. was used to measure the importance of the contact to others in the everyday life [26]. The subscale consists of five items (e.g. “I frequently think of my loved ones”). The internal consistency (Cronbach’s alpha) was  $\alpha = .772$ .

**Social anxiety (Fear of Rejection & Interaction deficit).** The SASKO Scale of Social Anxiety by Sabine Kolbeck contains the subscales “fear of rejection” and “interaction deficit” [18]. Each subscale contains five items, just like “I am afraid of situations in which I could get rejected by somebody of the opposite gender.” and “I feel uneasy at parties because I don’t know how to behave”. The subscales “fear of rejection” had a Cronbach’s Alpha of  $\alpha = .826$ , while the other subscale “interaction deficit” reached an internal consistency of  $\alpha = .746$ .

## 4 Results

### 4.1 Influence of personality traits on intention to buy (H1)

In general, it has to be noted that 40.3% of the present sample indicated that they could imagine to buy a sex robot now or within the next five years.

A logistic regression analysis was conducted to predict whether one could imagine buying such a robot now or within the next five years using anthropomorphic tendency, physical self-concept, negative attitudes towards robots, loneliness, importance of social contacts, fear of rejection and the individual degree of interaction deficits. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between men that would buy a sex robot now or within the next five years and men that would not buy such a robot ( $\chi^2(6) = 58.74, p \leq .01, N = 263$ ). Overall model fit was acceptable/good (Hosmer and Lemeshow  $\chi^2(8) = 8.80, p = 0.36$ ; Nagelkerke’s  $R^2 = 0.27$ ) (Backhaus, Erichson, Plinke, & Weiber, 2000). Prediction success overall was 70.3% (79.6% for decline and 56.6% for accept. The Wald criterion demonstrated that anthropomorphic tendency ( $\beta = .777, Wald = 8.36, p = .00, Exp(B) = 2.18, CI = 1.29 - 3.68$ ) and negative attitude towards robots ( $\beta = -1.60, Wald = 38.378, p \leq .01, Exp(B) = .20, p \leq .01, CI = .12 - .34$ ) made a significant contribution to prediction. Exp(B) value indicates that when the anthropomorphic tendency is raised by one unit (here 5-point-Likert scale) males are



almost twice as much imagining to buy a sex robot now or within the next five years, while increasing negative attitudes towards robots by one unit (also 5-point-Likert scale) reduces the likelihood of imagining to buy such a robot also almost twice as much.

#### **4.2 Differences with regard to relationship status and fulfillment of sexual life (RQ 1 & RQ2)**

Two Chi-square test of independence were computed in order to see whether there would be differences between singles and males in relationships and males that would rate their own sexual life as fulfilling or unfulfilling with regard to the question whether they could imagine to buy a sex robot now or within the next five years. No significant interaction between relationship status and the question whether males would buy a sex robot ( $\chi^2(1) = .248, p = .62$ ) could be found, nor was there one for the subjective rating of sexual fulfillment and imagining to buy such a robot ( $\chi^2(1) = .37, p = .54$ ).

## **5 Discussion**

The present study aimed to find aspects that would influence the intention to buy a sex robot now or within the next five years. And the results showed not only that there were many males who could imagine buying such a robot, but that many of aspects that could have played a role were not as important as assumed.

### **5.1 Influence of personality traits on intention to buy (H1)**

In general, it has to be noted that 40.3% of the present sample indicated that they could imagine to buy a sex robot now or within the next five years. This is fully in line with a study by Schuetz and Arnold who showed that more than two thirds of the males could imagine to use a sex robot [4]. This is an interesting result, as it was imaginable that males would not indicate this, based on social and sexual norms or social desirability in the context of the empirical study. This also highlights that sex robots could be interesting could be of interest for more than only a fringe group.

The results of the logistic regression analysis showed that only anthropomorphic tendency and negative attitude towards robots were significant predictors. Nomura et al. showed that the negative attitude towards robots has an important impact on the evaluations of situations in which robots and humans get closer, meaning that it influences the allowed distance between robots and humans and the willingness to engage in touch with robots [21]. And as those are aspects that play a huge role in the context of sexual interactions, the predictor is plausible.

On the other hand, anthropomorphic tendency was the other significant predictor for the intention to buy sex robots. This result would point out into the direction that sex robots need to be highly anthropomorphic in order to be attractive for possible costumers. As sex is such an intimate interaction it is assumable that the males do prefer familiar aspects in a sexual “partner”. More research needs to be done in the context of

media equation associated with sex robots as it is imaginable that users see more in sex robots as just machines. This result could be a first evidence for this assumption.

This both highlights the importance of human likeness in the context of sex robots. Of course, results regarding uncanny valley need to be into account when thinking about too human like robots, but it could be imaginable that clients who pay a lot for sex robots are aware of the fact that robots are non-human, which could prevent their evaluations from falling into the uncanny valley.

However, another main result of the present study is that affectional related characteristics, meaning the perceived loneliness, the importance of social contacts, fear or rejection and interaction deficits were all no predictors for intention to buy sex robots. This result shows that the picture of a lonely user who is not capable to bond with real people and instead uses a sex doll or robot was not confirmed empirically [3,13].

## **5.2 Differences with regard to relationship status and fulfillment of sexual life (RQ 1 & RQ2)**

And the result that there were no differences in the intention to buy a sex robot with regard to relationship status and the fulfilment of sex life underlines the finding that possible consumers are not just lonely singles, as frequently portrayed by media. The data rather shows that possible costumers can hardly be categorized and that frequently associated characteristics do not play a role in the intention to buy a sex robot now or within the next five years.

## **5.3 Limitation and Further Research**

One limitation could be seen in the fact that people were not aware of the costs of a sex robot and that they have probably never seen or used one. Another limitation could be seen in the participants, as we recruited them on social networking sites and newspaper ads in which we stated that the study would be about the evaluation of robots and the sexual aspects of human-robot-interaction. This is an important information as the evaluation included data on intimate topics. However, it is possible that mainly men took part in the study who were already open minded towards the topic of sex robots.

From a more general perspective, we argue that there is a strong need for future research focusing on the user and his or her acceptance for sex robots. And it should be a long-term goal to investigate real interactions between humans and sex robots, as research in the context of the uncanny valley phenomenon could already show that results differ based on the form of stimulus material [8]. Since sex robots are mainly built by the adult industry, researchers rely on their technological developments in order to improve the quality of research. However, first empirical approaches using different kinds of stimulus material, such as pictures, videos or virtual reality and different forms of qualitative or quantitative measures should be encouraged in order to get new insights into the users' acceptance of sex robots.

## 6 Conclusion

The present study did not only highlighted that social life related personality traits, just as loneliness, are no significant predictors for possible new buyers of sex robots. But also that there were no differences with regard to relationship status and sexual fulfilment in the intention to buy a sex robot. Instead the negative attitude towards robots and the anthropomorphic tendency seem to play an important role. The data did not support stereotypes about sex robot users (e.g. they are lonely and cannot get in touch with a real person).

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