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**Reducing deviant consumer behaviour with service robot guardians**

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## Reducing deviant consumer behaviour with service robot guardians

### Abstract

**Purpose** – Can service robots safeguard servicescapes from deviant consumer behaviour? Using Routine Activity Theory, this research examines whether increasing the perceived humanness of service robots reduces customer intentions to commit deviant consumer behaviour, and whether this negative relationship is mediated by perceived empathy and perceived risk of being caught.

**Design/methodology/approach** – Five hundred and fifty-three US residents responded to a hypothetical scenario that manipulated the humanness of a service agent (from self-service technology, to robot, to human employee) across seven conditions and measured the likelihood of deviant consumer behaviour, empathy towards the service robot, perceived risk of being caught and punished, and negative attitudes towards robots.

**Findings** – The results indicate that replacing human service agents with different types of service robots does inadvertently reduce customer perceptions of capable guardianship (i.e., the human element that deters potential offenders from committing crimes) in the servicescape and creates conditions that allow customers to perpetrate more deviant consumer behaviour.

**Originality/value** – Moving beyond research on customer adoption and use, this research examines the unintended consequences that might arise when deploying service robots in a technology-infused service environment. Humanised service robots offer more guardianship than self-service technology but do not replace human employees in preventing deviant consumer behaviour, as they remain more capable of deterring customer misbehaviour.

**Practical implications** – When investing in technology such as service robots, service providers need to consider the unintended cost of customer misbehaviour (specifically deviant consumer behaviour) in their return-on-investment assessments to optimise their asset investment decisions.

**Keywords** service innovation, consumer deviance, robotics, servicescape

## 1. INTRODUCTION

Emergent service technologies such as artificial intelligence, robotics and augmented reality are radically transforming the customer experience in service industries (Kunz, Heinonen and Lemmink, 2019). A significant breadth of research has examined the capability of a variety of service technologies across service industries such as retailing (Grewel *et al.*, 2017), hospitality (Ivanov *et al.*, 2019), healthcare (Čaić *et al.*, 2018) and education (Sisman and Kucuk, 2019). Indeed, the World Economic Forum (2020) estimates that by 2025, humans and machines will spend equal amounts of time performing service tasks at work.

Service robots, which are ‘system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organisation’s customers’ (Wirtz, Patterson, Kunz, Gruber, Lu, Paluch and Martins, 2018, p. 909), are increasingly replacing human service agents in an effort to improve productivity and cut costs (Marinova, de Ruyter, Huang, Meuter, and Challagalla, 2017; Mende, Scott, van Doorn, Grewel and Shanks, 2019). For example, robotic arms are serving coffee in CafeX (Cafesapp, 2021) and pizza in Paris (Chulain, 2021), while static humanoid robot Monty operates in a local café and food retailer (MontyCafe, 2021), and mobile humanoid robot Amy works in retail and hospitality (Quantum Robotics, 2021). It seems inevitable that interactions between service robots and customers will soon be more commonplace than interactions between human service agents and customers (Mende *et al.*, 2019; Wirtz *et al.*, 2018).

However, the economics behind investing in service robots is not as straightforward as claims suggesting that ‘robots are cheaper than human employees’ (Mortimer and Dootson, 2017). According to Beck and Hopkins (2016, p. 1080), ‘[o]ne of the unintended consequences of technological innovation is that it can promote opportunities for crime’. Historically, replacing frontline employees with self-service technologies in servicescapes saw huge rises in theft (Robinson, 2011; Silmalis, 2012; Beck, 2018; Beck, 2011), which was a cost not previously considered in the return-on-investment calculation. Concerningly, the introduction of self-service checkouts also saw the emergence of new types of shoplifters, including customers who would not normally shoplift but saw an opportunity to do so afforded by the new technology (Taylor, 2016). There is also risk to the service robots themselves (and by extension, the investment of the firm) as it is not uncommon for humans to abuse robots, whether that is a drunk person attacking a security service robot (BBC News, 2017), children kicking and punching a kindergarten robot (Brščić *et al.*, 2015), or attempts to steal from delivery robots, which prompted the introduction a ‘screaming’ feature (Palermo, 2022). These examples suggest that consumers may alter their behaviour in costly and unfavourable ways as service robots replace human service agents.

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3 Despite the rapid diffusion of service robots across many service industries, there is relatively little  
4 research exploring the unintended consequences of introducing technology-infused service experiences  
5 to customers (Choi, Mattila and Bolton, 2021; Marinova *et al.*, 2017). Automation of any kind ‘changes  
6 the nature of the work that humans do, often in ways unintended and unanticipated by the designers of  
7 automation’ (Parasuraman and Riley, 1997, p. 231). By adding service robots to the service experience,  
8 organisations may standardise service delivery and reduce errors of service provision through  
9 automation (Huang and Rust, 2018; Wirtz *et al.*, 2018), but may also unintentionally remove a human  
10 element that safeguards servicescapes from opportunistic customer misbehaviour (Daunt and Greer,  
11 2015; Cohen and Felson, 1979; Schepers and Streukens, 2022). Thus, it is critical to understand how  
12 the perceived humanness of different service robots impacts customer behaviour.  
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20 Using Routine Activity Theory (RAT; Cohen and Felson, 1979), this research explores whether  
21 replacing human service agents with different types of service robots may inadvertently reduce  
22 customer perceptions of capable guardianship (i.e., the human element that deters potential offenders  
23 from committing crimes) in the servicescape and create conditions that allow customers to perpetrate  
24 more opportunistic crime. Specifically, we investigate whether increasing the perceived humanness of  
25 a service robot reduces intentions to engage in deviant consumer behaviour, and whether this  
26 relationship is mediated by empathy and the perceived risk of being caught and moderated by a negative  
27 attitudes towards robots.  
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34 There is an opportunity in the literature to move the service field beyond asking how we can increase  
35 customer engagement with service robots to questioning whether this engagement will be positive and  
36 how we might mitigate opportunities for consumer deviance. In addressing this research opportunity,  
37 our work answers calls for research into service frontlines that are high in automated social presence  
38 with embodied service robots (van Doorn *et al.*, 2017) compared to human employees (Mende *et al.*,  
39 2019). Specifically, the research makes three main contributions to services literature. First, we present  
40 the first study to directly examine the unintended consequences associated with the emergence of  
41 service robots by investigating how customer propensity for deviant consumer behaviour is influenced  
42 by robot humanness. In doing so, we answer a call for research into whether a humanised service robot  
43 offers a perceived social presence that encourages obedience, as called for by Schepers and Streukens  
44 (2022). Second, we uncover the psychological mechanisms that help explain the relationship between  
45 perceived humanness and deviant consumer behaviour intentions (i.e., empathy, risk, and negative  
46 attitudes towards robots). Third, we examine the role of non-human actors in the social dimension of  
47 the servicescape, where only human actors have previously been considered as influencing customer  
48 behaviour (Rosenbaum and Massiah, 2011). Practically, we offer guidelines for service providers  
49 seeking to integrate service robots into a technology-infused servicescape around the need to enhance  
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3 humanness, empathy for the robot, and perceived risk of being caught enacting deviant consumer  
4 behaviour.  
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8 In the next section, we review literature on the social presence of service robots and the role of perceived  
9 humanness as a means of signalling capable guardianship as part of Routine Activity Theory (Cohen  
10 and Felson, 1979). Next, we propose the mediating relationships of perceived empathy and perceived  
11 risk of being caught and punished as mechanisms underpinning the perceived humanness of the service  
12 robot and deviant consumer behaviour relationship. We then introduce the moderating role of a negative  
13 attitudes towards robots, a psychological factor that impacts how customers interact with robots. We  
14 present the mediation and moderation results before discussing the findings, implications, and future  
15 research opportunities.  
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## 23 2. THEORETICAL FRAMEWORK

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26 The servicescape comprises four dimensions that influence how customers behave: a physical  
27 dimension, a social dimension, a socially symbolic dimension, and a natural dimension (Rosenbaum  
28 and Massiah, 2011). The social dimension focuses on how customers co-create value with employees  
29 and the resulting impact on the customer experience (Silva *et al.*, 2021), perceptions of service quality  
30 (Baker *et al.*, 1994), and customer's behavioural intentions to approach or avoid engaging with the  
31 service providers (Rosenbaum and Montoya, 2007). Employee and customers' verbal and non-verbal  
32 interactions make up the social dimension of a servicescape (Rosenbaum and Massiah, 2011). Most  
33 existing research assumes that these service agents are human, but non-human service agents can also  
34 be generated using technology and embedded in the servicescape (van Doorn *et al.*, 2017). For example,  
35 technology such as chatbots or robots use artificial intelligence to participate in functional service  
36 interactions and provide a level of automated social presence in the servicescape (Choi *et al.*, 2018; van  
37 Doorn *et al.*, 2017). This automated social presence allows customers to feel that they are co-creating  
38 with another social entity (Wirtz *et al.*, 2018).  
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47 Social presence, which is the 'sense of being with another' (Biocca, Harms and Burgoon, 2003, p. 465),  
48 can be created by non-human service agents when humans instinctively imbue inanimate objects with  
49 human-like characteristics, intentions, motivations, and behaviours (Epley, Waytz and Cacioppo,  
50 2007). This propensity is rooted in anthropomorphism, a psychological process in which individuals  
51 use their knowledge of humans and self to inductively infer the properties of the non-human agent  
52 (Epley *et al.*, 2007). Anthropomorphism facilitates interactions between human and non-human agents  
53 by (a) allowing humans to explain and predict the complex stimuli presented by non-human agents and  
54 (b) satisfying the human need for social connection by enabling connections with non-human agents  
55 (Epley *et al.*, 2007). Although the extent of anthropomorphism varies somewhat between individuals  
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3 (Epley *et al.*, 2007), this tendency to anthropomorphise is particularly salient when customers engage  
4 with non-human agents such as service robots (Blut, Wang, Wunderlich and Brock, 2021).  
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7 Service robots are a type of social robot designed to meaningfully interact with humans in a service  
8 setting (Wirtz *et al.*, 2018). Service robots are rapidly acquiring new capabilities, such as sophisticated  
9 natural language processing and biometric feature recognition (Wirtz *et al.*, 2018), that make them well-  
10 suited to working with customers (Marinova *et al.*, 2017). Service robots tend to be used to fulfil either  
11 customer service roles such as waiters or greeters, or operational roles such as baristas, surgical  
12 assistants, or aged care assistants (Čaić *et al.*, 2018; Mettler, Sprenger, and Winter, 2017). While service  
13 robots cannot wholly replace human service agents at this time, there are numerous contexts in which  
14 the cognitive-analytical and emotional-social characteristics of the service delivery context would allow  
15 service robots to operate without human service agents (Wirtz *et al.*, 2018).  
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23 Service robots are designed with varying attributes of representation, anthropomorphism, and task  
24 orientation (Wirtz *et al.*, 2018). First, robots can take a physical form (e.g., Yujin Robot's iRobi) or a  
25 virtual form (e.g., Apple's Siri) (Wirtz *et al.*, 2018). Second, robots can be designed to appear humanoid  
26 (e.g., Aldebaran's Nao robot) or non-humanoid (e.g., iRobot's Roomba) (Wirtz *et al.*, 2018). Finally,  
27 robots can complete analytical tasks (e.g., image processing to assess mask compliance) or socio-  
28 emotional tasks (e.g., greeting people) (Wirtz *et al.*, 2018). These robot attributes collectively influence  
29 the service robot's perceived humanness, which becomes the 'interaction counterpart' for customers  
30 (Wirtz *et al.*, 2018, p. 909).  
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37 Perceived humanness is 'the extent to which an individual is seen as having characteristics that are  
38 typical for humans' (Söderlund, 2021, p. 17). Service robots evoke perceived humanness through their  
39 morphology, which might comprise a face, arms and legs, as well as human-like characteristics such as  
40 warmth (Mende *et al.*, 2019; Söderlund, 2021). Perceived humanness distinguishes service robots from  
41 self-service technologies that can perform functional tasks but cannot engage in social connection (Choi  
42 *et al.*, 2018; van Doorn *et al.*, 2017). Thus, service robots are capable of being perceived as an employee  
43 that forms part of the social dimension of a servicescape (Rosenbaum and Massiah, 2011).  
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49 Research demonstrates that perceiving non-human agents as having human characteristics, intentions,  
50 motivations, and behaviours fundamentally alters how individuals behave towards a non-human agent.  
51 Specifically, the non-human agent may find that once it has been anthropomorphised, it may receive  
52 increased generosity (Haley and Fessler, 2005), conferral of moral rights and respect (Epley *et al.*,  
53 2007), increased perception of social presence (Gardner and Knowles, 2008; Haley and Fessler, 2005),  
54 increased connectedness (Tam, Lee and Chao, 2012) and even mimicry of perceived personality traits  
55 (Chartrand, Fitzsimons and Fitzsimons, 2008) and behavioural intentions (Aggarwal and McGill,  
56 2012). However, it is not yet clear whether the increased conferral of moral rights, respect, perception  
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3 of social presence and connectedness means that service robots are “human enough” to provide capable  
4 guardianship in servicescapes to prevent opportunistic customer misbehaviour such as theft.  
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7 Just as the dimensions and associated stimuli comprising a servicescape can influence customer  
8 experiences and decision-making (Rosenbaum and Massiah, 2011), they can also inadvertently  
9 influence the propensity for customer misbehaviour (Fisk *et al.*, 2010; Fullerton and Punj, 1993;  
10 Fellesson, Salomonson and Aberg, 2013). A recent study found that service robots in a hospitality  
11 context were perceived to signal safety in a servicescape impacted by the coronavirus (Schepers and  
12 Streukens, 2022). Safety has been proposed as an additional, critical dimension of servicescapes  
13 (Siguaw, Mai and Wagner, 2019; Schepers and Streukens, 2022), extending of the existing  
14 conceptualisation of dimensions of servicescape mentioned earlier (Rosenbaum and Massiah, 2011).  
15 Consistent with criminology literature, Siguaw and colleagues (2021) considered the role of physical  
16 stimuli like cameras, security, and signage to signal personal safety at a university campus. Surveillance  
17 tools (e.g., CCTV cameras, mirrors) and human employees, including regular staff and security guards,  
18 have long been used to signal a space is being guarded, with a goal of deterring potential offenders from  
19 making the servicescape ‘less safe’ for other customers (Beck and Palmer, 2011; Beck and Hopkins,  
20 2016). While Schepers and Streukens (2022) focused on how service robots can keep people safe (from  
21 coronavirus infection, in their context), research to date has not considered the service robot’s role as a  
22 capable guardian. Schepers and Streukens (2022) call for further research to understand whether  
23 humanistic service robots can influence safety compliance in a servicescape.  
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36 According to Routine Activity Theory (Cohen and Felson, 1979), opportunistic customer misbehaviour  
37 will occur in a servicescape when a motivated offender, a suitable target, and the absence of a capable  
38 guardian converge in time and space. A motivated offender is a criminally inclined individual capable  
39 of fulfilling their criminal inclinations (Cohen and Felson, 1979). Routine Activity Theory asserts that  
40 all humans are capable of opportunistic crime if the opportunity were to present itself, and thus any  
41 customer in a servicescape is a potential motivated offender (Daunt and Greer, 2015; Cohen and Felson,  
42 1979). A suitable target is any object or person of sufficient (real or symbolic) value, visibility,  
43 accessibility and low inertia to be desirable (Cohen and Felson, 1979). A capable guardian is any  
44 mechanism that would prevent a direct contact predatory violation (e.g., service employees, security  
45 guard, police officer, surveillance CCTV, etc.) (Cohen and Felson, 1979; Cardone and Hayes, 2012).  
46 Capable guardians bring a human presence to the servicescape to prevent opportunistic crime (Beck  
47 and Hopkins, 2016; Cohen and Felson, 1979). To date, Routine Activity Theory has been applied to  
48 explain the behaviour of human social agents, but could reasonably be extended to investigate the  
49 guardianship role that service robots might play given their perceived humanness.  
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## 2.1. Hypothesis Development

### 2.1.1. Humanisation of service robots

As human presence is known to prevent opportunistic crime (Daunt and Greer, 2015; Cohen and Felson, 1979), we investigate whether the perceived humanness of the service robot influences the intentions of customers to commit deviant consumer behaviour when a suitable target is available. Acknowledging that service robots vary widely in their representation, anthropomorphism, and task orientation (Wirtz *et al.*, 2018) and thus potentially vary in perceived humanness, we posit that more human-like service robots can act as capable guardians to prevent customer theft. Thus, we propose the following hypothesis:

**Hypothesis (H1).** As the perceived humanness of the service agent increases, intentions to commit deviant consumer behaviour decrease.

### 2.1.2. The mediating role of empathy and perceived risk of being caught and punished

As customers begin to humanise service robots and consider them capable guardians, both emotional and cognitive processes may be invoked that explain subsequent intentions not to engage in opportunistic customer misbehaviour. One important emotional outcome that may occur when customers anthropomorphise service robots is empathy (Airenti, 2015). Batson and colleagues (1995, p. 1042) define empathy as an 'other-oriented emotional response congruent with the perceived welfare of another person'. When a customer's anthropomorphic tendencies are triggered, empathy for the agent can manifest. Empathy occurs when an individual can understand another's experience from their point of view (Bellet and Maloney, 1991).

The empathy-altruism hypothesis proposes that when an individual experiences empathic emotion, it evokes an altruistic motivation towards the person for whom empathy is felt (Batson *et al.*, 1989, 1995, 2011). This empathy-induced altruism is thought to increase moral, prosocial behaviour (Batson *et al.*, 1995, 2011), suggesting that empathy for a social agent in a servicescape may suppress the urge to act on any opportunity the servicescape presents for theft. We propose that empathy mediates the influence of perceived humanness on deviant consumer behaviour intentions, such that empathy is the underlying mechanism explaining the negative relationship between the perceived humanness of the service agent and deviant consumer behaviour intentions. Thus, we propose the following hypothesis:

**Hypothesis (H2).** Empathy mediates the negative relationship between perceived humanness of the service agent and deviant consumer behaviour intentions.

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3 Furthermore, an important cognitive outcome that emerges when customers anthropomorphise service  
4 robots and consider them capable guardians is the perceived risk of getting caught engaging in deviant  
5 consumer behaviour. Increasing the perceived risk of being caught and punished for engaging in deviant  
6 consumer behaviour is a common approach to deterrence because it minimises perceived opportunity  
7 (Cohen and Felson, 1979). Deterrence theory, from the classical school of criminology (Beccaria, 1963;  
8 Bentham, 1967), argues that people weigh up the costs and benefits of engaging in a specific action  
9 (Pratt *et al.*, 2010). If a customer perceives legal sanctions (e.g., arrest, imprisonment, fines) as certain,  
10 severe, and swift, they will be deterred from engaging in illegal behaviour (Akers and Sellers, 2004;  
11 Grasmick and Green, 1980). Enhancing this sense of risk is why capable guardians like security guards  
12 have an influence: they serve to highlight the likelihood of being caught (Daunt and Greer, 2015; Beck  
13 and Hopkins, 2016).  
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22 Therefore, we propose that the perceived risk of being caught and punished is a likely mediator of  
23 deviant consumer behaviour where the service robot is humanised to the degree it is considered a  
24 capable guardian. Like empathy, perceived risk requires an evaluation to take place (in this case, of the  
25 situation and risk to the self, as opposed to evaluations of an agent). Thus, we propose the following  
26 hypothesis:  
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31 **Hypothesis (H3).** Perceived risk mediates the negative relationship between perceived humanness of  
32 the service agent and deviant consumer behaviour intentions.  
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### 35 **2.1.3. The moderating role of negative attitudes towards robots**

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38 Humanisation of robots does not always produce positive outcomes. Humanisation can trigger a sense  
39 of competition and result in the humanised object being perceived as a threat or adversary (Yang,  
40 Aggarwal, and McGill, 2020). When threatened, customers can react and behave in a manner opposite  
41 to the desired, normative behaviour of the situation. A negative attitudes towards robots is a  
42 “psychological factor that impacts how customers interact with robots” (Nomura, Kanda and Suzuki,  
43 2006, p. 138). Negative attitudes towards robots are a psychological predisposition that impact how  
44 people assess the situation where the robot-human interaction is happening, the social influence of the  
45 robot, and the emotional reactions the interaction inspires (Nomura *et al.*, 2006; 2008; Blut *et al.*, 2021).  
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52 While negative attitudes towards robots do not capture anxiety surrounding technology use, they  
53 capture a negative attitudes specific to the robot itself (Blut *et al.*, 2021). People who report highly  
54 negative attitudes towards robots feel uncomfortable interacting with them due to their general dislike  
55 for robots (Blut *et al.*, 2021). In this research, we hypothesise that negative attitudes towards robots are  
56 a psychological factor that will strengthen the negative relationship between perceived humanness of  
57 the service agent (who is likely to embody different levels of robotic and human elements) and deviant  
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3 consumer behaviour intentions, such that highly negative attitudes towards robots would likely intensify  
4 the negative relationship between a lack of perceived humanness and deviant consumer behaviour  
5 intentions. Thus, we propose the following hypothesis:  
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9 **Hypothesis (H4).** Negative attitudes towards robots will moderate the relationship between perceived  
10 humanness of the service agent and deviant consumer behaviour intentions, such that negative attitudes  
11 towards robots will strengthen the negative relationship.  
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### 14 15 **3. METHOD**

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17 A scenario-based experiment was designed to test the hypotheses in a technology-infused service  
18 encounter. The experiment was conducted in the financial services context as it offers routine  
19 activities that create a ‘convergence in time and space giving people the opportunity for deviance’,  
20 consistent with the theoretical requirements for examining Routine Activity Theory (Cohen and  
21 Felson, 1979). Banking is a universally undertaken service. We manipulated the level of humanness  
22 via three types of guardian stimuli, resulting in seven conditions of varying humanness (three ATMs,  
23 three humanoid service robot agents, and a human bank teller), as detailed in the Design section of the  
24 paper. While all stimuli were intended to function as guardians, the level of humanness for each  
25 stimulus functioned on a continuum, making it likely that some stimuli would be perceived as  
26 possessing more guardian-like qualities (i.e., humanness, enhanced empathy, enhanced risk) than  
27 others.  
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#### 36 37 **3.1 Design**

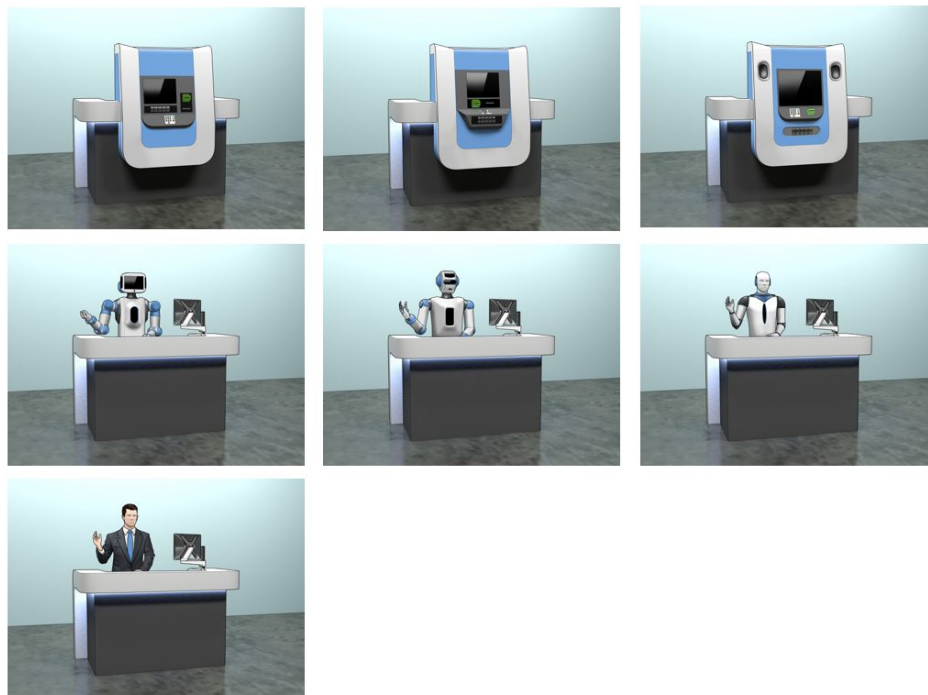
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39 Following the online data collection methods reported by recent social science experiments (Miller *et*  
40 *al.*, 2021; Park *et al.*, 2021), five hundred and fifty-three US residents (48.7% female, 60% aged 18-  
41 34yo) were recruited from Amazon Mechanical Turk to complete a 5-10-minute survey on Qualtrics.  
42 MTurk offers similar levels of internal and external validity to experiments conducted via lab and field  
43 (Horton *et al.*, 2011) and produces data quality on-par with or superior to traditional online panels or  
44 student samples (Kees, Berry, Burton, and Sheehan, 2017). While MTurk is noted as a source for high  
45 quality, reliable data (Buhrmester, Kwang, and Gosling, 2015) and high levels of participant attention  
46 (Hauser and Schwarz, 2016), we also adopted additional measures to ensure data quality – including  
47 following best practice by recruiting only those participants with very high approval ratings (95%+)  
48 and applying stringent data cleaning prior to analysis commencing. To ensure ethical data collection,  
49 participants were compensated USD 1.20, a rate slightly exceeding minimum wage at the time of data  
50 collection. Respondents completed demographic questions, then read and responded to a hypothetical  
51 scenario containing one of the stimuli, completed a manipulation check, and answered survey questions  
52 on the foci constructs of the study. The submission of the survey implied informed consent.  
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3 Participants were randomly allocated to one of seven conditions: an ATM, a subtle humanised ATM,  
4 an explicit humanised ATM, a humanised service robot (cute), a humanised service robot (mechanical),  
5 a humanised service robot (android), and a human bank teller (see Figure I). The seven conditions  
6 represent variations in the humanoid nature of the service agent as per the work of Piçarra and Giger  
7 (2018). The ATM stimuli were modified in line with Kim and McGill (2011), manipulating the design  
8 to show subtle human face features (e.g., eyes and mouth), which research has consistently shown will  
9 increase perceived *human-likeness* of a robot (Blut *et al.*, 2021). The visual elements not relevant to the  
10 manipulation were kept homogenous (e.g., lighting, desk, colour). A manipulation check was conducted  
11 to assess humanness did vary across conditions using a one-way between subjects Analysis of Variance  
12 (ANOVA) test. An ANOVA found perceptions of humanness differed significantly across the ATM ( $M$   
13 = 1.90;  $SD = 1.52$ ), a subtle humanized ATM ( $M = 2.16$ ,  $SD = 1.75$ ), an explicit humanized ATM ( $M$   
14 = 2.77,  $SD = 1.54$ ), a humanized robot (cute) ( $M = 2.96$ ,  $SD = 1.53$ ), a humanized robot (mechanical)  
15 ( $M = 3.33$ ,  $SD = 1.42$ ), a humanized robot (android) ( $M = 3.95$ ,  $SD = 1.57$ ), and a human bank teller  
16 ( $M = 5.08$ ,  $SD = 1.29$ ) conditions ( $F(6, 555) = 40.57$ ,  $p = 0.000$ ). A post-hoc Tukey HSD test identified  
17 that the conditions differed significantly at  $p < 0.05$ ; specifically, the ATM condition, a humanised robot  
18 (android) condition, and human condition differed, with varying differences between the other  
19 conditions. Clustering the conditions to ATM, robot, and human found perceived humanness differed  
20 significantly ( $F(2, 555) = 101.62$ ,  $p = 0.000$ ) suggesting respondents distinguished three clear types of  
21 service agents in the servicescape: self-service technology, robot, human.  
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35 All items in the survey were measured on a 7-point Likert scale. The independent variables included  
36 the following. The dependent variable, *deviant consumer behaviour intentions*, was measured using a  
37 hypothetical scenario: “Sam withdraws some cash from [an ATM next door to the bank/a bank]. Sam  
38 notices the [ATM/robot/teller] dispenses an additional \$20 note, with no charge to their account. The  
39 scenario was followed by a one-item question asking respondents to rate the likelihood that Sam would  
40 keep the money, on a seven-point Likert scale of very unlikely (1) to very likely (7). Using a third-  
41 person technique allowed the respondent to transfer his or her own attitudes towards the third person to  
42 explain that person’s behaviour (Zikmund *et al.*, 2011). Each hypothetical scenario is matched with one  
43 of the experimental conditions of a service agent. *Humanness* ( $\alpha = 0.96$ ) was operationalised as a mean  
44 response to four items: the [ATM/robot/teller] were not at all similar/very similar to Sam, not at all like  
45 a human/very much like a human, not at all like a person/very much like a person, does not at all  
46 resemble a human/very much like a human. *Empathy* ( $\alpha = 0.95$ ) was operationalised as a mean response  
47 to six items, based on how they thought Sam felt about the scenario: sympathetic, soft-hearted, warm,  
48 compassionate, tender, moved (Batson *et al.*, 1995). *Perceived risk* ( $\alpha = 0.67$ ) was measured using an  
49 adaption of Grasmick and Green’s (1980) perceived probability of being caught and perceived severity  
50 of punishment measures as used in (Dootson, Johnston, Beatson and Lings, 2016). To capture perceived  
51 probability of being caught, respondents were asked “If Sam chose to keep the \$20: how likely is it Sam  
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would get caught?” and were required to answer on a 7-point Likert scale from very unlikely (1) to very likely (7). To capture perceived severity of punishment, respondents were asked “If Sam chose to keep the \$20: how severe would Sam's punishment be?” and were required to answer on a 7-point Likert scale from not at all severe (1) to very severe (7). The *negative attitudes towards robots* scale ( $\alpha = 0.77$ ) was operationalised as a mean response to 14 items, including statements such as: “I would feel uneasy if robots really had emotions”, “I would feel very nervous just standing in front of a robot”, and “I would feel paranoid talking to a robot” (Nomura *et al.*, 2006).

**FIGURE I.** Stimuli for experiments





## 4. RESULTS

### 4.1 Descriptive statistics

Table I presents the means, standard deviations, and bivariate correlations to examine the state and relationships between constructs for all study variables.

*[Insert TABLE I. here]*

### 4.2 Testing mediated moderation

To test H1-4, Hayes' (2017) PROCESS Model 5 (bootstrap estimation with 5,000 resamples) was run. The mediated moderation model was significant (see Figure II). First, there was a significant negative main effect of perceived humanness of service agent on deviant consumer behaviour intentions, ( $b = -0.61, p = 0.00$ ). Significant indirect effects were present for both empathy ( $b = -0.08, SE = 0.02; 95\% CI = -0.12, -0.05$ ) and risk ( $b = -0.06, SE = 0.02; 95\% CI = -0.1, -0.03$ ). The total effect was also significant ( $b = -0.25, SE = 0.04; 95\% CI = -0.33, -0.17$ ). Analyses indicate a partial mediation. Hypotheses 1, 2 and 3 were therefore supported.

For the moderator, a significant interaction effect is apparent, supporting hypotheses 1 and 4. Figure III illustrates the pattern of interaction. For individuals low in negative attitudes towards robots (1SD below the mean), the perceived humanness of the service agent had a negative association with their deviant consumer behaviour intentions ( $b = -0.26, SE = .05, p < .001, 95\% CI = [-0.36, -0.16]$ ). When negative attitudes towards robots was at the mean level, a negative association between the two constructs ( $b = -0.12, SE = .04, p < .001, 95\% CI = [-0.20, -0.04]$ ) was observed. For those who were high in negative attitudes towards robots (1SD above the mean), the perceived humanness of the service agent had a positive association with deviant consumer behaviour intentions ( $b = 0.02, SE = .05, p = 0.67, 95\% CI = [-0.09, 0.13]$ ), however, it was not significant. To further examine this finding, a Johnson-Neyman analysis was conducted. The Johnson-Neyman analysis indicates that the moderator has a significant influence for those participants who scored between 1.00 and 4.23 (58.3% of the sample), or above 6.19 out of 7.00 (2.3% of the sample) on the negative attitudes towards robots scale. For those outside of these ranges, the line slope is not different from zero, suggesting that the relationship between perceived humanness of service agent and deviant consumer behaviour intentions becomes non-significant.

In essence, the final model indicates that consumers are less likely to harbour opportunistic theft intentions if a robot looks more human, as partially explained by their empathy for the robot and their heightened sense of perceived risk. Consumer negative attitudes towards robots do influence the

relationship between humanness and intended deviance, but this effect is significant only for those who exhibit lower (below 4.23) or very high (above 6.19) scores for negative attitudes towards robots.

**FIGURE II.** Mediated moderation model - negative attitudes towards robots moderating the perceived empathy and perceived risk mediated relationship between humanness and deviant consumer behaviour intentions.

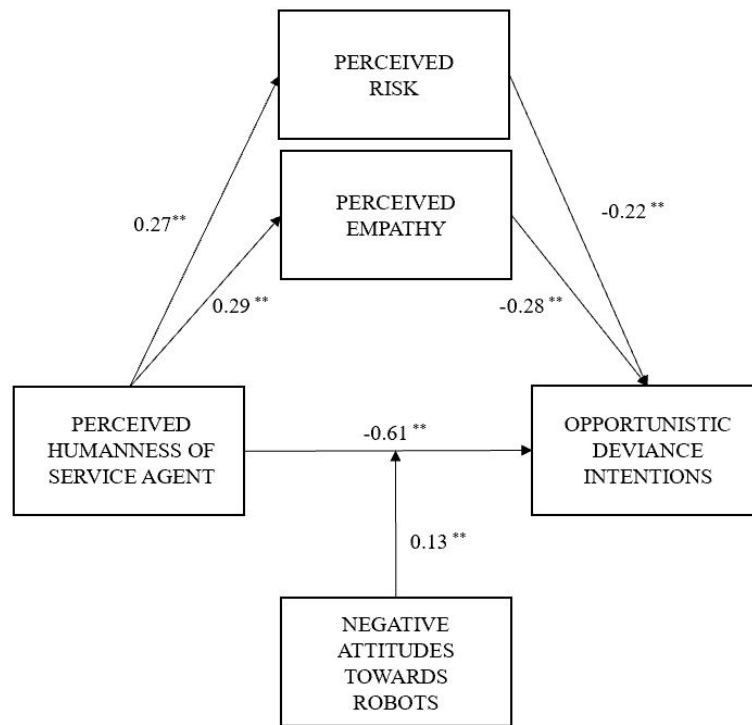
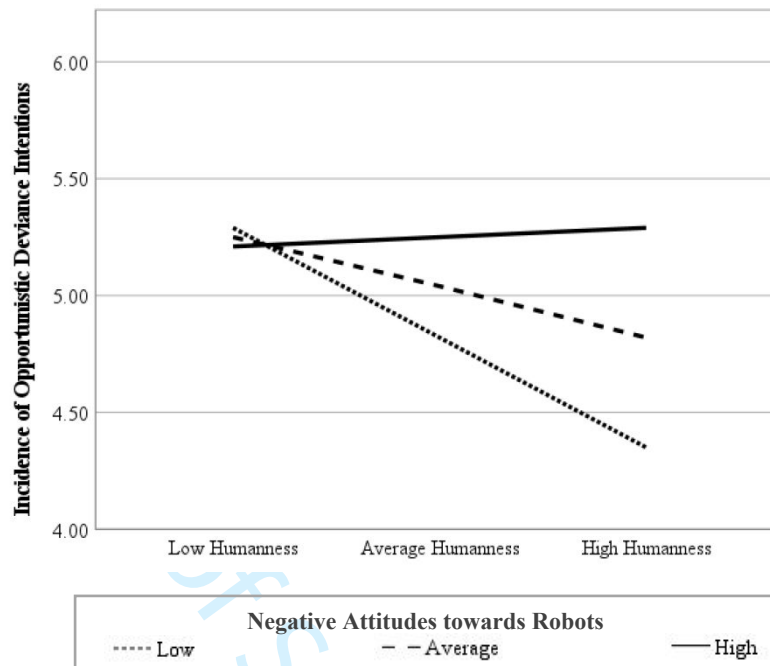


FIGURE III. Interaction for mediated moderation



## 5. DISCUSSION

Given the increasing prevalence of service agents operating in technology-infused service encounters (e.g., in banking, hospitality industries), opportunities for consumer deviance have steadily grown over the last decade in line with new technology development. Indeed, there has been very little research examining any of the unintended consequences of the rapid introduction of service robots (Choi *et al.*, 2021; Marinova *et al.*, 2017). Applying the lens of Routine Activity Theory (Cohen and Felson, 1979), this research contributes to this stream of enquiry by directly examining the unintended consequence of deviant consumer behaviour, as well as uncovering psychological mechanisms explaining how theft propensity can vary by individual characteristic (e.g., negative robot attitudes), individual evaluations (e.g., empathy, risk), and the perceived guardianship in the design of the robot (e.g., humanness).

We find that introducing service robots into the service environment in place of human service agents does reduce customer perceptions of capable guardianship, contributing to conditions that lead to more deviant consumer behaviour in the service environment. The potential increase in deviant consumer behaviour is alleviated (though not eliminated) by increased humanness in service robots. This relationship between perceived robot humanness and intentions to perpetrate deviant consumer behaviour was explained by empathy towards the service robot and the perceived risk of being caught and punished. These partially mediated relationships were moderated by a negative attitudes towards

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3 robots, which strengthened the humanness-empathy, and humanness-risk relationships and weakened  
4 the humanness-deviance relationship when perceived humanness was low. These findings directly  
5 contribute to an enhanced understanding of how and why service agents can replace human employees  
6 as capable guardians in the servicescape to reduce opportunities for consumer deviance. Specifically,  
7 guardianship can be achieved by designing non-human service agents to embody human characteristics,  
8 which thus engender empathy and trigger a risk perception of being caught engaging in deviance  
9 (conditional upon the customer lacking negative attitudes towards robots).  
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### 15 **5.1. Theoretical implications**

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18 By investigating the impact of the perceived humanness of the service robot, we make several key  
19 contributions to the service field. First, we extend the literature in robotics and services beyond  
20 examining customer adoption of service robots (e.g., Park *et al.*, 2021; Sheehan *et al.*, 2020; Wirtz *et*  
21 *al.*, 2018) to consider how customers respond to technology-infused service experiences. To date,  
22 ‘specific reactions to humanoid versus human service providers have not been widely examined’  
23 (Mende *et al.*, 2019). This is especially important in servicescapes where customers do not have a choice  
24 in how they interact with the organisation – either via a human, service robot, or traditional self-service  
25 technology. Our research suggests the introduction of these different technologies into the servicescape  
26 can alter customer behaviour in unintended ways. Specifically, our comparison of a human employee,  
27 service robot, and traditional self-service technology saw increasing rates of deviant consumer  
28 behaviour intentions across each of the three categories, respectively. Our research suggests perceived  
29 humanness of a service robot impacts intentions for deviant consumer behaviour, such that humanoid  
30 robots have some capacity to represent capable guardianship in the servicescape, thereby deterring more  
31 deviant consumer behaviour in comparison to self-service technology. However, the findings also  
32 suggest that a humanoid service robot is not a direct replacement of a human employee as a capable  
33 guardian, as it deterred less deviant consumer behaviour than a human service agent. Therefore, a  
34 second contribution of the work is in extending the applicability of Routine Activity Theory (Cohen  
35 and Felson, 1975) in explaining non-human actors as guardians that reduce instances of deviance, where  
36 previous research using the theory has focused only on human guardians (e.g., Daunt and Greer, 2015).  
37 Similarly, the research extends our existing understanding of the social dimension of a servicescape  
38 proposed by Rosenbaum and Massiah (2011), by considering customer interactions with non-human  
39 agents rather than human agents. The social dimension of a servicescape will continue to evolve as  
40 organisations increasingly replacing human service agents with non-human agents (Marinova *et al.*,  
41 2017), which warrants ongoing research on how human and non-human agents co-create value. Third,  
42 we answer the call for additional research into service frontlines high in automated social presence  
43 using embodied humanoid service robots (van Doorn *et al.*, 2017). Such social robots embrace  
44 appropriate norms of behaviour for their role (van Doorn *et al.*, 2017) and thus encourage customers to  
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3 uphold and reciprocate those social norms of behaviour. Consequently, the research findings answer a  
4 call for research to understand whether a service robot offers a social presence to encourage obedience  
5 with servicescape rules and norms (Schepers and Streukens, 2022). Our research finds humanoid  
6 service robots do have capacity to encourage obedience, through capable guardianship, but not with the  
7 same effectiveness as a human.  
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## 11 12 **5.2. Managerial implications** 13

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15 Practically, this research considers how to best mitigate and manage incidences of deviant consumer  
16 behaviour in technology-infused service environments (Choi *et al.*, 2021; Marinova *et al.*, 2017). The  
17 findings in this research provide guidelines for designing-out deviance towards service robots and  
18 suggest that managers have two levers to mitigate the extent of deviant consumer behaviour intentions  
19 with employing service robots: perceived risk or enhanced empathy. Robotic service agents are unique  
20 in that they offer the ability to design compliance and security into the robotic employee (Wirtz and  
21 Zeithaml, 2018) to increase perceived guardianship through empathy and risk and reduce instances of  
22 deviant consumer behaviour. Using a 'risk' lever involves introducing service robots as guardians that  
23 signal the same perceived risk as having a human employee without triggering reactance from  
24 customers (i.e., avoiding feelings of limited choice, or the forced use of service robots over humans),  
25 which was observed with the introduction of cameras on self-service checkouts where customers felt  
26 unnecessarily surveilled (Mortimer and Dootson, 2020). Conversely, using the 'empathy' lever involves  
27 humanising the design of the service robot to engender empathy in customers and signal social closeness  
28 to reduce deviant consumer behaviour intentions of customers, such as more human-like features and  
29 speech (e.g., Sheehan, Jin and Gottlieb, 2020).  
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40 The research findings also have implications for organisations calculating return-on-investment of  
41 service robot agents, where potential loss stemming from a reduced perception of capable  
42 guardianship in the servicescape needs to be accounted for as a cost alongside acquisition,  
43 programming, and maintenance of the service robot. While the reasons to introduce technologies into  
44 the servicescape are, for the most part, economically compelling, there is little consideration in  
45 literature and in practice for the unintended consequences of deviant consumer behaviour intentions  
46 (Mortimer and Dootson, 2017). Given the link between new technologies and customer misbehaviour  
47 established in this work, it is possible that to save wage costs, managers may instead increase costs  
48 associated with deviant consumer behaviour and other customer misbehaviours, due to the removal of  
49 a capable guardian in the service environment. A recent survey of Australian retailers found that  
50 losses of \$3.37 billion (0.92% of revenue) affect the retail sector each year from crime (ARA, 2019).  
51 Our findings indicate that the presence of a person or humanised robot is the most effective guardian.  
52 To help practitioners with considering the ROI, a junior retail worker in Australia earns about \$44,000  
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3 per year plus oncosts (Fair Work Ombudsman, 2022), while a humanised robot like a Pepper costs  
4 about \$44,000 to purchase (R4 Robotics, 2022) and then varying maintenance costs depending on  
5 level of service. Otherwise, robots like Amy can be leased for \$40 per day (Quantum Robotics, 2022).  
6 Therefore, a business can calculate its potential ROI by considering its total revenue, the costs  
7 associated with different types of guardians over the years, and whether the guardians needed cost less  
8 than 0.92% of revenue. There is also the option of working with self-service checkout manufacturers  
9 to 'humanise' the design – as self-checkouts are often already in operation, so the costs of incremental  
10 small design changes may be minimised.  
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17 We recommend not only adding human features to new technology-infused servicescapes, but also  
18 extensively testing the robot service agents in a series of market tests before roll-out. Unintended  
19 consequences could be costs incurred from more than just theft, but also damage to the technology,  
20 misuse, needing to reprogram, cost of shrinkage or additional labour because of the specific technology  
21 used (e.g., Brščić *et al.*, 2015).  
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### 26 27 **5.3. Limitations and future research**

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29 This research has several limitations and opportunities for future research. The research involves  
30 scenario-based experiments. Although scenario-based experiments are widely used in the study of  
31 customer misbehaviour due to their methodological and ethical appropriateness, they lack external  
32 validity. The findings are generalisable to lab studies examining consumer deviance in routine  
33 activities (e.g., withdrawing money from the bank), however, future research could consider other  
34 routine activities across other contexts where service robots are being introduced, and where there is  
35 significant potential for consumer deviance, such as hospitality, retail, and government services.  
36 While future consumer deviance and service robot research would benefit from observational studies  
37 in servicescapes, it raises some ethical challenges around deception, rule-breaking, and illegal  
38 behaviour (National Health and Medical Research Council, 2018). One way to mitigate the ethical  
39 challenges of studying deviant consumer behaviour is by using virtual reality lab experiments, which  
40 are proving useful in understanding non-compliant or deviant decision-making in other contexts (e.g.,  
41 Kinateder, Müller, Jost, Mühlberger and Pauli, 2014) as the virtual reality scenarios are realistic and  
42 can trigger realistic feelings in study participants about the subject matter (Feng *et al.*, 2018). Further,  
43 despite existing research looking at 'humanness' being embedded into robot design in the robotics  
44 fields (e.g., Roesler *et al.*, 2021), there appears to be more to explore in services research to explain  
45 why customers are likely to engage in deviant consumer behaviour intentions towards service robot,  
46 such as perceptions of trust, guilt, and justifications (Kim, Lee, Lee and Duhachek, 2019). Given that  
47 the mediated relationships in this study were partial, it is suggested that other work may build on the  
48 presented model by seeking other mediators to fully explain the relationship. Finally, future research  
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3 could perform active manipulation of the target suitability and guardianship variables to offer a deeper  
4 understanding of each dimension's mechanisms and role in explaining and mitigating deviant  
5 consumer behaviour intentions towards service robots under Routine Activity Theory.  
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**TABLE I.** Means, standard deviations, and correlations of the main study variables

Variables	<i>M</i>	<i>SD</i>	1	2	3	4	5
1. Humanness	3.17	1.82	--				
2. Empathy	3.79	1.51	0.35**	--			
3. Risk	3.34	1.61	0.31**	0.33**	--		
4. NARs	3.97	1.12	0.09*	0.11**	0.20**	--	
5. Theft intentions	5.05	1.77	-0.26**	-0.32**	-0.27**	0.04	--

\* Correlation is significant at the 0.05 level (2-tailed)

\*\* Correlation is significant at the 0.01 level (2-tailed).