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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

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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.

Despite the rapid diffusion of service robots across many service industries, there is relatively little research exploring the unintended consequences of introducing technology-infused service experiences to customers (Choi, Mattila and Bolton, 2021; Marinova *et al.*, 2017). Automation of any kind 'changes the nature of the work that humans do, often in ways unintended and unanticipated by the designers of automation' (Parasuraman and Riley, 1997, p. 231). By adding service robots to the service experience, organisations may standardise service delivery and reduce errors of service provision through automation (Huang and Rust, 2018; Wirtz *et al.*, 2018), but may also unintentionally remove a human element that safeguards servicescapes from opportunistic customer misbehaviour (Daunt and Greer, 2015; Cohen and Felson, 1979; Schepers and Streukens, 2022). Thus, it is critical to understand how the perceived humanness of different service robots impacts customer behaviour.

Using Routine Activity Theory (RAT; Cohen and Felson, 1979), this research explores whether replacing human service agents with different types of service robots may inadvertently reduce customer perceptions of capable guardianship (i.e., the human element that deters potential offenders from committing crimes) in the servicescape and create conditions that allow customers to perpetrate more opportunistic crime. Specifically, we investigate whether increasing the perceived humanness of a service robot reduces intentions to engage in deviant consumer behaviour, and whether this relationship is mediated by empathy and the perceived risk of being caught and moderated by a negative attitudes towards robots.

There is an opportunity in the literature to move the service field beyond asking how we can increase customer engagement with service robots to questioning whether this engagement will be positive and how we might mitigate opportunities for consumer deviance. In addressing this research opportunity, our work answers calls for research into service frontlines that are high in automated social presence with embodied service robots (van Doorn *et al.*, 2017) compared to human employees (Mende *et al.*, 2019). Specifically, the research makes three main contributions to services literature. First, we present the first study to directly examine the unintended consequences associated with the emergence of service robots by investigating how customer propensity for deviant consumer behaviour is influenced by robot humanness. In doing so, we answer a call for research into whether a humanised service robot offers a perceived social presence that encourages obedience, as called for by Schepers and Streukens (2022). Second, we uncover the psychological mechanisms that help explain the relationship between perceived humanness and deviant consumer behaviour intentions (i.e., empathy, risk, and negative attitudes towards robots). Third, we examine the role of non-human actors in the social dimension of the servicescape, where only human actors have previously been considered as influencing customer behaviour (Rosenbaum and Massiah, 2011). Practically, we offer guidelines for service providers seeking to integrate service robots into a technology-infused servicescape around the need to enhance

humanness, empathy for the robot, and perceived risk of being caught enacting deviant consumer behaviour.

In the next section, we review literature on the social presence of service robots and the role of perceived humanness as a means of signalling capable guardianship as part of Routine Activity Theory (Cohen and Felson, 1979). Next, we propose the mediating relationships of perceived empathy and perceived risk of being caught and punished as mechanisms underpinning the perceived humanness of the service robot and deviant consumer behaviour relationship. We then introduce the moderating role of a negative attitudes towards robots, a psychological factor that impacts how customers interact with robots. We present the mediation and moderation results before discussing the findings, implications, and future research opportunities.

2.   THEORETICAL FRAMEWORK

The servicescape comprises four dimensions that influence how customers behave: a physical dimension, a social dimension, a socially symbolic dimension, and a natural dimension (Rosenbaum and Massiah, 2011). The social dimension focuses on how customers co-create value with employees and the resulting impact on the customer experience (Silva *et al*., 2021), perceptions of service quality (Baker *et al*., 1994), and customer's behavioural intentions to approach or avoid engaging with the service providers (Rosenbaum and Montoya, 2007). Employee and customers' verbal and non-verbal interactions make up the social dimension of a servicescape (Rosenbaum and Massiah, 2011). Most existing research assumes that these service agents are human, but non-human service agents can also be generated using technology and embedded in the servicescape (van Doorn *et al.*, 2017). For example, technology such as chatbots or robots use artificial intelligence to participate in functional service interactions and provide a level of automated social presence in the servicescape (Choi *et al.*, 2018; van Doorn *et al.*, 2017). This automated social presence allows customers to feel that they are co-creating with another social entity (Wirtz *et al.*, 2018).

Social presence, which is the 'sense of being with another' (Biocca, Harms and Burgoon, 2003, p. 465), can be created by non-human service agents when humans instinctively imbue inanimate objects with human-like characteristics, intentions, motivations, and behaviours (Epley, Waytz and Cacioppo, 2007). This propensity is rooted in anthropomorphism, a psychological process in which individuals use their knowledge of humans and self to inductively infer the properties of the non-human agent (Epley *et al*., 2007). Anthropomorphism facilitates interactions between human and non-human agents by (a) allowing humans to explain and predict the complex stimuli presented by non-human agents and (b) satisfying the human need for social connection by enabling connections with non-human agents (Epley *et al*., 2007). Although the extent of anthropomorphism varies somewhat between individuals

(Epley *et al*., 2007), this tendency to anthropomorphise is particularly salient when customers engage with non-human agents such as service robots (Blut, Wang, Wünderlich and Brock, 2021).

Service robots are a type of social robot designed to meaningfully interact with humans in a service setting (Wirtz *et al*., 2018). Service robots are rapidly acquiring new capabilities, such as sophisticated natural language processing and biometric feature recognition (Wirtz *et al*., 2018), that make them well-suited to working with customers (Marinova *et al*., 2017). Service robots tend to be used to fulfil either customer service roles such as waiters or greeters, or operational roles such as baristas, surgical assistants, or aged care assistants (Čaić *et* al., 2018; Mettler, Sprenger, and Winter, 2017). While service robots cannot wholly replace human service agents at this time, there are numerous contexts in which the cognitive-analytical and emotional-social characteristics of the service delivery context would allow service robots to operate without human service agents (Wirtz *et al*., 2018).

Service robots are designed with varying attributes of representation, anthropomorphism, and task orientation (Wirtz *et al*., 2018). First, robots can take a physical form (e.g., Yujin Robot's iRobi) or a virtual form (e.g., Apple's Siri) (Wirtz *et al*., 2018). Second, robots can be designed to appear humanoid (e.g., Aldebaran's Nao robot) or non-humanoid (e.g., iRobot's Roomba) (Wirtz *et al*., 2018). Finally, robots can complete analytical tasks (e.g., image processing to assess mask compliance) or socio-emotional tasks (e.g., greeting people) (Wirtz *et al*., 2018). These robot attributes collectively influence the service robot's perceived humanness, which becomes the 'interaction counterpart' for customers (Wirtz *et al*., 2018, p. 909).

Perceived humanness is 'the extent to which an individual is seen as having characteristics that are typical for humans' (Söderlund, 2021, p. 17). Service robots evoke perceived humanness through their morphology, which might comprise a face, arms and legs, as well as human-like characteristics such as warmth (Mende *et al*., 2019; Söderlund, 2021). Perceived humanness distinguishes service robots from self-service technologies that can perform functional tasks but cannot engage in social connection (Choi *et al.*, 2018; van Doorn *et al.*, 2017). Thus, service robots are capable of being perceived as an employee that forms part of the social dimension of a servicescape (Rosenbaum and Massiah, 2011).

Research demonstrates that perceiving non-human agents as having human characteristics, intentions, motivations, and behaviours fundamentally alters how individuals behave towards a non-human agent. Specifically, the non-human agent may find that once it has been anthropomorphised, it may receive increased generosity (Haley and Fessler, 2005), conferral of moral rights and respect (Epley *et al*., 2007), increased perception of social presence (Gardner and Knowles, 2008; Haley and Fessler, 2005), increased connectedness (Tam, Lee and Chao, 2012) and even mimicry of perceived personality traits (Chartrand, Fitzsimons and Fitzsimons, 2008) and behavioural intentions (Aggarwal and McGill, 2012). However, it is not yet clear whether the increased conferral of moral rights, respect, perception

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of social presence and connectedness means that service robots are "human enough" to provide capable guardianship in servicescapes to prevent opportunistic customer misbehaviour such as theft.

Just as the dimensions and associated stimuli comprising a servicescape can influence customer experiences and decision-making (Rosenbaum and Massiah, 2011), they can also inadvertently influence the propensity for customer misbehaviour (Fisk *et al.*, 2010; Fullerton and Punj, 1993; Fellesson, Salomonson and Aberg, 2013). A recent study found that service robots in a hospitality context were perceived to signal safety in a servicescape impacted by the coronavirus (Schepers and Streukens, 2022). Safety has been proposed as an additional, critical dimension of servicescapes (Siguaw, Mai and Wagner, 2019; Schepers and Streukens, 2022), extending of the existing conceptualisation of dimensions of servicescape mentioned earlier (Rosenbaum and Massiah, 2011). Consistent with criminology literature, Siguaw and colleages (2021) considered the role of physical stimuli like cameras, security, and signage to signal personal safety at a university campus. Surveillance tools (e.g., CCTV cameras, mirrors) and human employees, including regular staff and security guards, have long been used to signal a space is being guarded, with a goal of deterring potential offenders from making the servicescape 'less safe' for other customers (Beck and Palmer, 2011; Beck and Hopkins, 2016). While Schepers and Streukens (2022) focused on how service robots can keep people safe (from coronavirus infection, in their context), research to date has not considered the service robot's role as a capable guardian. Schepers and Streukens (2022) call for further research to understand whether humanistic service robots can influence safety compliance in a servicescape.

According to Routine Activity Theory (Cohen and Felson, 1979), opportunistic customer misbehaviour will occur in a servicescape when a motivated offender, a suitable target, and the absence of a capable guardian converge in time and space. A motivated offender is a criminally inclined individual capable of fulfilling their criminal inclinations (Cohen and Felson, 1979). Routine Activity Theory asserts that all humans are capable of opportunistic crime if the opportunity were to present itself, and thus any customer in a servicescape is a potential motivated offender (Daunt and Greer, 2015; Cohen and Felson, 1979). A suitable target is any object or person of sufficient (real or symbolic) value, visibility, accessibility and low inertia to be desirable (Cohen and Felson, 1979). A capable guardian is any mechanism that would prevent a direct contact predatory violation (e.g., service employees, security guard, police officer, surveillance CCTV, etc.) (Cohen and Felson, 1979; Cardone and Hayes, 2012). Capable guardians bring a human presence to the servicescape to prevent opportunistic crime (Beck and Hopkins, 2016; Cohen and Felson, 1979). To date, Routine Activity Theory has been applied to explain the behaviour of human social agents, but could reasonably be extended to investigate the guardianship role that service robots might play given their perceived humanness.

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.

Furthermore, an important cognitive outcome that emerges when customers anthropomorphise service robots and consider them capable guardians is the perceived risk of getting caught engaging in deviant consumer behaviour. Increasing the perceived risk of being caught and punished for engaging in deviant consumer behaviour is a common approach to deterrence because it minimises perceived opportunity (Cohen and Felson, 1979). Deterrence theory, from the classical school of criminology (Beccaria, 1963; Bentham, 1967), argues that people weigh up the costs and benefits of engaging in a specific action (Pratt *et al.*, 2010). If a customer perceives legal sanctions (e.g., arrest, imprisonment, fines) as certain, severe, and swift, they will be deterred from engaging in illegal behaviour (Akers and Sellers, 2004; Grasmick and Green, 1980). Enhancing this sense of risk is why capable guardians like security guards have an influence: they serve to highlight the likelihood of being caught (Daunt and Greer, 2015; Beck and Hopkins, 2016).

Therefore, we propose that the perceived risk of being caught and punished is a likely mediator of deviant consumer behaviour where the service robot is humanised to the degree it is considered a capable guardian. Like empathy, perceived risk requires an evaluation to take place (in this case, of the situation and risk to the self, as opposed to evaluations of an agent). Thus, we propose the following hypothesis:

Hypothesis (H3). Perceived risk mediates the negative relationship between perceived humanness of the service agent and deviant consumer behaviour intentions.

2.1.3. The moderating role of negative attitudes towards robots

Humanisation of robots does not always produce positive outcomes. Humanisation can trigger a sense of competition and result in the humanised object being perceived as a threat or adversary (Yang, Aggarwal, and McGill, 2020). When threatened, customers can react and behave in a manner opposite to the desired, normative behaviour of the situation. A negative attitudes towards robots is a "psychological factor that impacts how customers interact with robots" (Nomura, Kanda and Suzuki, 2006, p. 138). Negative attitudes towards robots are a psychological predisposition that impact how people assess the situation where the robot-human interaction is happening, the social influence of the robot, and the emotional reactions the interaction inspires (Nomura *et al.*, 2006; 2008; Blut *et al.*, 2021).

While negative attitudes towards robots do not capture anxiety surrounding technology use, they capture a negative attitudes specific to the robot itself (Blut *et al.*, 2021). People who report highly negative attitudes towards robots feel uncomfortable interacting with them due to their general dislike for robots (Blut *et al.*, 2021). In this research, we hypothesise that negative attitudes towards robots are a psychological factor that will strengthen the negative relationship between perceived humanness of the service agent (who is likely to embody different levels of robotic and human elements) and deviant

consumer behaviour intentions, such that highly negative attitudes towards robots would likely intensify the negative relationship between a lack of perceived humanness and deviant consumer behaviour intentions. Thus, we propose the following hypothesis:

Hypothesis (H4). Negative attitudes towards robots will moderate the relationship between perceived humanness of the service agent and deviant consumer behaviour intentions, such that negative attitudes towards robots will strengthen the negative relationship.

3. METHOD

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

3.1 Design

Following the online data collection methods reported by recent social science experiments (Miller *et al*., 2021; Park *et al*., 2021), five hundred and fifty-three US residents (48.7% female, 60% aged 18-34yo) were recruited from Amazon Mechanical Turk to complete a 5-10-minute survey on Qualtrics. MTurk offers similar levels of internal and external validity to experiments conducted via lab and field (Horton *et al*., 2011) and produces data quality on-par with or superior to traditional online panels or student samples (Kees, Berry, Burton, and Sheehan, 2017). While MTurk is noted as a source for high quality, reliable data (Buhrmester, Kwang, and Gosling, 2015) and high levels of participant attention (Hauser and Schwarz, 2016), we also adopted additional measures to ensure data quality – including following best practice by recruiting only those participants with very high approval ratings (95%+) and applying stringent data cleaning prior to analysis commencing. To ensure ethical data collection, participants were compensated USD 1.20, a rate slightly exceeding minimum wage at the time of data collection. Respondents completed demographic questions, then read and responded to a hypothetical scenario containing one of the stimuli, completed a manipulation check, and answered survey questions on the foci constructs of the study. The submission of the survey implied informed consent.

Participants were randomly allocated to one of seven conditions: an ATM, a subtle humanised ATM, an explicit humanised ATM, a humanised service robot (cute), a humanised service robot (mechanical), a humanised service robot (android), and a human bank teller (see Figure I). The seven conditions represent variations in the humanoid nature of the service agent as per the work of Piçarra and Giger (2018). The ATM stimuli were modified in line with Kim and McGill (2011), manipulating the design to show subtle human face features (e.g., eyes and mouth), which research has consistently shown will increase perceived *human-likeness* of a robot (Blut *et al.*, 2021). The visual elements not relevant to the manipulation were kept homogenous (e.g., lighting, desk, colour). A manipulation check was conducted to assess humanness did vary across conditions using a one-way between subjects Analysis of Variance (ANOVA) test. An ANOVA found perceptions of humanness differed significantly across the ATM (*M* = 1.90; SD = 1.52), a subtle humanized ATM (*M* = 2.16, SD = 1.75), an explicit humanized ATM (*M* = 2.77, SD = 1.54), a humanized robot (cute) (*M* = 2.96, SD = 1.53), a humanized robot (mechanical) (*M* = 3.33, SD = 1.42), a humanized robot (android) (*M* = 3.95, SD = 1.57), and a human bank teller (*M* = 5.08, SD = 1.29) conditions ($F_{(6, 555)} = 40.57$, $p = 0.000$). A post-hoc Tukey HSD test identified that the conditions differed significantly at $p<0.05$; specifically, the ATM condition, a humanised robot (android) condition, and human condition differed, with varying differences between the other conditions. Clustering the conditions to ATM, robot, and human found perceived humanness differed significantly ($F_{(2, 555)}=101.62$, $p=0.000$) suggesting respondents distinguished three clear types of service agents in the servicescape: self-service technology, robot, human.

All items in the survey were measured on a 7-point Likert scale. The independent variables included the following. The dependent variable, *deviant consumer behaviour intentions*, was measured using a hypothetical scenario: "Sam withdraws some cash from [an ATM next door to the bank/a bank]. Sam notices the [ATM/robot/teller] dispenses an additional $20 note, with no charge to their account. The scenario was followed by a one-item question asking respondents to rate the likelihood that Sam would keep the money, on a seven-point Likert scale of very unlikely (1) to very likely (7). Using a third-person technique allowed the respondent to transfer his or her own attitudes towards the third person to explain that person's behaviour (Zikmund *et al.*, 2011). Each hypothetical scenario is matched with one of the experimental conditions of a service agent. *Humanness* (α = 0.96) was operationalised as a mean response to four items: the [ATM/robot/teller] were not at all similar/very similar to Sam, not at all like a human/very much like a human, not at all like a person/very much like a person, does not at all resemble a human/very much like a human. *Empathy* (α = 0.95) was operationalised as a mean response to six items, based on how they thought Sam felt about the scenario: sympathetic, soft-hearted, warm, compassionate, tender, moved (Batson *et al.*, 1995). *Perceived risk* (α = 0.67) was measured using an adaption of Grasmick and Green's (1980) perceived probability of being caught and perceived severity of punishment measures as used in (Dootson, Johnston, Beatson and Lings, 2016). To capture perceived probability of being caught, respondents were asked "If Sam chose to keep the $20: how likely is it Sam

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
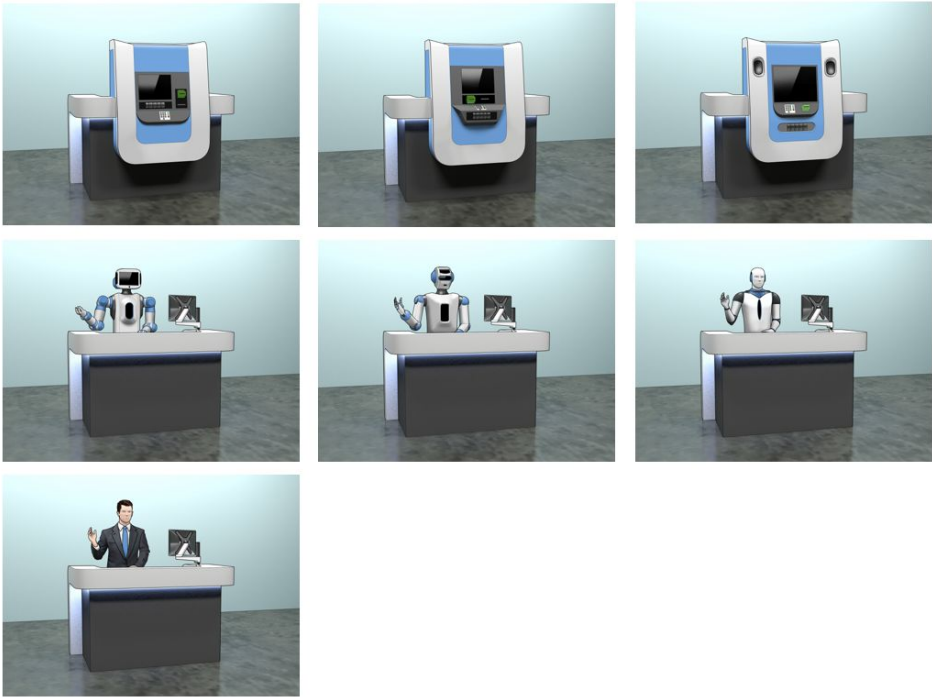
4. RESULTS

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.
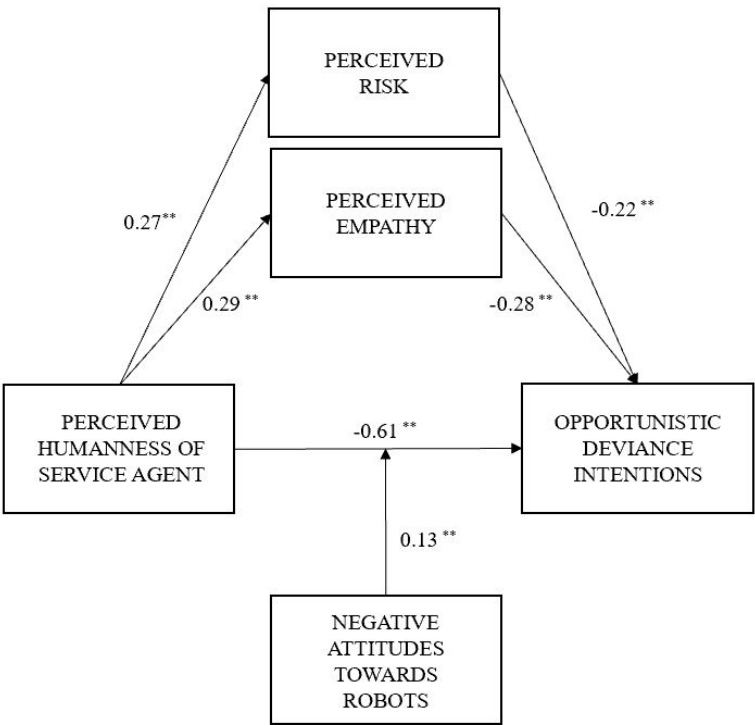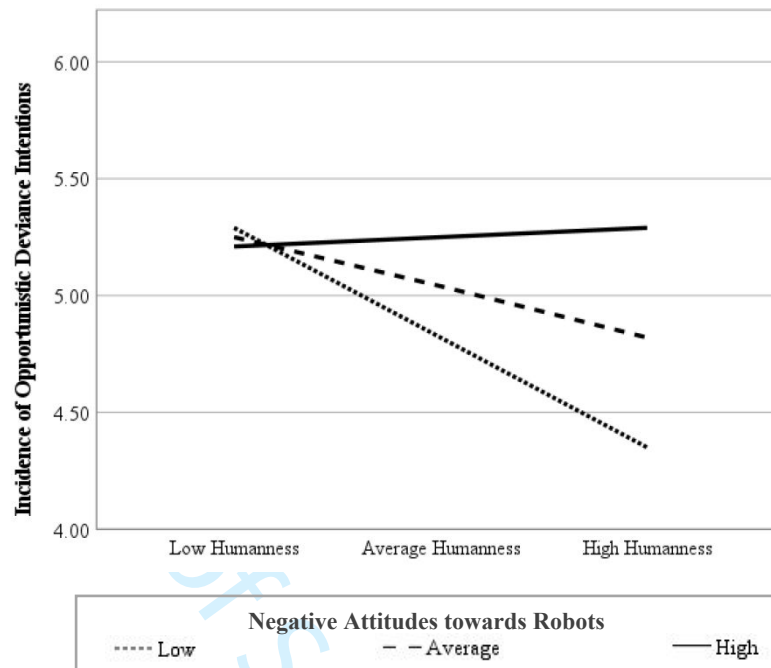
FIGURE III. Interaction for mediated moderation

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

5.1. Theoretical implications

By investigating the impact of the perceived humanness of the service robot, we make several key contributions to the service field. First, we extend the literature in robotics and services beyond examining customer adoption of service robots (e.g., Park *et al.,* 2021; Sheehan *et al*., 2020; Wirtz *et al.,* 2018) to consider how customers respond to technology-infused service experiences. To date, 'specific reactions to humanoid versus human service providers have not been widely examined' (Mende *et al*., 2019). This is especially important in servicescapes where customers do not have a choice in how they interact with the organisation – either via a human, service robot, or traditional self-service technology. Our research suggests the introduction of these different technologies into the servicescape can alter customer behaviour in unintended ways. Specifically, our comparison of a human employee, service robot, and traditional self-service technology saw increasing rates of deviant consumer behaviour intentions across each of the three categories, respectively. Our research suggests perceived humanness of a service robot impacts intentions for deviant consumer behaviour, such that humanoid robots have some capacity to represent capable guardianship in the servicescape, thereby deterring more deviant consumer behaviour in comparison to self-service technology. However, the findings also suggest that a humanoid service robot is not a direct replacement of a human employee as a capable guardian, as it deterred less deviant consumer behaviour than a human service agent. Therefore, a second contribution of the work is in extending the applicability of Routine Activity Theory (Cohen and Felson, 1975) in explaining non-human actors as guardians that reduce instances of deviance, where previous research using the theory has focused only on human guardians (e.g., Daunt and Greer, 2015). Similarly, the research extends our existing understanding of the social dimension of a servicescape proposed by Rosenbaum and Massiah (2011), by considering customer interactions with non-human agents rather than human agents. The social dimension of a servicescape will continue to evolve as organisations increasingly replacing human service agents with non-human agents (Marinova *et al*., 2017), which warrants ongoing research on how human and non-human agents co-create value. Third, we answer the call for additional research into service frontlines high in automated social presence using embodied humanoid service robots (van Doorn *et al*., 2017). Such social robots embrace appropriate norms of behaviour for their role (van Doorn *et al*., 2017) and thus encourage customers to

uphold and reciprocate those social norms of behaviour. Consequently, the research findings answer a call for research to understand whether a service robot offers a social presence to encourage obedience with servicescape rules and norms (Schepers and Streukens, 2022). Our research finds humanoid service robots do have capacity to encourage obedience, through capable guardianship, but not with the same effectiveness as a human.

5.2. Managerial implications

Practically, this research considers how to best mitigate and manage incidences of deviant consumer behaviour in technology-infused service environments (Choi *et al*., 2021; Marinova *et al*., 2017). The findings in this research provide guidelines for designing-out deviance towards service robots and suggest that managers have two levers to mitigate the extent of deviant consumer behaviour intentions with employing service robots: perceived risk or enhanced empathy. Robotic service agents are unique in that they offer the ability to design compliance and security into the robotic employee (Wirtz and Zeithaml, 2018) to increase perceived guardianship through empathy and risk and reduce instances of deviant consumer behaviour. Using a 'risk' lever involves introducing service robots as guardians that signal the same perceived risk as having a human employee without triggering reactance from customers (i.e., avoiding feelings of limited choice, or the forced use of service robots over humans), which was observed with the introduction of cameras on self-service checkouts where customers felt unnecessarily surveilled (Mortimer and Dootson, 2020). Conversely, using the 'empathy' lever involves humanising the design of the service robot to engender empathy in customers and signal social closeness to reduce deviant consumer behaviour intentions of customers, such as more human-like features and speech (e.g., Sheehan, Jin and Gottlieb, 2020).

The research findings also have implications for organisations calculating return-on-investment of service robot agents, where potential loss stemming from a reduced perception of capable guardianship in the servicescape needs to be accounted for as a cost alongside acquisition, programming, and maintenance of the service robot. While the reasons to introduce technologies into the servicescape are, for the most part, economically compelling, there is little consideration in literature and in practice for the unintended consequences of deviant consumer behaviour intentions (Mortimer and Dootson, 2017). Given the link between new technologies and customer misbehaviour established in this work, it is possible that to save wage costs, managers may instead increase costs associated with deviant consumer behaviour and other customer misbehaviours, due to the removal of a capable guardian in the service environment. A recent survey of Australian retailers found that losses of $3.37 billion (0.92% of revenue) affect the retail sector each year from crime (ARA, 2019). Our findings indicate that the presence of a person or humanised robot is the most effective guardian. To help practitioners with considering the ROI, a junior retail worker in Australia earns about $44,000

per year plus oncosts (Fair Work Ombudsman, 2022), while a humanised robot like a Pepper costs about $44,000 to purchase (R4 Robotics, 2022) and then varying maintenance costs depending on level of service. Otherwise, robots like Amy can be leased for $40 per day (Quantum Robotics, 2022). Therefore, a business can calculate its potential ROI by considering its total revenue, the costs associated with different types of guardians over the years, and whether the guardians needed cost less than 0.92% of revenue. There is also the option of working with self-service checkout manufacturers to 'humanise' the design – as self-checkouts are often already in operation, so the costs of incremental small design changes may be minimised.

We recommend not only adding human features to new technology-infused servicescapes, but also extensively testing the robot service agents in a series of market tests before roll-out. Unintended consequences could be costs incurred from more than just theft, but also damage to the technology, misuse, needing to reprogram, cost of shrinkage or additional labour because of the specific technology used (e.g., Brščić *et al.,* 2015).

5.3. Limitations and future research

This research has several limitations and opportunities for future research. The research involves scenario-based experiments. Although scenario-based experiments are widely used in the study of customer misbehaviour due to their methodological and ethical appropriateness, they lack external validity. The findings are generalisable to lab studies examining consumer deviance in routine activities (e.g., withdrawing money from the bank), however, future research could consider other routine activities across other contexts where service robots are being introduced, and where there is significant potential for consumer deviance, such as hospitality, retail, and government services. While future consumer deviance and service robot research would benefit from observational studies in servicescapes, it raises some ethical challenges around deception, rule-breaking, and illegal behaviour (National Health and Medical Research Council, 2018). One way to mitigate the ethical challenges of studying deviant consumer behaviour is by using virtual reality lab experiments, which are proving useful in understanding non-compliant or deviant decision-making in other contexts (e.g., Kinateder, Müller, Jost, Mühlberger and Pauli, 2014) as the virtual reality scenarios are realistic and can trigger realistic feelings in study participants about the subject matter (Feng *et al*., 2018). Further, despite existing research looking at 'humanness' being embedded into robot design in the robotics fields (e.g., Roesler *et al*., 2021), there appears to be more to explore in services research to explain why customers are likely to engage in deviant consumer behaviour intentions towards service robot, such as perceptions of trust, guilt, and justifications (Kim, Lee, Lee and Duhachek, 2019). Given that the mediated relationships in this study were partial, it is suggested that other work may build on the presented model by seeking other mediators to fully explain the relationship. Finally, future research

could perform active manipulation of the target suitability and guardianship variables to offer a deeper understanding of each dimension's mechanisms and role in explaining and mitigating deviant 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	M	SD	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).