Customer Responses to (Im)Moral Behavior of Service Robots Online Experiments in a Retail Setting

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Abstract

Service robots play an increasingly important role in the service sector. Drawing on moral psychology research, moral foundations theory as well as the computers-as-social-actors (CASA) paradigm, this experimental study containing of four online experiments examines the extent to which the moral or immoral behavior of a service robot affects customer responses during a service interaction. This study contributes to design science by defining, conceptualizing and operationalizing morality of service robots and developing a corresponding vignette as basis to manipulate (im)moral robotic behavior in a retail setting. To investigate possible effects of the robot's appearance, we tested our hypotheses with two different robots, i.e., a humanoid robot and an android robot. Results from the online experiment indicate that the (im)moral behavior of service robots at the customer interface has a significant effect on customers' trust and customers' ethical concerns towards the robot.

Keywords: design science, human-robot interaction, moral psychology of robotics, service robot morality

1. Introduction

Through its intersection between productivity and personalization, the service sector has always played an important role in promoting new innovations and technological advancements (Etemad-Sajadi et al., 2022). Consequently, the deployment of service robots in frontline services has increased immensely over the last years (Wirtz et al., 2018), which is why human-robot relations advance and increase steadily. Service robots are "system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization's customers" (Wirtz et al., 2018, p. 909). Cutting-edge technologies and the fast developments in the area of artificial intelligence enable service robots to act with a high degree of autonomy, which allows rich interactions with humans and increases the robot's social presence (Jörling et al., 2019). Due to their perceived social presence and their human-like appearances, robots are no longer noticed as fully remote-controlled machines, but are increasingly perceived as social entities as well as social interaction partners (van Doorn et al., 2017).

In light of these developments, service robots quickly move away from performing work that is "dull, dirty, or dangerous" (Lin et al., 2014, p. 4). Instead, they are more and more capable to give purposive advice to customers, assist and guide them to find products in the store or provide them with personalized offers and recommendations (Lu et al., 2020; Song & Kim, 2022; Wirtz et al., 2018). Hereby, customers can benefit from improved and consistent service quality as well as enhanced shopping experiences at the customer interface (Mende et al., 2019; Pantano & Scarpi, 2022). The social presence of service robots and their advanced human-likeness can strengthen customer trust and increase the proximity between customers and the service robot (van Doorn et al., 2017). However, as the relationship between the service robot and the customer gets closer, the severe potential for deceiving customers grows (De Graaf, 2016). Although there has been much discussion about the marketing aspects and adequate use of service robots at the customer interface (Lu et al., 2020; Wirtz et al., 2018), there has been little consideration of ethical implications for customer responses. Followingly, a particularly important question relates to the ethically correct reasoning (Sullins, 2015) or the morality of service robots (van Dang et al., 2017) in the service context.

Some scholars argue that the terms ethics and morality can be applied interchangeably (Deigh, 1995). However, different definitions of these terms can be found in the literature. Ethics is defined as the "philosophical study of morality" (Deigh, 1995, p. 284), emphasizing its theoretical focus. In contrast, morality is seen as "a set of personal or social standards for good or bad behaviour and character" (Cambridge University Press, n.d.), emphasizing its practical nature. Morality is subjective and can thus be influenced by society or culture (Tangwa, 2005).

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In human-human interactions, ethical understandings are investigated by moral psychology research, which is defined as "the study of the intersection of behavior, motivations and questions about our moral agency" (Plaisance, 2015, p. 14). Regarding human-robot interactions (HRI), we will rely on the moral psychology of robotics which "reflects a new era in research, where moral psychological phenomena will no longer reflect interactions between people, but between people and autonomous AIs" (Laakasuo et al., 2019, p. 38). It has been shown that "themes dealt with in the moral psychology of robotics […] are getting closer to real-world relevance, or are already there" (Laakasuo et al., 2021a, p. 21). Researchers emphasize the importance of ethical principles and morality in robots and assume such principles will be applied to every robot in the future (van Dang et al., 2017). However, research on moral psychology of robotics is still "in its infancy" (Laakasuo et al., 2021b, p. 1686; Scheutz & Malle, 2018).

The increasing control of service robots by AI-based algorithms makes the prevention of deviant and immoral behaviors through remotely-controlled mechanisms difficult. Because of the increased complexity of information processing and the inaccuracy and falsity of available information, intelligent systems, such as service robots, need to be able to determine the appropriate action (Wallach & Allen, 2013). Wallach and Allen (2009) suggest that if there is an increase in the artificial system's autonomy and its ethical sensitivity (i.e., sensitivity to moral considerations), it will lead to an increase in the level of its morality. Consequently, as robots become more sophisticated and their autonomy expands, robots may soon move from being operationally moral (i.e., the morality of the system's action and choices is defined by the agent's designer) to being functionally moral (i.e., the robot has the capacity and ability to evaluate behavior and responses in a moral manner, without human intervention) (Wallach & Allen, 2009, 2013). Through the increased deployment of robots, humans are more often affected by autonomous machines, such as service robots, which make decisions with moral implications (Laakasuo et al., 2021b). Against this background, an investigation of moral robotic behavior and corresponding customer responses during the service encounter is timely and necessary.

Addressing this issue, we draw on design science research to develop and evaluate an integrated framework for the examination of service robot morality in human-robot interactions. Design science focuses on the development of new and innovative artifacts in order to understand and solve problems and expand current boundaries (Hevner et al., 2004; Peffers et al., 2007). Thus, design science integrates "principles, practices, and procedures required to carry out such research" (Peffers et al., 2007, p. 46). Value-sensitive design, for instance, is a field of research which addresses the embedment of societal and moral values into technologies and aims to guide the design and creation of technological artifacts (Simon, 2016).

We raise the following research questions for *design science* literature:

RQ1) How can a service robot's morality be defined, conceptualized and operationalized in a retail setting?

RQ2) How can (im)morality of a service robot be manipulated in a retail setting?

From a *content-related* perspective, we ask:

RQ3) How do customers respond to (im)moral behavior of a service robot in a retail setting?

This study has two overall contributions. First it contributes to design science literature. By proposing a framework for the investigation of morality of service robots in a service setting as guidance on a value-sensitive design of HRI (Figure 1), we introduce a new artifact relying on design science.

From a content-related perspective, this study contributes to current research in several important ways: First, we examine the so far underexplored topic of the ethical design of service robots during the service encounter with customers. Specifically, we investigate service robot's (im)moral behavior during a customer-robot interaction in a retail setting.

Second, we attempt to take a closer look into customer responses to a service robot's moral behavior.

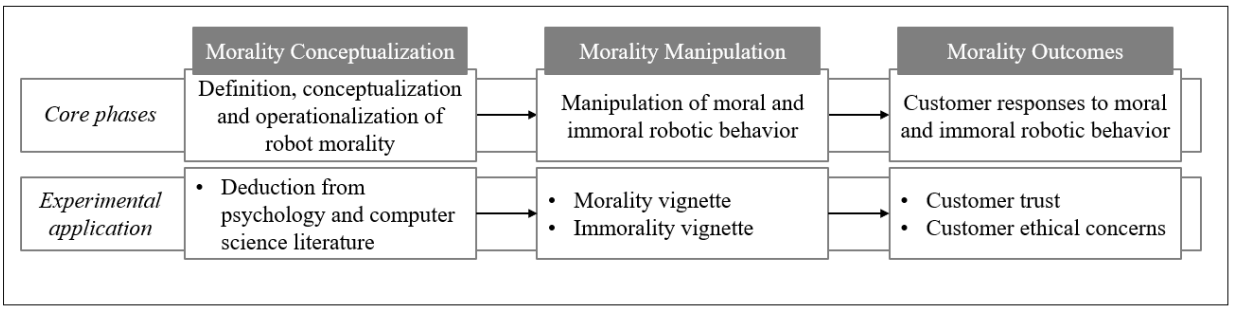

Figure 1. Design science framework for morality in human-robot interactions.

To acquire a better understanding of moral psychological mechanisms of the HRI during a service encounter, we shed light on customers' responses in regard to their trust and ethical concerns to (im)moral behaviors of service robots.

Third, as customer responses can vary depending on the robotic appearance and the human-likeness of the robot, this study tested the hypotheses with two types of robots, i.e., a humanoid robot and an android robot.

2. Design science framework for morality in human-robot interactions

2.1. Online study 1 – How to define, conceptualize and operationalize morality of a service robot

In order to answer our first research question (*"How can a service robot's morality be defined, conceptualized and operationalized in a retail setting?*"), we draw on the definition of descriptive morality by Banks (2019), where morality describes "what people […] do in relation to questions of right and wrong" (Banks, 2019, p. 364). Applied to artificial agents, morality can be seen as "functions engaged by agents in determining what counts as 'good' or 'bad'" (Banks, 2019, p. 364). Referring to these definitions, we define that a service robot's morality relates to how a service robot behaves and reacts in regard to what is right or wrong.

To measure a service robot's morality in a retail setting, we conducted an online study via the platform Amazon Mechanical Turk (MTurk). We utilized an experimental vignette methodology (Aguinis & Bradley, 2014), which is suitable to create a comparable scenario for all participants. A vignette is a "short, carefully constructed description of a […] situation, representing a systematic combination of characteristics" (Atzmüller & Steiner, 2010, p. 128). In the online study participants had to read a conversation between a service robot and a customer in a retail store. During the conversation, the service robot behaved either morally or immorally. Afterwards, the participants had to rate the perceived morality of the service robot. For this purpose, we utilized and validated the morality scale by Banks (2019), which contains six items. The participants indicated their answers on a 5-point Likert-scale (1: *absolutely disagree* to 5: *absolutely agree*).

After the exclusion of invalid cases due to incomplete data sets, false answers to the attention check or speeding (Leiner, 2019), 29 cases (65 % male, 35 % female, M_{age} = 38.00 years, SD_{age} = 10.69) remained for data analysis. The data was exposed to an exploratory factor analysis, utilizing principal component analysis and Varimax rotation. The suitability of the data for factor analysis was verified according to the Kaiser-Meyer-Olkin measure as well as the Bartlett's test of sphericity. As the Kaiser-Meyer-Olkin measure (KMO = 0.83) was higher than the threshold value of 0.6 and the Bartlett's test was significant (χ^2 (15) = 104.29, $p < .001$), the data was appropriate for factor analysis (Shrestha, 2021).

The results of the factor analysis revealed one factor with 67.26% variance explained (Table 1). The morality scale showed an acceptable internal consistency. The reliability of the scale was measured with Cronbach's alpha (α), which was high (α = .89) (Taber, 2018). In sum, the results point towards the conclusion that this scale is reliable and well suited to measure moral behavior of service robots in a service setting and was therefore utilized in the following online experiments.

2.2. Online studies 2-4 – How to manipulate moral and immoral behavior of service robots

Extant literature shows that ethical concerns towards service robots mainly include privacy as well as security risks (Fosch-Villaronga et al., 2020; Lu et al., 2020). This may be the case, as mistakes or errors made by service robots can result in dangerous situations, which can jeopardize peoples' safety (Etemad-Sajadi et al., 2022).

Furthermore, immoral behavior can be expressed

Table 1. Factor loadings of morality scale (adapted from Banks, 2019).

Morality – M = 3.33 (SD = .92), Cronbach's α = .89, 67.26% variance explained	
Item	Factor loading
During the conversation…	
…the service robot had a sense for what was right and wrong.	.871
…the service robot thought through whether its action was moral.	.786
…the service robot felt obligated to behave in a moral way.	.921
…the service robot was capable of being rational about good and evil.	.745
…the service robot behaved according to moral rules.	.891
…the service robot refrained from doing this that have painful repercussions.	.681

by disrespecting other human beings (Cureton, 2013) or other stakeholders, such as the environment (Palmer et al., 2014). Consequently, a service robot may explicitly express disrespect towards the customer or other interest groups. In addition, a service robot can act immorally by deceiving or manipulating the customer (Sparrow & Sparrow, 2006; Wallach & Allen, 2009).

We further draw on the prominent and well-respected theory in the field of moral psychology, the moral foundations theory (MFT) (Doyle-Burke & Haring, 2020; Graham et al., 2013; Haidt et al., 2009). The MFT describes five moral foundations, namely care/harm, fairness/cheating, loyalty/betrayal, authority/subversion, as well as sanctity/degradation (Haidt et al., 2009). As not all moral foundations seem appropriate in a customer-robot interaction in a retail setting, we mainly draw on the dimensions of care/harm, fairness/cheating and loyalty/betrayal. Thus, for the moral condition, the service robot is fair, honest and loyal and tries to care for the customer. In the immoral condition, the service robot is unjust and tries to harm the customer.

To answer our second research question ("*How can (im)morality of a service robot be manipulated in a retail setting?"),* we conducted an online experiment via the platform MTurk. We developed a conversation script between a service robot and a customer, where the service robot's morality was manipulated. In the moral condition, the service robot pays attention to the aspects of safety, data security (i.e., privacy), respect for others and respect for the environment and emphasizes their importance in a moral perspective, while the service robot in the immoral condition violates these aspects (Figure 2).

In the online experiment the participants were shown a picture of either a humanoid or an android service robot and asked to imagine themselves in the role of the customer interacting with the service robot in the picture in a retail store. The conversation between the human customer and the service robot was then demonstrated, with the service robot behaving either morally or immorally. Subsequent to the conversation, the participants were asked to rate the service robot's morality. We assessed the perceived service robot morality via the six-item scale adapted from Banks (2019). T-tests were used to detect differences between the moral and immoral conditions.

As the manipulation checks in online study 2 and 3[1] were not significant, the conversation scripts were revised and adjusted. We additionally considered participant feedback retrieved from open text boxes at the end of the online experiment as valuable source in order to modify the conversation. In online study 4[2] the manipulation check was highly significant, both for the humanoid service robot ($p < .001$) and for the android service robot ($p < .05$) (Table 2). These findings indicate that participants were clearly able to differentiate between moral and immoral behavior of the service robots.

Moral Behavior	Exemplary sources	Sample statements for moral robotic behavior	Sample statements for immoral robotic behavior
Safety / care	Graham et al. (2013); Haidt et al. (2009); Etemad-Sajadi et al. (2022)	• "Product X has an official security seal, which means that it is super safe" • "High moral standards are important to me when I serve my customers. And from a moral perspective, product X is the best choice for you as it will generate the most benefit for you"	• "There were several accidents with product Y. The product may not be super safe. But so far, they all seem to have survived…as far as I know at least […] I would definitely recommend product Y"
Respect for others	Cureton (2013); Graham et al. (2013)	• "Product X is even quieter than product Y, so your neighbors will be happy as well" • "I see it as my moral duty to answer honestly"	• "Product Y is louder than product X, but I mean, even if the neighbors should complain, they will survive, right?"
Respect for environment	Palmer et al. (2014)	• "Product X uses environmentally friendly materials, which is not the case for product Y unfortunately" • "With the purchase of product X you will protect the environment"	• "Product X uses environmentally friendly materials, which is not the case for product Y. But who cares about the environment?"
Data security / privacy	Fosch-Villaronga et al. (2020); Lu et al. (2020); Etemad-Sajadi et al. (2022)	• "We will store your data safely for internal use only. Do you have any concerns or further questions on this?"	• "We will store your data for internal use. We will also sell it to a market research institute […] but too late for concerns, you are all set"

Figure 2. Sample statements for (im)moral robotic behavior used in online experiment.

[1] Online study 2 (n = 190 US MTurkers, 46 % male, 54 % female, M_{age} = 37.70 years, SD_{age} = 9.24); online study 3 (n = 101 US MTurkers, 53 % male, 46 % female, 1 % diverse, M_{age} = 37.24 years, SD_{age} = 11.92)

[2] Online study 4 (n = 100 US MTurkers, 56 % male, 44 % female, M_{age} = 37.48 years, SD_{age} = 9.45)

Table 2. Manipulation check: T-test for mean differences of perceived service robot morality.

Robot type	Moral condition M (SD)	Immoral condition M (SD)	ΔM	Sig.
Humanoid robot	4.33 (.54)	3.17 (1.15)	1.17*	< .001
Android robot	4.06 (.67)	3.45 (1.19)	0.61*	< .05

*Notes: Measured on a 5-point Likert scale: 1 = absolutely disagree, 5 = absolutely agree; M = Mean; SD = Standard deviation; ΔM = Mean difference; n = 100; *p < .05*

3. Customer responses to a service robot's (im)moral behavior

3.1. Online study 4 – Customer trust and customer ethical concerns

As service robots work and engage directly with customers, the interaction can have an enormous impact on the company's reputation (Etemad-Sajadi et al., 2022). Therefore, companies need to ensure that customers feel comfortable during the HRI. In this matter, extant literature emphasizes the importance of ethical robot behavior during the HRI (Lu et al., 2020; Wirtz et al., 2018). Endorsing this idea, prior research indicates a positive relationship between higher perceived morality and trust (Banks, 2019). Trust is defined as "the attitude that an agent will help achieve an individual's goals in a situation characterized by uncertainty and vulnerability" (Lee & See, 2004, p. 51). More specifically, trust in buyer-seller relationships consists of the perceived competence (i.e., the trustee is effective and reliable) and benevolence of the trustee (Doney & Cannon, 1997). Benevolence trust considers "the care and concern that the trustee (robot) [has] for the genuine welfare of the other party (customer)" (Wirtz et al., 2018, p. 918). As service robots perform increasingly complex tasks and services (Wirtz et al., 2018), trust between the customer and the service robot becomes more and more important. Due to the robots' human-likeness and their advanced artificial emotions and movements, robots are increasingly able to influence or even persuade and deceive humans (Ham & Spahn, 2015).

In this matter, we draw on the computers-as-social-actors (CASA) paradigm, which states that people subconsciously apply social scripts from human-human interactions to computers (Nass & Moon, 2000). As customers perceive service robots as social actors (van Doorn et al., 2017), we assume that customers mindlessly apply similar social responses and behaviors to service robots than to human service representatives. Since extant literature has shown a positive relationship between ethical behavior of a human service agent and customer trust in service settings (Ou et al., 2015; Román & Ruiz, 2005), we assume a similar effect between customers and service robots. Therefore, we hypothesize the following:

H1: Customers' trust is higher towards moral service robots than towards immoral service robots.

Moreover, ethical considerations can have a detrimental impact on the interaction between customers and new technology, such as robots (Etemad-Sajadi et al., 2022). Such ethical concerns may arise due to the perceived asymmetry between the customer and the robot (i.e., robots may be able to deceive the customer but not the other way around) (Ham & Spahn, 2015) or due to the perception that intelligent machines make moral considerations by calculating costs and benefits (Everett et al., 2017). Consequently, customers may show high ethical concerns, engaging in reluctant and resistant behaviors towards service robots. We assume that the perception of immoral behavior of a service robot during the service encounter will increase customers' ethical concerns. Thus, we hypothesize:

H2: Customers' ethical concerns are higher towards immoral service robots than towards moral service robots.

Robotic design (i.e., artificial attributes and expressions), such as gaze, facial expressions or human-likeness can impact human responses to service robots (Belanche et al., 2021; Kirby et al., 2010; Mende et al., 2019; Trovato et al., 2017; Yamazaki et al., 2010). Similarly, it has been shown that humans' moral judgments get influenced by the artificial appearances of robots as well as the robot type (Laakasuo et al., 2021b; Malle et al., 2016). In accordance with the uncanny valley paradigm which proposes a relationship between the human-like appearance of the robot and the associated human reaction (Mori, 1970), we argue that customers will respond differently to the humanoid service robot than to the android service robot. The uncanny valley paradigm presumes that humans' affinity for human-like robots increases until the extent to which the robot becomes overly human-like (Mori, 1970; Mori et al., 2012). At that point, people get a feeling of eeriness and discomfort (Mori et al., 2012). Supporting this notion, Laakasuo et al. (2021b) reported a moral uncanny valley effect, where participants rated "moral choices by human-looking robots as less ethical than the same choices made by a human or a non-uncanny robot" (p.1684). Thus, we assume that customers may show higher trust towards the humanoid

robot, avoiding the uncanny valley effect. In addition, due to anthropomorphizing effects, we presume that customers may expect higher moral behavior of the android (i.e., human-like) robot, which may in turn result in higher ethical concerns in case of immoral behaviors of the service robot at the customer interface.

This leads to the following hypotheses:

H3: Customers' trust is higher towards the humanoid than towards the android service robot.

H4: Customers' ethical concerns are higher towards the android than towards the humanoid service robot.

3.2. Methods

Participants. The online survey sample for study 4 was collected via MTurk (n = 100 US MTurkers, 56 % male, 44 % female, M_{age} = 37.48 years, SD_{age} = 9.45). Only US-MTurkers with a historic acceptance rate greater than 97% were able to participate in our study to ensure data quality. The respondents reported some experience with robotic technologies (M = 3.46, SD = 1.29, 5-point Likert-scale). For around 40% of the participants this experience was in the form of an interaction with a service robot in a hotel or restaurant, while around 30% indicated to only have interacted with chatbots. Others had only seen robots, but not interacted with them (13%).

Procedure. To answer our third research question ("*How do customers respond to (im)moral behavior of a service robot in a retail setting?"),* a 2 (moral vs. immoral behavior) x 2 (humanoid vs. android robot) between subject design was used for our experiment. Thus, the participants were randomly assigned to one of the four conditions. In the beginning of the survey the participants answered questions regarding their demographics. The respondents were then shown a picture of a humanoid or an android service robot, respectively, and indicated their general ethical concerns towards service robots. Participants were then asked to take on the role of the customer in the retail store and read the conversation between the customer and the service robot. To counteract possible inattentiveness of the MTurkers (Aguinis et al., 2021), the survey included several screening questions (e.g., "Which role had the service robot during the conversation?") as attention checks. After the presented conversation a post-stimuli survey was conducted, which included items on the customers' ethical concerns towards the service robot in the conversation and their trust towards the service robot. In addition, the participants rated the comprehensibility and realism of the demonstrated scenario. The participants rated the conversation as very easy to understand (M = 4.35, SD = .80, 5-point Likert-scale) and very realistic (M = 4.00, SD = 1.07, 5-point Likert-scale).

Measures. To assess trust towards the service robot we relied on measures adapted from McKnight et al. (2002). The utilized trust scale comprised seven items in total and consisted of two sub-scales relating to the service agent's competence (four items, e.g., "The service robot was competent and effective in providing advice"; α = .87) and benevolence (three items, e.g., "The service robot acted in the customer's best interest"; α = .89). A 5-point Likert-scale (1: *absolutely disagree* to 5: *absolutely agree*) was utilized to indicate answers.

To assess ethical concerns towards the service robot, we adapted items from Dinev et al. (2006). Our ethical concerns measure contained four items. Ethical concerns were measured before the demonstrated conversation (e.g., "In a retail setting, a service robot could misuse its position"; α = .91) and after the conversation (e.g., "Based on the conversation I just read, I am concerned that a service robot in a retail setting could misuse its position"; α = .93). A 5-point Likert-scale (1: *absolutely disagree* to 5: *absolutely agree*) was utilized to indicate answers.

3.3. Results

We used t-tests to detect differences in mean values in order to evaluate the impact of the morality of the service robot on customers' trust and ethical concerns. Table 3 shows the t-test results for the three outcome variables (i.e., competence trust, benevolence trust and ethical concerns) for both types of robots.

Our findings indicate that customers' trust is significantly higher towards moral service robots than towards immoral service robots. More specifically, for both the humanoid and the android robot, the participants' mean scores for competence trust and benevolence trust were significantly higher for participants in the moral condition as compared to in the immoral condition ($p < .05$). These results support our hypothesis 1.

Further, we examined the effect of a service robot's morality on customers' ethical concerns. The general ethical concerns that participants indicated prior to the manipulation did not differ significantly between the moral and the immoral condition, neither for the humanoid robot (moral: M = 2.76, SD = 1.26; immoral: M = 2.92; SD = 1.26, t(48) = -.455, p = .65), nor for the android robot (moral: M = 3.24, SD = 1.02; immoral: M = 3.21; SD = 1.23, t(48) = .101, p = .92). Thus, the sample did not show any significant asymmetries in regard to their ethical concerns before the experiment. In addition, these findings suggest that customers do

Table 3. Results of online study 4.

Outcome variable	Robot type	Moral condition M (SD)	Immoral condition M (SD)	ΔM	Sig.
Trust: Competence	Humanoid robot	4.42 (0.61)	3.50 (1.09)	0.92*	<.001
	Android robot	4.16 (0.68)	3.70 (0.86)	0.46*	<.05
Trust: Benevolence	Humanoid robot	4.40 (0.58)	3.27 (1.31)	1.13*	<.001
	Android robot	4.13 (0.84)	3.42 (1.15)	0.71*	<.05
Ethical concerns	Humanoid robot	2.40 (1.22)	3.36 (1.20)	0.96*	<.01
	Android robot	2.91 (1.26)	3.77 (1.01)	0.86*	<.05

*Notes: Measured on a 5-point Likert scale: 1 = absolutely disagree, 5 = absolutely agree; M = Mean; SD = Standard deviation; ΔM = Mean difference; n = 100; *p < .05*

indeed have ethical concerns towards service robots.

Investigating our hypothesis 2, the findings revealed that customers show significantly higher ethical concerns towards the immoral service robot than towards the moral service robot. This effect was found for both the humanoid robot and the android robot ($p < .05$). These results support hypothesis 2.

Regarding the effect of robotic appearance (i.e., humanoid vs. android service robot) on customers' trust and ethical concerns, no significant differences were found. The participant's mean scores in regard to competence trust, benevolence trust and ethical concerns did not differ significantly based on the type of robot within the conditions ($p > .05$). Thus, hypothesis 3 and hypothesis 4 could not be supported.

4. Discussion

4.1. Research implications

Starting point for this study was the observation that service robots are increasingly deployed in hotels, restaurants, retail stores, airports and shopping malls to increase service quality as well as the service experience (Pantano & Scarpi, 2022; Webster & Ivanov, 2020). The emerging deployment and the numerous commercial applications of service robots at the customer interface give rise to many critical questions in relation to robots' adequate placement, implementation and programming. Although research has considered and discussed the ethical concerns regarding the use of service robots for other service fields, such as elderly or child care (Sharkey & Sharkey, 2011) or military (Lin et al., 2014), the ethical aspects of the usage of service robots during the service encounter with customers has surprisingly hardly been considered so far. By addressing this important and so far underexplored topic, our study contributes to extant research in several important ways:

First, to our knowledge, the presented study is one of the first studies that aimed to understand the extent to which the moral or immoral behavior of a service robot affects responses at the customer interface in a retail setting. To this end, we conducted four online experiments. First, relying on HRI literature and moral psychology research, we conceptualized and operationalized a service robot's morality in a retail setting. Second, applying moral foundations theory (Haidt et al., 2009) to HRI, we developed two suitable vignettes as basis to manipulate moral and immoral behavior of service robots in a retail context. Third, we drew on the CASA paradigm (Nass & Moon, 2000) as well as the uncanny valley paradigm (Mori, 1970) to examine customer responses to moral and immoral behaviors of a service robot.

Our findings indicate that (im)moral robotic behavior has a significant effect on customers' trust and their ethical concerns towards the service robot. More precisely, our results revealed that customers' trust (i.e., competence and benevolence trust) was significantly higher towards moral than towards immoral service robots, whereas customers' ethical concerns were higher towards immoral than towards moral service robots. Contrary to the assumptions of the uncanny valley paradigm (Mori, 1970), the robotic appearance did not show any significant differences in our study.

Second, this study contributes to design science research in regard to the presented framework on how to investigate a service robot's morality in a service context and how to design an HRI in a value-sensitive manner. Thus, we introduce a new artifact and demonstrate implications for design science.

Third, by investigating the described interrelations and effects, this study expands current literature on the moral psychology of robotics as well as service marketing research. Our results indicate important implications regarding affective (e.g., trust), cognitive (e.g., perception of the robot) as well as behavioral (e.g., possible avoidance behavior due to ethical concerns) aspects for the relationship between the customer and the service robot during the service encounter, emphasizing the great importance of ethical considerations in HRI in service contexts.

4.2. Managerial implications

As noted earlier, service robots have an enormous potential to enhance services and create value for the service sector. In order to successfully implement service robots in the daily business, companies, practitioners and decision-makers in this field need to understand how service robots should be used, programmed and placed in order to satisfy the customer. This research can help to make the usage of service robots more desirable and beneficial for customers as well as companies by taking the ethical perspective into consideration.

Our study contributes to managerial knowledge in that it provides insights about desirable robotic behaviors at the customer interface. In particular, our findings reveal that customers are more likely to express ethical concerns towards immoral robots, while customers tend to trust service robots more when they are perceived as moral. As service robots are still a new technology that customers need to get acquainted to, the concepts of trust and (ethical) concerns play a major role as cornerstones of a safe and reliable HRI and as basis for robot acceptance. To develop service environments with robotic service agents that increase customers' trust and decrease their concerns, companies should consider moral robotic behaviors and related ethical aspects when programming and deploying service robots.

4.3. Limitations and future perspectives

Despite its contributions, this study has some limitations. To examine the effect of the robotic appearance, our study used static pictures of the service robots (i.e., humanoid and android service robot) as stimuli. Using static images as experimental stimuli can impact and bias participants' perceptions and responses as well as emotional experiences due to the lack of shared context and real interaction (Jung et al., 2021). Thus, as our results are based on a script-based online experiment with image stimuli, our study suffers from low external validity. Dynamic live-action videos, for instance, could have been more efficient for our online study as this method offers the possibility to show subtle differences in robots' exhibited behaviors (e.g., movements) or facial expressions (Jung et al., 2021). Future studies should conduct in-person experiments with real service robots in the laboratory and the field to examine the effect of the sense of social presence (Wirtz et al., 2018) and to get a deeper understanding of real interactions between customers and service robots.

In addition, the use of the online platform Amazon Mechanical Turk (MTurk) should be taken with caution. Although collecting data through MTurk has several advantages (e.g., large participant pool, speedy data collection process, reasonable costs), the potential downsides (e.g., the MTurker's inattention) need to be considered as well (Aguinis et al., 2021).

Further, our study only draws on a single service scenario of a service robot in a retail store. To increase the generalizability of our results, further service contexts and scenarios could be examined.

In addition, this study only manipulated moral vs. immoral behavior of the service robot. A potential next step could be to shed light on the effect of the degree of expressed morality on customer trust. Here it would be interesting to examine whether customer trust increases proportionally to the service robot's expressed morality or whether this relationship tilts at a certain level, resulting in mistrust, skepticism or the perception of deception.

As ethical sales behavior is positively associated with customer satisfaction and customer loyalty in human-human service interactions (Madhani, 2014; Román & Ruiz, 2005), future research could examine whether the moral or immoral sales behavior of service robots has a similar impact on the mentioned outcome variables in human-robot service interactions.

Finally, longitudinal approaches could be used to look into possible changes of customers' psychological effects and moral expectations or concerns towards service robots over time.

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6. References

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