Shape It – The Influence of Robot Body Shape on Gender Perception in Robots

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Abstract. Previous research has shown that gender-related stereotypes are even applied to robots. In HRI, a robot's appearance, for instance, visual facial gender cues such as hairstyle of a robot have successfully been used to elicit gender-stereotypical judgments about male and female prototypes, respectively. To complement the set of features to visually indicate a robot's gender, we explored the impact of waist-to-hip ratio (WHR) and shoulder width (SW) in robot prototypes. Specifically, we investigated the effect of male vs. female appearance on perceived robot gender, the attribution of gender stereotypical traits, the robots' suitability for stereotypical tasks, and participants' trust toward the robots. Our results have demonstrated that the manipulation of WHR and SW correctly elicited gendered perceptions of the two prototypes. However, the perception of male robot gender did not affect the attribution of agentic traits and cognitive trust. Nevertheless, participants tended to rate the male robot as more suitable for stereotypically male tasks. In line with our predictions, participants preferred to use the female robot shape for stereotypically female tasks. They tended to attribute more communal traits and showed more affective trust toward the robot that was designed with a female torso versus a male robot torso. These results demonstrate that robot body shape activates stereotypes toward robots. These in turn, deeply impact people's attitudes and trust toward robots which determine people's motivation to engage in HRI.

Keywords: Robot body shape · Gender · Gender stereotypes · Cognitive and affective trust in HRI

1 Introduction

According to [1], age, ethnicity, and gender are the main social categories people use to make judgements about other humans. Similarly, these categories are even applied to nonhuman entities such as robots [2]. For instance, [2] have shown that participants used robot facial gender cues to categorize a robot as male or female. The authors depicted a robot head and manipulated robot hairstyle. They found that a short-haired robot was perceived as male, whereas a long-haired robot was perceived as female. More importantly, participants ascribed more agentic traits to the male robot and more communal traits to the female robot. Further, the male robot was rated as more suitable

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to perform stereotypical male tasks. Complementary, the female robot was evaluated as more suitable to perform stereotypical female tasks.

However, robots like Meka M1 robot (Meka Robotics San Francisco, USA) feature a humanoid body with two dexterous arms, but its sensor-head does not provide any facial social cues that could be used to infer robot gender. Which other design choices could impact the perception of robots as male versus female?

Previous work on person perception has shown that an individual's body shape is used to make gender-related judgments. Shoulder-width and even more so, a person's waist-to-hip ratio (WHR) cause the categorization of people as male or female [3]. [4] have proposed WHR norms according to which people are commonly perceived either as male or female. Body shape, however, has yet not been explored in the context of impression formation about robots. Therefore, the present research sought to investigate the effects of robot body shape on gender stereotypical judgments about allegedly male vs. female robots. Like [2], we explored the attribution of gender stereotypical traits such as communion and agency or warmth and competence, respectively [5–7]. Stereotypes can also impact peoples' trust in others [7]. Trust is a multidimensional construct that encompasses three analytically distinctive dimensions, namely affective, cognitive, and behavioral trust [8, 9]. The present research will only focus on cognitive and affective trust: In interpersonal relationships, cognitive trust is motivated by "good rational reasons" [8] (p. 972) to trust another individual. It is grounded on a trustee's competence, reliability, and predictability. Affective trust between humans is motivated by a strong affect for the trustee. It is based on beliefs about the trustee's attitude and benevolence, and on mutual "interpersonal care and concern" [8, 9]. In the context of HRI, it has been found that cognitive trust is related to robot-performance (e.g., whether a robot carries out its responsibilities reliably), whereas affective trust is based on users' attributions about the robot's motives [10, 11]. Putting the aforementioned key constructs into perspective, it is plausible that communion is closely related to cognitive trust, while agency might be linked to affective trust in robots. This might be due to the fact that communion and affective trust are both linked to social motives and morality, whereas agency and cognitive trust are related to competence and performance [10, 11]. The present research will examine the relationship between these constructs in more depth.

1.1 Research Aims

Firstly, we sought to investigate whether robot body shape would elicit the categorization of robots as male vs. female. To tests this, drawings of robot torsos were administered in which WHR and SH were manipulated. According to human body norms by [3, 4], we hypothesized that a robot with a WHR of 0.9 and 100% SW would be perceived as relatively more male than the robot prototype with WHR of 0.5 and 80% SW (H1a). Analogously, we hypothesized that a robot with WHR of 0.5 and 80% SW would be perceived as relatively more female than the robot with WHR of 0.9 and 100% (H1b). Further, we explored whether participants would assign gender stereotypical traits and show a preference to use the robot for gender stereotypical tasks according to the robots' perceived gender. We predicted that participants would ascribe more agentic traits to the robot with a male shape than to the female version (H2a).

Likewise, we predicted that they would attribute more communal traits to the robot with a female shape compared to the male version (H2b). Moreover, we expected the robot with a male shape to be perceived as more suitable for stereotypically male tasks than the female version (H3a). The robot with a female shape was expected to be rated as more suitable for stereotypically female tasks than the male version (H3b). We expected that participants would show more cognitive trust toward the robot with a male shape than toward the robot with a female shape (H4a) and more affective trust toward the robot with a female shape than toward the male version (H4b). Finally, since participants' knowledge about cultural gender stereotypes, their self-reported robot anxiety, their technology commitment, their tendency to anthropomorphize, nonhuman entities, their social desirability concerns, and their ambivalent sexist attitudes were expected to impact their responses, these variables were considered as covariates. We conducted a survey study to test our hypotheses.

2 Method

2.1 Manipulation of Robot Gender

We created colored drawings of robot prototypes and manipulated WHR and SW according to [3, 4]. An attribution of male gender was expected to be caused by WHR 0.9 and 100% SW (male shape = MS). A WHR 0.5 and 80% SW (80% of the SW of the male shape) was expected to cause the attribution of female gender (female shape = FS) (see Fig. 1).

Fig. 1. Robots with WHR 0.9, 100% SW (left) and WHR 0.5, 80% SW (right).

Pilot Study. The aim of the pilot study was to test whether the drawings of the robot prototypes were rated as male and female according to the manipulation of WHR and SW. At the same time, it was important to ensure that the stimuli would not differ on robot-typicality, humanlikeness, and machinelikeness. Robot-typicality was important to make sure that the robots would clearly be categorized as robots and not as any humanlike figures. Robots should be rated equally machinelike to avoid a biased perception due to the fact that technical devices might be more strongly associated to male gender than to female gender [12]. In a between-subjects pilot study, the pictures of the robots were rated by 60 participants (male: n = 29, female: n = 30, one participant did not indicate gender (M_{age} = 22.15, SD_{age} = 2.45). Using 7-point Likert scales, participants had to indicate the extent to which they would perceive the robots as male, female, typical for a robot, machinelike, and humanlike. High scores indicated high ratings regarding the respective dimension. Importantly, the male robot shape was rated as more male compared to the female robot shape (M_{MS} = 4.45, SD_{MS} = 1.45; M_{FS} = 2.57, SD_{FS} = 1.10; $t(57) = 5.61$, $p < .001$). The female robot shape was perceived as more female than the male robot shape (M_{FS} = 4.90, SD_{FS} = 1.49; M_{MS} = 2.73, SD_{MS} = 1.53; $t(58) = -5.55$, $p < .001$). Both robot types were perceived as equally typical instances of robots (M_{MS} = 5.30, SD_{MS} = 1.18; M_{FS} = 4.93, SD_{FS} = 1.60; $t(58) = 1.01$, $p = .316$), as equally machinelike (M_{MS} = 4.80, SD_{MS} = 1.56; M_{FS} = 4.33, SD_{FS} = 1.58; $t(58) = 1.15$, $p = .255$), and as equally humanlike (M_{MS} = 3.97, SD_{MS} = 1.57; M_{FS} = 4.47, SD_{FS} = 1.36; $t(57) = -1.31$, $p = .194$).

2.2 Participants and Design

83 participants (male: $n = 26$, female: $n = 55$, two participants did not indicate gender, M_{age} = 26.15; SD_{age} = 7.74) took part in this between-subjects study. Except for two individuals, all participants reported German as their first language.

2.3 Procedure

The study was conducted in Unipark, a tool for online surveys. Participants were recruited via advertisements at Bielefeld University or on social media platforms. We told participants the study was about the evaluation of a newly designed multi-functional robot (see Fig. 1). We explained that only the robot head and torso would be depicted because the arms of the robot were exchangeable. Half of the participants rated the male robot shape. The other half of the participants rated the female robot shape. Colored pictures (3200 px × 3000 px) of the respective robot were shown on top of each page of the survey. Participants completed the questionnaire items in the same order as described in Sects. 2.4 and 2.5. Further, we assessed participants' experience with robots and demographics like gender, age, nationality, native language, and profession. It took about 30 min to complete the survey.

2.4 Dependent Measures

Participants' responses were recorded using 7-point Likert scales. When necessary, items were recoded, so that high scores indicate high endorsement of the respective construct.

Attribution of Robot Gender. To assess whether the robots were perceived as male or female according to WHR and SH, two items were used to assess the attribution of robot gender. These items read: "To what extent is this robot female" and "To what extent is the robot male?".

Trait Attributions. Participants rated the robots on 14 gender stereotypical traits taken from the Bem Sex-Role Inventory [6]. Half of the traits tapped the dimension of agency (e.g., "self-confident", $\alpha = .84$). The remaining items assessed the dimension of communion (e.g., "affable", $\alpha = .88$).

Task Preferences. Participants had to judge to what extent they would use the robot for a list of 12 gender stereotypical tasks that were adapted from [2]. Six tasks were defined as stereotypically male (e.g., “to transport goods”, α = .84). The remaining six tasks were defined as stereotypically female (e.g., “to take care of children”, α = .87).

Cognitive and Affective Trust in HRI. We assessed 30 items on robot-related trust based on existing scales on cognitive and affective trust in interhuman relationships [8] and general trust in HRI [10, 11]. A Maximum-Likelihood factor analysis was performed to test whether these items would differentially load on two factors, namely cognitive and affective trust. According to theoretical assumptions and our empirical findings, we used 20 items for further analyses: 10 items on cognitive trust assessed to what extent participants would trust in the robots’ performance (e.g., “This robot would perform a task reliably.”, α = .79). 10 items on affective trust assessed to what extent participants would trust in the robots’ motives (e.g., “This robot would only be interested in taking its own advantage.”, α = .79).

2.5 Covariates

Societal Gender Stereotypes. To assess cultural stereotypes, we used four gender stereotypical traits related to agency (e.g., “independent”, α = .46) and four items that reflected communion (e.g., “sincere”, α = .71) were taken from the Bem Sex-Role Inventory [6]. Participants were instructed to report the extent to which these traits would be perceived as typical for robots in Western society [see 12].

Robot Anxiety. Eight self-generated items were administered to measure participants fear of robots in general (e.g., “I fear robots might replace humans.”, α = .76).

Technology Commitment. Twelve items by [13] measured participants’ affinity for technology using the subscales. acceptance (e.g., “I am interested in using new technology.”, α = .89), control over technology (e.g., “It’s on me to solve difficulty using technology.”, α = .78), and competence in technology use (e.g., “I just can’t handle technology.”, all items on control had to be reversed, α = .89).

Individual Differences in Anthropomorphism (IDAQ). Four items by [14] described participants’ tendency to anthropomorphize robots in general (e.g., “Indicate to what extent a robot perceives emotions.”, α = .74).

Social Desirability. 17 items by [15] assessed participant’s tendency to respond in a socially desirable manner (e.g., “I always eat healthy food.”, α = .77).

Ambivalent Sexism. To measure participants’ level of ambivalent sexist attitudes, we used a German short version of the ambivalent sexism scale [16]. Six items measured participants’ scores on benevolent sexism (e.g., “Men are incomplete without women.”, α = .78). Moreover, six items assessed participants’ scores on hostile sexism (e.g., “Women exaggerate problems they have at work.”, α = .87).

Manipulation Check. To confirm the results of the pilot study, we assessed robot-typicality, humanlikeness, and machinelikeness. To avoid that participants would guess the purpose of the study, we added some filler-items on robot design. The fillers are not part of further analyses.

3 Results

3.1 Manipulation Check

As a manipulation check, we performed independent *t*-tests to compare both robot types: In line with the pilot study, both robot types were perceived as equally typical instances of the category of 'robots' ($M_{MS} = 4.53$, $SD_{MS} = 1.29$; $M_{FS} = 4.53$, $SD_{FS} = 1.43$; $t(81) = -0.004$, $p = .997$, $d < 0.01$). They were also rated as equally humanlike ($M_{MS} = 4.79$, $SD_{MS} = 1.23$; $M_{FS} = 4.78$, $SD_{FS} = 1.34$; $t(81) = 0.06$, $p = .949$, $d = .01$) and as equally machinelike ($M_{MS} = 5.38$, $SD_{MS} = 1.54$; $M_{FS} = 4.78$, $SD_{FS} = 1.37$; $t(81) = 1.89$, $p = .063$, $d = 0.42$).

3.2 Main Analyses

To test our main predictions, multivariate analyses of covariance (MANCOVA) were performed on the dependent measures as a function of robot prototypes (male vs. female shape) including the following covariates: attribution of gender stereotypical traits to robots in general in Western society, robot anxiety, technology commitment, anthropomorphism, social desirability, and ambivalent sexism. To explore the potential role of covariates further, we also computed Pearson correlation analyses between the statistically significant covariates and the dependent variables.

3.3 The Influence of Robot Type on the Attribution of Robot Gender

To test whether the robots were perceived as male or female based on WHR and SH (H1a, H1b), a MANCOVA was performed as described in Sect. 3.2 using participants' attributions of male and female robot gender as dependent variables. As expected, we found a statistically significant effect of robot type on the attribution of robot gender (Wilk's lambda = 0.46, $F(2,69) = 40.10$, $p < .001$, $\eta_p^2 = .54$). The robot with WHR 0.9, 100% SW was perceived as more male ($M_{MS} = 4.91$, $SD_{MS} = 1.42$) than the robot with WHR 0.5, 80% SW ($M_{FS} = 2.29$, $SD_{FS} = 1.29$; $F(1,70) = 60.50$, $p < .001$, $\eta_p^2 = .46$). The robot with WHR 0.5, 80% SW was rated as more female ($M_{FS} = 5.42$, $SD_{FS} = 1.44$) than the male robot with WHR 0.9, SH 100% ($M_{MS} = 2.68$, $SD_{MS} = 1.32$; $F(1,70) = 68.41$, $p < .001$, $\eta_p^2 = .49$). The covariates did not affect perceived robot gender (*ps* > .05). In line with and H1a and H1b, the robots' body shape accurately elicited perceptions of the robot prototypes as male vs. female, respectively.

3.4 The Impact of Robot Type on Trait and Task Attribution

To test the hypotheses that robot type would lead to the differential attribution of gender stereotypical traits to both robot prototypes (H2a, H2b), a MANCOVA was performed as indicated in Sect. 3.2. That is, we analyzed participants' attributions of gender stereotypical traits as dependent variables. Overall, there was an effect of participants' tendency to anthropomorphize robots in general on trait attribution (Wilk's lambda = 0.90, $F(2,69) = 3.65$, $p = .031$, $\eta_p^2 = 0.07$). The more participants anthropomorphized robots in general, the more stereotypically male (r = .28, p = .012) and stereotypically female traits (r = .25, p = .025) they ascribed to both robot types. Overall, there was no statistically significant effect of robot type on trait attribution (Wilk's lambda = 0.95, $F(2,69) = 1.79$, $p = .175$, $\eta_p^2 = .05$). Contrary to predictions of H2a, participants did not attribute more agentic traits to the male robot ($M_{\mathrm{MS}} = 3.53$, $SD_{\mathrm{MS}} = 1.14$) than to the female robot ($M_{\mathrm{FS}} = 3.51$, $SD_{\mathrm{FS}} = 0.86$; $F(1,70) = 0.13$, $p = .724$, $\eta_p^2 = .002$). However, partly confirming H2b, participants tended to attribute more communal traits to the female robot ($M_{\mathrm{FS}} = 4.00$, $SD_{\mathrm{FS}} = 1.05$) than to the male robot ($M_{\mathrm{MS}} = 3.45$, $SD_{\mathrm{MS}} = 1.07$; $F(1,70) = 3.60$, $p = .062$, $\eta_p^2 = .05$).

To test our predictions that robot type would affect to what extent participants rated the robots as suitable for gender stereotypical tasks, a MANCOVA as specified in Sect. 3.2 was performed on stereotypical male and female tasks as dependent variables. Cultural stereotypes about warmth turned out as a significant covariate (Wilk's lambda = 0.87, $F(2,69) = 5.19$, $p = .008$, $\eta_p^2 = .13$). Pearson correlations showed that both ratings of suitability for stereotypical male tasks ($r = -.29$, $p = .008$) and for stereotypically female tasks ($r = .22$, $p = .048$) were weakly correlated with the attribution of warmth to robots in general in Western society. Further, the higher participants' scores on social desirability, the less they perceived the robots as suitable for stereotypical female tasks ($r = -.26$, $p = .016$). Complementary, the higher participants' scores on social desirability, the less they thought that members of Western society would ascribe warmth to robots ($r = -.28$, $p = .011$). Social desirability affected participants' ratings on suitability for gender stereotypical tasks (Wilk's lambda = 0.90, $F(2,69) = 3.93$, $p = .024$, $\eta_p^2 = .10$). Further, technology acceptance influenced participants' ratings on suitability for gender stereotypical tasks (Wilk's lambda = 0.89, $F(2,69) = 4.08$, $p = .021$, $\eta_p^2 = .11$). Technology acceptance was positively correlated with ratings on suitability for stereotypical male ($r = .35$, $p < .001$) and female tasks ($r = .32$, $p = .003$). In line with our predictions, robot type had an effect on participants' ratings on suitability for gender stereotypical tasks (Wilk's lambda = 0.77, $F(2,69) = 10.47$, $p < .001$, $\eta_p^2 = .23$). Regarding H3a, participants tended to rate the male robot as more suitable for stereotypical male tasks ($M_{\mathrm{MS}} = 5.09$, $SD_{\mathrm{MS}} = 1.24$) than the female robot ($M_{\mathrm{FS}} = 4.70$, $SD_{\mathrm{FS}} = 1.37$). However, this difference was not statistically significant ($F(1,70) = 1.34$, $p = .251$, $\eta_p^2 = .02$). In line with H3b, participants rated the female robot as more suitable for stereotypical female tasks ($M_{\mathrm{FS}} = 3.79$, $SD_{\mathrm{FS}} = 1.54$) than the male robot ($M_{\mathrm{MS}} = 2.59$, $SD_{\mathrm{MS}} = 0.93$; $F(1,70) = 18.88$, $p < .001$, $\eta_p^2 = .21$).

3.5 The Influence of Robot Type on Cognitive and Affective Trust

To test the prediction that robot type would influence trust toward the robots (H4a, H4b), a MANOVA as described in Sect. 3.2 was performed on cognitive and affective trust as dependent variables. Overall, participants' beliefs about the extent Western society would ascribe competence to robots (Wilk's lambda = .90, $F(2,69) = 4.01$, $p = .023$, $\eta_p^2 = .10$), their self-ratings on control over technology (Wilk's lambda = 0.87, $F(2,69) = 5.36$, $p = .007$, $\eta_p^2 = .13$), social desirability (Wilk's lambda = 0.84,

F(2,69) = 6.75, p = .002, η_p^2 = .16), and robot type (Wilk's lambda = 0.86, F(2,69) = 5.43, p = .006, η_p^2 = .14) had effects on their cognitive and affective trust toward the robots. Participants' beliefs about the extent to which members of the Western society would ascribe competence to robots was positively correlated with affective trust toward both robots (r = .26, p = .020). Self-reported control over technology was positively correlated with cognitive trust felt toward the two robots (r = .34, p = .002). The higher participants' scores on social desirability, the lower their scores on cognitive trust toward the robots (r = −.44, p < .001). Overall, people with high affective trust also reported higher cognitive trust (r = .40, p < .001). Contrary to prediction H4a, participants showed less cognitive trust toward the male robot shape (M_{MS} = 4.12, SD_{MS} = 0.81) than toward the female robot shape (M_{FS} = 4.30, SD_{FS} = 0.88, F(1,70) = 4.22, p = 0.44, η_p^2 = .06. In line with prediction H4b, participants showed more affective trust toward the female robot (M_{FS} = 3.75, SD_{FS} = 0.80) than toward the male robot (M_{MS} = 3.10, SD_{MS} = 0.98; F(1,70) = 9.97, p = .002, η_p^2 = .13).

4 Discussion

In an online survey, we investigated the impact of waist-to-hip ratio (WHR) and shoulder width (SW) in robot prototypes. Further, we explored whether participants would ascribe gender stereotypical traits and show a preference for gender stereotypical tasks, cognitive or affective trust to a robot according to perceived robot gender. To do so, we created pictures of a robot and manipulated WHR and SW. As predicted, a robot with WHR 0.9 and 100% SW was rated as male. A robot with WHR 0.5 and 80% SW was rated as female, respectively. More importantly, in line with our predictions, participants tended to ascribe more communal traits to a female robot. Further, they rated it as more suitable for stereotypical female tasks and showed more affective and surprisingly, even more cognitive trust toward the female robot compared to the male robot. Although participants tended to rate the male robot as more suitable for stereotypical male tasks, they did not ascribe more agentic traits and more cognitive trust to the male robot than to the female robot. These results demonstrated that robot body shape elicited gendered perceptions in robots and affected evaluations of the male vs. female robot prototypes. Interestingly, our predictions were mainly confirmed for the female robot. The reason might be that male gender is commonly used as a "default" [17]. In our case, the female robot might have violated participants' expectation that robots are commonly male. This violation of this expectation might have activated participants' associations, attitudes, stereotypes, and beliefs about female gender. This in turn, might have caused them to respond accordingly and in line with our predictions about participants' evaluations of the female robot (e.g., [5]). Relatedly, participants' beliefs about female traits prevalent in Western society about robots in general influenced their ratings on the robot's suitability for gender stereotypical tasks. Further, participants high in social desirability might have adapted their explicit ratings on robot suitability for stereotypical female tasks according to their beliefs about the cultural impact on perceived warmth in robots. The higher participants' intention to act social desirably, the less cognitive trust they showed to the robot. Interestingly, social desirability did not affect trait attribution, nor affective trust which was expected to be related to female gender. Control over technology was related to cognitive trust, but not to affective trust. This supports the link between cognitive trust as a distinct dimension of trust and robot functions [11]. Designers should consider that subtle manipulations of robot body shape cause gender attribution on robots. This in turn, determines trait attributions, ratings of robot suitability for gender stereotypical tasks, and even trust toward robots. Hence, the salience of robot gender activates stereotypes even toward robots which impact HRI.

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References

1. Fiske, S.T., Cuddy, A.J., Glick, P.: Universal dimensions of social cognition: warmth and competence. Trends Cogn. Sci. **11**(2), 77–83 (2007)
2. Eyssel, F., Hegel, F.: (S)he's got the look: gender stereotyping of robots. J. Appl. Soc. Psychol. **42**(9), 2213–2230 (2012)
3. Johnson, K.L., Tassinary, T.L.: Perceiving sex directly and indirectly: meaning in motion and morphology. Psychol. Sci. **16**(11), 890–897 (2005)
4. Lippa, R.: Sex typing and the perception of body outlines. J. Pers. **51**(4), 667–682 (1983)
5. Bem, D.L., Allen, A.: On predicting some of the people some of the time: the search for cross-situational consistencies in behavior. Psychol. Rev. **81**(6), 506 (1974)
6. Schneider-Düker, S., Kohler, A.: Die Erfassung von Geschlechtsrollen: Ergebnisse zur deutschen Neukonstruktion des Bem Sex-Role Inventory [Assessment of gender roles: German version of Bem sex-role inventory]. Diagnostica **34**, 256–270 (1988)
7. Fiske, S.T., Cuddy, A.J., Glick, P., Xu, J.: A model of (often mixed) stereotype content: competence and warmth respectively follow from perceived status and competition. J. Pers. Soc. Psychol. **82**(6), 878–902 (2002)
8. Johnson, D., Grayson, K.: Cognitive and affective trust in service relationships. J. Bus. Res. **58**(4), 500–507 (2005)
9. Lewis, J.D., Weigert, A.: Trust as a social reality. Soc. Forces **63**(4), 967–985 (1985)
10. Waytz, A., Heafner, J., Epley, N.: The mind in the machine: anthropomorphism increases trust in an autonomous vehicle. J. Exp. Soc. Psy. **52**, 113–117 (2014)
11. Hancock, P.A., Billings, D.R., Schaefer, K.E., Chen, J., de Visser, E., Parasuraman, R.: A meta-analysis of factors affecting trust in human-robot interaction. Hum. Fact. J. Hum. Fact. Ergon. Soc. **53**(5), 517–527 (2011)
12. Schaefer, K.: The perception and measurement of human-robot trust. Dissertation (2013)
13. Neyer, F., Felber, J., Gebhardt, C.: Entwicklung und Validierung einer Kurzskala zur Erfassung von Technikbereitschaft [Technology commitment]. Diagnostica **58**, 87–99 (2012)
14. Waytz, A., Cacioppo, J., Epley, N.: Who sees human? The stability and importance of individual differences in anthropomorphism. Perspect. Psychol. Sci. **5**(3), 219–232 (2010)

15. Stöber, J.: The Social Desirability Scale-17 (SDS-17): convergent validity, discriminant validity, and relationship with age. Eur. J. Psychol. Assess. **17**(3), 222 (2001)
16. Rollero, C., Glick, P.: Tartaglia: psychometric properties of short versions of the ambivalent sexism inventory and ambivalence toward men inventory. TPM Test. Psychom. Methodol. Appl. Psychol. **21**(2), 149–159 (2014)
17. Devine, P.G.: Automatic and controlled processes in prejudice: The role of stereotypes and personal beliefs. In: Pratkanis, A.R., Breckler, S.J., Greenwald, A.G. (eds.) Attitude Structure and Function: The Third Ohio State University Volume on Attitudes and Persuasion, pp. 181–212. Lawrence Erlbaum Associates, Hillsdale (1989)