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## **REPLACED BY A ROBOT: SERVICE IMPLICATIONS IN THE AGE OF THE MACHINE**

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## REPLACED BY A ROBOT: SERVICE IMPLICATIONS IN THE AGE OF THE MACHINE

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### Abstract

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Service organizations, emboldened by the imperative to innovate, are increasingly introducing robots to frontline service encounters. However, as they augment or substitute human employees with robots, they may struggle to convince a distrusting public of their brand's ethical credentials. Consequently, this paper develops and tests a holistic framework to ascertain a deeper understanding of customer perceptions of frontline service robots (FLSRs) than has previously been attempted. Our experimental studies investigate the effects of the 1) Role (*augmentation or substitution of human employees or no involvement*) and 2) type (*humanoid FLSR vs. self-service machine*) of FLSRs under the following service contexts: a) Value creation model (asset-builder, service-provider), and b) Service type (*experience, credence*). By empirically establishing our framework, we highlight how customers' personal characteristics (*openness-to-change* and *preference for ethical/responsible service provider*) and cognitive evaluations (*perceived innovativeness, perceived ethical/societal reputation, and perceived innovativeness-responsibility fit*) influence the impact that FLSRs have on service experience and brand usage intent. Our findings operationalize and empirically support seminal frameworks from extant literature, as well as elaborate on the positive and negative implications of using robots to complement or replace service employees. Further, we consider managerial and policy implications for service in the age of machines.

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**Keywords:** *Service Robots, Service Experience, Brand Usage Intent, Service Innovativeness, Ethical/Societal Reputation*

## INTRODUCTION

To improve frontline service encounters, service providers increasingly utilize autonomous service robots infused with artificial intelligence (AI) to augment or replace the role of human employees. Traditionally, customer-employee interactions at the social interface have been solely responsible for developing service encounters that create brand equity by enhancing the customer experience (Brakus, Schmitt and Zarantonello 2009; Hepola, Karjaluoto and Hintikka 2017) and driving brand usage intent (Hollebeck, Glynn and Brodie 2014). It has long been asserted that “the people make the brand” (Hurrell and Scholarios 2014, p. 54) and that frontline employees play an important role in defining frontline service encounters (De Keyser et al. 2019; Voorhees et al. 2017). In this paper, we attempt to answer the following questions: *how will customers react when employees’ roles are augmented or substituted by frontline service robots (FLSRs), and what are the implications for service in terms of the innovativeness and ethical/social responsibility aspects of such augmentation or substitution?*

While it is true that we do not yet have commercially viable robots that can walk dogs or run errands, it has been predicted that by 2025, service-providing robots “will be melded into numerous service experiences” (van Doorn et al. 2017, p. 44). Their introduction will fundamentally change the interactions customers have with service organizations and the functions and responsibilities of all actors involved in service encounters (De Keyser et al. 2019; Wirtz 2019; Larivière et al. 2017). For the purpose of this paper, service robots are defined as “system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization’s customers” (Wirtz et al. 2018, p. 909). In contrast to other forms of AI, which are beyond the scope of this article, intelligent physically embodied FLSRs can have meaningful social interactions with customers and can therefore be considered as service agents (Jörling, Böhm and Paluch 2019; Mende et al. 2019; van Doorn et al. 2017). FLSRs can be categorized from humanoid

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3 (anthropomorphized robots imbued with human-like characteristics) to non-humanoid (e.g. an  
4 artificially intelligent reception FLSR at a restaurant) (Wirtz et al. 2018). In this paper, we refer to  
5 a non-humanoid FLSR that possesses the same ability, functionality and intelligence as a  
6 humanoid FLSR, as a self-service machine<sup>1</sup>. They are intuitive, interact and communicate with  
7 customers in a similar way to employees. Human-like features can inspire trust and bonding,  
8 however uncanny valley theory (Mori 2012) suggests that the introduction of highly human-like  
9 robots might create “feelings of eeriness or a threat to (a customer’s) human identity” (Mende et  
10 al. 2019, p. 539). The deployment of self-service machines that perform the same functions as  
11 humanoid FLSRs may not engender the same response. Therefore, service providers seeking to  
12 introduce FLSRs face the challenge of understanding both positive and negative implications that  
13 may follow and need to gain insights into how FLSRs will influence a customer’s service  
14 experience or intent to use a brand (Hollebeek et al., 2014). Furthermore, in seeking to answer  
15 these questions, rather than isolate our research to a particular service setting, we adopt a holistic  
16 approach by investigating how customer perceptions change according to service type (e.g. for a  
17 credence service in comparison to an experience service).

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37 FLSRs conversant with big data analytics and biometrics are providing a variety of  
38 innovations that significantly alter service settings (Mende et al. 2019; Wirtz et al. 2018).  
39 Nonetheless, they are simultaneously threatening human jobs (Harris, Kimson and Schwedel 2018)  
40 and creating ethical and societal challenges that might lead to public distrust, inhibiting broader  
41 adoption and customer engagement with FLSRs (Huang and Rust 2018). This may have a negative  
42 influence on the service provider. Given the above it is surprising that from a customer-centric  
43 perspective, a dearth of empirical academic research focuses on whether the introduction of FLSRs  
44 may create a dichotomy between negative perceptions relating to potential ethical and societal  
45 challenges and more positive perceptions of innovative service encounters. This paper addresses  
46 these gaps in the literature and responds to demands for more research prioritizing frontline service  
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3 encounters and the role that technology plays in advancing service provision (e.g. Hollebeek,  
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5 Andreassen and Sprott 2018; Ostrom et al. 2015).

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7 In two experimental studies, we extend and refine the work of Larivière et al. (2017) by  
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9 exploring how the expected positive impact of innovativeness shaped by FLSRs, influences  
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11 customer perceptions of a frontline service encounter. In Study 1, we simultaneously investigate  
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13 the potential negative effects on the *'perceived ethical/societal reputation'* and positive effects on  
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15 the *'perceived innovativeness'* of a service organization that uses a FLSR to either replace or  
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17 complement a human employee in frontline service encounters. Subsequently, in Study 2, we build  
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19 upon our initial results, incorporating new service types (credence vs experience) and compare  
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21 responses from customers who have been exposed to two AI types (humanoid FLSR vs non-  
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23 humanoid self-service machine). We focus on *'perceived innovativeness-responsibility fit'* in an  
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25 attempt to develop a holistic approach to understanding customer perceptions of FLSRs. We  
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27 consider the influence of individual characteristics, particularly an individual's *'openness-to-*  
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29 *change'* (Schwartz 2003), as well as an individual's *'preferences for an ethical/responsible service*  
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31 *provider'* (Ramasamy and Yeung 2009), as the adoption of innovative services may be influenced  
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33 by an individual's preferences for innovation (Hoffmann and Soyez 2010). To the best of our  
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35 knowledge, no other study has comprehensively explored these factors.  
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41 In this paper, we make several important contributions to the literature. First, we address  
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43 the urgent need to better understand the relationship between FLSRs, service providers and brands  
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45 (Mende et al. 2019). Second, we also answer calls for further research to explore the net effect that  
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47 automated service interactions have on customers, including the influence of positive as well as  
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49 negative factors (Čaić, Odekerken-Schröder and Mahr 2018; Hollebeek, Jaakkola and Alexander  
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51 2018). Third, not only does our work address the need for further research into the factors that  
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53 drive customer acceptance or conversely mistrust of AI and FLSRs, it also provides more  
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55 knowledge about how FLSRs can be better integrated into the servicescape (Wirtz et al. 2018).  
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2 Specifically, we emphasize the importance of jointly considering the barriers and drivers of AI  
3 adoption in the service context. These factors may be technology-related such as innovativeness,  
4 and/or customer-related characteristics such as values. Fourth, we develop and test a holistic  
5 conceptual framework by extending and refining Larivière et al.'s (2017) conceptual Service 2.0  
6 model. Larivière et al.'s (2017) model provides a comprehensive overview that considers the  
7 impact of automated technologies and provides a strong foundation for an empirical investigation  
8 into the effects of robots in frontline service encounters. Finally, we outline important managerial  
9 implications that highlight the importance of adopting a holistic approach to the introduction of  
10 FLSRs.  
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## 23 **CONCEPTUAL FOUNDATIONS AND FRAMEWORK**

### 24 ***Role of Robots in Frontline Services***

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26 Larivière et al.'s (2017) ambitious conceptual paper recently sought to revamp and update  
27 service marketing's conceptualization of the service encounter. They highlight two important roles  
28 that robots can play in customer-facing service scenarios: a) '*Augmentation*' (assisting and  
29 complementing human employees), and b) '*Substitution*' (replacing human employees) which in  
30 this paper we refer to as '*Role of FLSR*.' By building on extant literature, they also identify two  
31 different business models that create value (which we refer to as '*Value Creation Model*') where  
32 robots may complement or replace humans: '*Asset-Builder*' (businesses/service organizations that  
33 deliver physical goods including retailers) and '*Service-Provider*' (for example hotels, restaurants  
34 and airlines or airports). We focus on both Asset-Builders, which through physical infrastructure  
35 and marketing typically deliver value much as a retailer does — and on Service-Providers who  
36 deliver value for the most part through the skill of their employees. It is in these types of  
37 organizations, where technological augmentation is most likely to flourish, that employees with a  
38 strong sense of role clarity, ability and motivation are seen as key progenitors of innovation. As  
39 Larivière et al. (2017, p. 241) state "authentic human touch can help differentiate offerings in the  
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2 marketplace and display unique brand-building behaviors” which create an experience driven by  
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4 “sensations, feelings, cognitions, social and behavioral responses that result from interacting with  
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6 other parties – employees, technology etc.” (Ibid. p. 242).  
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### 9 *Customer Cognitive Evaluations of FLSRs*

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11 Customers’ perceptions of a FLSR are informed not only by their cognitive evaluation of  
12  
13 the service encounter, but also by their broader knowledge and understanding of the positive and/or  
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15 negative consequences of introducing robots to the servicescape. Successful service innovations,  
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17 for example, can provide real value for customers (Hollebeek and Andreassen 2018; Kim, Garrett  
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19 and Jung 2015). In their study of service design and value creation, Andreassen et al. (2016, p. 22)  
20  
21 state “innovation is the new ticket” for organizations seeking to play and stay in the service  
22  
23 industry. Therefore, a better understanding of innovative service provision represents a growing  
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25 priority for both researchers and practitioners (Antons and Breidbach 2018; Patricio, Gustaffsson  
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27 and Fisk 2018), particularly in the area of radical service innovations (Goduscheit and Faillant  
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29 2018) such as FLSRs. Our focus is micro level and customer-centric, since customers are  
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31 ultimately responsible for the success of an innovation (Kunz, Schmitt and Meyer 2011).  
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37 Although FLSRs will be perceived as innovative and provide benefits, their use in frontline  
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39 service settings also creates a number of ethical and societal implications that may influence  
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41 customer perceptions. Wirtz et al. (2018) highlight how customers may be concerned about  
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43 ‘privacy and security’ as robots can gather and store data and remotely connect and share it with  
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45 other sources. Sensitive customer data collected by FLSRs and stored in the cloud could be hacked  
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47 by criminals. They also discuss ‘dehumanization and social deprivation’ issues. For example,  
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49 substituting human carers with robots may dehumanize care, cause emotional concerns and lead  
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51 to social isolation, particularly for the elderly (Čaić et al. 2018). Intuitively, an apathetic,  
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53 emotionless, innately cold robot does not seem like the ideal caregiver (Stahl and Coeckelbergh  
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55 2016).  
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3 Over the last decade, robots have replaced humans by performing automatable tasks on  
4 manufacturing assembly lines, raising concerns that there may be job losses in the service sector  
5 as increasingly intelligent robots gain the ability to perform cognitive non-routine manual tasks  
6 (Decker, Fischer and Ott 2017). Huang and Rust (2018) highlight how AI will increasingly take  
7 over analytical, intuitive and eventually empathetic tasks in the future. However, it is not known  
8 if and how customers will react to service providers that are replacing service staff with FLSRs  
9 and whether they will consider such behavior as unethical or create concerns that they act poorly  
10 in terms of ethical and societal reputation. We explore three different measures which differ  
11 conceptually and enable us to gain a holistic understanding of key issues: 1) perceived ethical/  
12 societal reputation; 2) preference for ethical/responsible service providers; and 3) perceived  
13 innovativeness-responsibility fit.  
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### 28 **Customer Engagement Outcomes**

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31 FLSRs have the potential to revolutionize customer engagement by transforming the  
32 service experience and influencing the extent to which customers intend to use a brand (brand  
33 usage intent). For example, Natwest Bank is testing *Cora* and Finistra has developed *Sophia*, which  
34 are both highly lifelike digital human bots empowered with AI and deep learning that can detect  
35 human emotions and physically react with their own facial expressions (Joyce 2018). In the United  
36 States, Lowe's hardware stores are testing FLSRs that answer customers' questions and help them  
37 navigate around a store (Rafaeli et al. 2017).  
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49 For frontline service encounters, robots are likely to play an increasingly important role in  
50 enhancing the customer experience in the future; however, to the best of our knowledge no extant  
51 research has focused on FLSRs and the brand. We focus on two different customer-centric  
52 outcomes, the '*Service Experience*' and '*Brand Usage Intent*'. Service experience is  
53 conceptualized based on a customer's perceptions of the experience they have with a service  
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2 provider and draws from the brand experience literature (Brakus et al. 2009), while brand usage  
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4 intent is defined as “customers’ differential response between a focal brand and an unbranded  
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6 product when both have the same level of marketing stimuli and product attributes” (Hollebeek et  
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8 al. 2014, p. 163). Scholars have reported that an innovative service experience and brand usage  
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10 intent increase customer engagement (Hollebeek et al. 2014; Lin 2015).  
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### 13 14 **HYPOTHESIS DEVELOPMENT**

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17 The introduction of FLSRs to service settings is still a relatively novel experience for  
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19 customers, therefore the pathways which influence service outcomes such as the service  
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21 experience and brand usage intent have not been completely mapped. A variety of sometimes  
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23 opposing theoretical foundations can be used to explain parts of the picture, however, there is a  
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25 need for an overarching framework to gain a more holistic understanding. Therefore, based on the  
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27 preceding foundations, we propose a holistic conceptual framework that is presented in Figure 1.  
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29 Additional key components of the framework are described in the paragraphs that follow.  
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35 INSERT FIGURE 1 ABOUT HERE

#### 36 37 ***Perceived Innovativeness, Perceived Ethical/Societal Reputation and Role of FLSR***

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40 Perceived innovativeness involves a customer’s receptiveness and predisposition to a  
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42 service provider adopting new ideas and launching new products and/or services (e.g. Hurley and  
43  
44 Hult 1998) that result in “novel, creative, and impactful ideas and solutions” (Kunz et al. 2011, p.  
45  
46 817). Existing studies suggest that service providers who demonstrate innovativeness create  
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48 positive behavioral intentions (Eisingerich and Rubera 2010; Jin, Line and Merkebu 2016) and  
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50 that perceived innovativeness increases value in service settings (Kim et al. 2015; Lin 2015).  
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52 Conceptually, it can be argued that customers will perceive that introducing FLSRs is innovative,  
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2 particularly if FLSRs completely replace (substitute) rather than complement/augment existing  
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4 employees. Therefore:  
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8 H1: The effect of FLSRs on *perceived innovativeness* is stronger for human employee  
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10 substitution than human employee augmentation.  
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13 The concept of perceived ethical/societal reputation relates to customer perceptions of a  
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15 service provider's level of engagement in ethical practices and adherence to socially responsible  
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17 principles, which contributes to long-term success (Fukukawa, Balmer and Grey. 2007; Stanaland,  
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19 Lwin and Murphy 2011). Thus, perceived ethical/societal reputation combines customer  
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21 perceptions of a service provider's fulfilment of ethical standards and societal responsibilities  
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23 (Stanaland et al. 2011). Such practices are particularly important in the context of AI  
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25 implementation. Davenport (2020) notes the importance of carefully considering ethical  
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27 implications such as issues surrounding data privacy, biases or the purpose of AI applications.  
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29 Qureshi and Syed (2014) suggest that the introduction of robots in the healthcare sector is 'killing  
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31 off jobs' and could easily turn the perceptions of health workers and patients against such a  
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33 development. Moreover, the installation of FLSRs on one side of the service interaction  
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35 effectively removes the relational interplay between two human beings that previously  
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37 characterized such encounters. This interplay was invariably governed by universal norms and  
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39 unwritten moral codes (Abela and Murphy 2008). Thus, substituting employees with FLSRs in a  
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41 previously human-human dyad may be perceived by customers as innovative, but perhaps could  
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43 inadvertently damage a service provider's ethical credentials. At the same time, there is an  
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45 expectation that service providers should act in the best interests of society. Substituting willing  
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47 workers for robots, an act which will leave many unemployed and possibly destitute, is unlikely  
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49 to be regarded as socially responsible (Barrat 2013; Ford 2015). Therefore, we propose:  
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3 H2: The effect of FLSRs on perceived ethical/societal reputation *is stronger* for human  
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5 employee substitution than human employee augmentation.  
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### 8 ***Openness-to-Change***

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10 In general, customer adoption of innovative services is influenced by individual  
11 characteristics. Their values which are an essential psychographic trait reflect the motivational  
12 foundation which guides individual behavior across situations (Schwartz 2012). For example, the  
13 level of customer engagement in a brand is dependent on individual values such as uncertainty  
14 avoidance (Hollebeek 2018). Schwartz's (2012) value theory organizes ten value types in a  
15 motivational structure, which can be described by two axes: *self-transcendence* versus *self-*  
16 *enhancement*, and *openness-to-change* versus *conservation*. The circumplex structure reflects a  
17 motivational continuum, in which similar value types are located close to each other (Schwartz  
18 and Boehmke 2004).  
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31 The influence of openness-to-change on an individual's acceptance of and reasons for  
32 adopting innovative services, which in turn stimulates actual adoption behavior, has been  
33 established for different contexts. For example, Wang, Dou and Zhou (2008) show that new  
34 product adoption is positively related to the degree of openness-to-change a customer holds, and  
35 negatively to their preference for traditional products. Hence, high levels of openness-to-change  
36 should be associated with favorable behavioral outcomes as a consequence of FLSR  
37 implementation, while low levels should be related to negative outcomes. Specifically, as  
38 individuals with high levels of openness-to-change form more positive attitudes towards the  
39 implementation of innovation (Claudy, Garcia and O'Driscoll 2015), the mediation via perceived  
40 innovativeness in such cases should be stronger. Additionally, as low levels of openness-to-change  
41 are accompanied by a preference for traditional and/or conservative products or service provision  
42 (Pepper, Jackson and Uzzell 2009; Wang et al. 2008), these individuals may be more skeptical  
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3 towards FLSR implementation. As such, the negative mediation effect through perceived  
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5 ethical/societal reputation should be weakened for customers with high levels of openness-to-  
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7 change. Therefore, we propose:

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10 H3: High openness-to-change strengthens the positive effect of FLSRs on *perceived*  
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12 *innovativeness*.

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14 H4: High openness-to-change weakens the negative effect of FLSRs on *perceived*  
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16 *ethical/societal reputation*.

### 17 18 19 ***Service Experience, Perceived Innovativeness and Perceived Ethical/Societal Reputation***

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21 The results of previous research in a service context suggest that customer experience is an  
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23 antecedent of brand engagement and brand equity (Ding and Tseng 2015; Hepola et al. 2017; Lin  
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25 2015) and drives brand loyalty (van der Westhuizen 2018). Given the influence of the role of  
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27 service robots on perceived innovativeness (H1), and perceived ethical/societal reputation (H2), it  
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29 is likely FLSRs may provide an overall mediated effect on service experience. In their study of  
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31 service robots, Čaić et al. (2018) suggest there is a need to consider both the positive and negative  
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33 consequences of introducing robots simultaneously in a single study. On the basis of the  
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35 conceptualization of our framework derived from our literature review, we expect that customer  
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37 experience with a service organization is subconsciously influenced by both factors during a  
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39 frontline service encounter. We subsequently propose the following mediating hypotheses:

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42 H5: FLSRs have a positive indirect effect on service experience via *perceived*  
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44 *innovativeness* (H5a), and a negative indirect effect on service experience via *perceived*  
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46 *ethical/societal reputation* (H5b).  
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### 54 55 ***Perceived Innovativeness-Responsibility Fit and AI Type***

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57 Perceived Innovativeness-Responsibility fit relates to customer perceptions of apparent  
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59 incongruences between the innovative aspects of cutting-edge technology (AI) and service  
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3 providers' adherence to sound ethical, socially responsible principles. Brand congruency theory  
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5 suggests that it is important for customer brand associations to be consistent with the behavior of  
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7 brand owners (Arbouw, Ballantine and Ozanne 2018; Sjödin and Törn 2006). In a similar manner  
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9 to brand owners attempting to ensure that product extensions have a good fit with the parent brand  
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11 (Carter and Curry 2014), service providers must ensure that there is congruency between new  
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13 FLSRs and their existing brand – in particular, a fit or congruence with ethical and socially  
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15 responsible activities (Jong and Meer 2017). However, technology providers have frequently been  
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17 criticized for their poor responsibility records and questionable ethical practices (Vaidhyathan  
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19 2018). For example, Facebook has been condemned for selling personal data to Cambridge  
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21 Analytica who potentially influenced the results of the US election. In Europe and the UK Google  
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23 has faced scorn for not paying tax (Delfanti and Arvidsson 2019). Debate is continuing regarding  
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25 AI and weapons, where robots and drones could save our armed forces, but create ethical  
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27 challenges if robots are given the power to kill people without human intervention (Marr and Ward  
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29 2019). Such examples create challenges in many customers' minds regarding FLSRs and perceived  
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31 innovativeness-responsibility fit. Drawing on conceptual underpinnings from the brand  
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33 congruency and socially responsible consumption literature (Ramasamy and Yeung 2009;  
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35 Stanaland et al. 2011), as well as recent studies that highlight how uncanny valley theory suggests  
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37 customers may feel apprehension and unease with humanoid robots (e.g. Kim, Schmitt and  
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39 Thalmann 2019; Mende et al. 2019), we hypothesize:

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42 H6: Humanoid FLSRs have a weaker effect on *perceived innovativeness-responsibility* fit than  
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44 self-service machines.

### 45 46 47 ***Perceived Innovativeness-Responsibility Fit and Service Type***

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The credence-experience service typology (Keh and Sun 2018), has been used to categorize  
services that mainly have credence or experience attributes (Ostrom and Iacobucci 1995). Services

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3 differ in terms of the extent to which customers are able to evaluate them, even at the post-  
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5 consumption stage. Credence services such as those associated with an insurance agency have  
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7 attributes that are difficult to evaluate prior to or after consumption (Keh and Sun 2018).  
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9 Experience attributes such as those related to a haircut, a stay at a hotel or meal at a restaurant can  
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11 only be evaluated during or after consumption (Chocarro, Cortinas and Villneuva 2018). As  
12  
13 credence services are usually non-standardized and developed for the needs of an individual  
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15 customer or family (e.g. holiday insurance may vary according to an individual's age, where they  
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17 are travelling to, as well as existing health conditions), their consumption is linked with uncertainty  
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19 and risk (Mitra, Reiss, and Capella 1999) and they are harder to evaluate in comparison to  
20  
21 experience services (Ostrom and Iacobucci 1995; Keh and Sun 2018). As such, when evaluating  
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23 customer perceptions about the innovativeness and ethical and societal implications of FLSRs, it  
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25 is pivotal to examine the differential effects of credence vs. experience services. Drawing on  
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27 conceptual foundations from the brand congruency and ethical/social responsibility literature and  
28  
29 credence-experience typology we suggest:  
30  
31  
32  
33

34 H7: The negative effect of humanoid FLSRs (vs. self-service machine) on *perceived*  
35  
36 *innovativeness-responsibility fit* is stronger for experience services than credence services.  
37  
38

39  
40 ***Preference for Ethical/Responsible Service Providers, Perceived Innovativeness-Responsibility***  
41  
42 ***fit and Service Type***  
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44

45 An individual customer is likely to have specific preferences for ethical/responsible service  
46  
47 providers, which can be defined as the importance they place on businesses that act in an ethical  
48  
49 and socially responsible manner (Ramasamy and Yeung 2009). Theories of socially responsible  
50  
51 consumption suggest that customers who have strong ethical values are more likely to be receptive  
52  
53 to ethical and pro-environmental products and services (De Groot and Steg 2009; Osburg et al.  
54  
55 2019). Therefore, we would expect an individual's preferences for an ethical/responsible service  
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1  
2 provider to influence their perceptions of perceived innovativeness-responsibility fit. Building  
3  
4 upon H7 and theoretical underpinnings from the credence and experience service literature, we  
5  
6 hypothesize:  
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9  
10 H8: High preference for ethical/responsible service providers strengthens the negative  
11  
12 effect of humanoid FLSRs (vs. self-service machine) on *perceived innovativeness-*  
13  
14 *responsibility fit*.  
15  
16

### 17 ***Perceived Innovativeness-Responsibility Fit, AI Type and Brand Usage Intent***

18  
19  
20  
21 When introducing H5, we described the need to test whether perceived innovativeness and  
22  
23 ethical/societal reputation, which are forms of cognitive evaluation, provide an overall mediated  
24  
25 effect on the service experience – highlighting the need to simultaneously consider both  
26  
27 factors. Following similar arguments, we expect that another form of cognitive evaluation  
28  
29 (perceived innovativeness-responsibility fit), which is essentially a combination of perceived  
30  
31 innovativeness and perceived ethical/societal reputation, will indirectly influence brand usage  
32  
33 intent. Therefore:  
34  
35

36  
37 H9: Humanoid FLSRs (vs. self-service machine) have a negative indirect effect on *brand*  
38  
39 *usage intent* via *perceived innovativeness-responsibility fit*.  
40  
41

42 An extended conceptual framework incorporating the hypotheses tested in Studies 1 and 2 is  
43  
44 presented in Figure 2.  
45

46 INSERT FIGURE 2 ABOUT HERE  
47

### 48 **STUDY 1: FLSRs AND THE SERVICE PROVIDER EXPERIENCE**

49  
50  
51 Data for all studies was from a consenting representative sample of UK adults (aged over  
52  
53 18), collected randomly by the market research firm Qualtrics using an online survey.  
54

55  
56 ***Design, procedure, and stimuli.*** To test the hypothesized effects presented in the  
57  
58 conceptual framework, an online experiment was conducted, which adopted a 3 (Role of FLSRs:  
59  
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1  
2  
3 *augmentation, substitution, control*) x 2 (Value Creation Model: *asset-builder, service-provider*)  
4  
5 between-subject design. For role of FLSRs, an artificially intelligent humanoid FLSR was  
6  
7 presented as either assisting human airline staff during a check-in process (i.e. *augmentation*), or  
8  
9 entirely replacing human staff to complete this process autonomously (i.e. *substitution*). The  
10  
11 *control* condition stated that only human staff were present. The value creation model was  
12  
13 manipulated to control for differences in the salience of frontline service provision to customers;  
14  
15 service-providers are likely to have greater interaction with customers than asset-builders, since a  
16  
17 more human-relational experience is considered more important during service encounters  
18  
19 (Lariviere et al. 2017). The asset-builder context was represented by the hypothetical visit to a  
20  
21 duty-free shop within the airport transfer terminal, and the service-provider scenario was based on  
22  
23 the check-in process with the airline.  
24  
25  
26  
27

28 At the beginning of the survey, participants were asked to imagine the following situation.  
29  
30 “Imagine that you are currently having a stopover at an airport whilst flying to a holiday  
31  
32 destination. You are using the airline that you usually or frequently fly with”. Participants were  
33  
34 then randomly assigned to one of the experimental conditions. The information provided to the  
35  
36 participants is shown in the Supplementary Table 1 (online material) for each experimental  
37  
38 condition. In addition to the text, an image of a humanoid FLSR was included for augmentation  
39  
40 and substitution of human employees, whilst images of duty-free stores were used to complement  
41  
42 the visualization of the value creation model. Images representing the humanoid FLSR presented  
43  
44 in all studies, as well as the non-humanoid service-machine presented in Study 2, are presented in  
45  
46 Figure 3.  
47  
48  
49

50  
51 INSERT FIGURE 3 ABOUT HERE  
52

53 ***Sample and measures.*** Prior to the main study, a preliminary study (more details of the  
54  
55 preliminary study are presented in the supplementary materials section) was carried out to check  
56  
57 the manipulations with 85 randomly chosen participants ( $m_{age}=35.7$  years, 42.4% female) from the  
58  
59  
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1  
2  
3 UK. In addition, standard manipulation checks were carried out in the main study, as well as an  
4  
5 attention check, whereby respondents were asked to correctly identify the scenarios presented to  
6  
7 them earlier in the survey. Only those who passed the attention check were retained as part of the  
8  
9 final sample. This resulted in a random sample of 563 useable responses (all UK) for the main  
10  
11 study ( $m_{age}=42.2$  years, 52.4% female).

12  
13  
14 After exposure to the stimulus, the constructs of the conceptual framework were assessed  
15  
16 with established scales: 1) Perceived Ethical/Societal Reputation (Stanaland et al. 2011), 2)  
17  
18 Perceived Innovativeness (Kunz et al. 2011), 3) Service Experience (adapted from Brakus et al.  
19  
20 2009) and 4) Openness-to-Change (World Value Survey 2006). Minor modifications were made  
21  
22 to the other items to ensure that they matched the context of the scenarios. Perceived  
23  
24 Ethical/Societal Reputation, Perceived Innovativeness and Service Experience were measured  
25  
26 with 7-point scales ranging from “strongly disagree” (1) to “strongly agree” (7). Respondents rated  
27  
28 their perceived similarity to 10 fictitious personality descriptions on a 6-point scale (1: “not at all  
29  
30 like me”, 6: “very much like me”) for the measurement of the Schwartz Value Circumplex.  
31  
32 Manipulation checks were carried out to ensure a successful manipulation of the experimental  
33  
34 conditions. Supplementary Table 3 provides an overview of the scales and items.

### 35 36 37 38 39 ***Results for Study 1: FLSRs and the Service Experience***

40  
41  
42 Table 1 presents a descriptive profile of participants, and Table 2 shows an overview of  
43  
44 responses by experimental group. Construct validity and reliability tests were carried out  
45  
46 (Supplementary Tables 5 to 7 (available online)) and the composite reliability (CR) measure was  
47  
48 found to be greater than 0.7 for all constructs. Further, the average variance extracted (AVE)  
49  
50 exceeds 0.5 for each construct, while  $\sqrt{AVE}$  exceeds correlations with other constructs and is less  
51  
52 than the maximum shared variance; thus, convergent and discriminant validities are established  
53  
54 (Hair et al. 2010). The factor means for dependent variables are summarized in Figure 4 by  
55  
56 experimental condition. The manipulation checks revealed a significant effect for both  
57  
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60

1  
2 manipulated factors: Value Creation Model ( $F= 13.453$ ;  $p<0.001$ ) and Role of FLSR ( $F= 11.083$ ;  
3  $p<0.001$ ). Preliminary analysis using a two-way factorial MANOVA shows that substitution has a  
4 greater positive effect on perceived innovativeness compared to no FLSR involvement  
5 ( $\Delta m=0.248$ ,  $p<0.05$ ); but augmentation of human employees effect in this respect, although  
6 positive ( $\Delta m=0.125$ ), is not statistically significant. Similarly, substitution of human employees  
7 has a greater negative effect on perceived ethical/societal reputation compared to no FLSR  
8 involvement ( $\Delta m=-0.298$ ,  $p<0.05$ , CI: -0.536, -0.061), but augmentation of human employees  
9 effect ( $\Delta m=-0.228$ ) is not statistically significant, compared to no FLSR involvement.  
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21 INSERT TABLES 1 AND 2 AS WELL AS FIGURE 4 ABOUT HERE  
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23

24 Further analyses were conducted based on the Ordinary Least Squares regression method  
25 using the Hayes PROCESS tool (custom Model 10); bootstrapped ( $N=5000$ ) bias-corrected  
26 confidence intervals (CI) and heteroscedasticity-consistent standard errors (SE) were computed in  
27 line with standard practice (Hayes 2013; Yoganathan, Osburg and Akhtar 2019). Categories of the  
28 manipulated factors were coded using the indicator method (Hayes and Preacher 2014). Values for  
29 openness-to-change were obtained following the procedure of Dobewall and Strack (2014) and  
30 Strack and Dobewall (2012) by mean-centering relevant items, which were then used for  
31 computing a specific composite score for each respondent. Respondents' previous experience or  
32 interaction with FLSRs was controlled for by including it as a covariate in the model, which  
33 resulted in a non-significant effect on service experience ( $\beta=-0.0656$ ; CI: -0.2359, 0.1047).  
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48 The effect of the role of FLSRs on perceived innovativeness is positive and statistically  
49 significant for substitution of human employees ( $\beta=0.1779$ ; CI: 0.0442, 0.3116); but for  
50 augmentation of human employees, the effect is weaker and not significant. H1 is therefore  
51 supported. Similarly, the effect of the role of FLSRs on perceived ethical/societal reputation is  
52 negative and statistically significant for substitution ( $\beta=-0.1940$ ; CI: -0.3301, -0.0580), whereas  
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3 the effect is not significant for augmentation. Hence, H2 is also supported. However, there were  
4  
5 no significant differences observed between the value creation models (asset-builder, service-  
6  
7 provider) in relation to the effect of FLSR on either perceived innovativeness or perceived  
8  
9 ethical/societal reputation. Further, there was no evidence that the effects of the role of FLSRs on  
10  
11 perceived innovativeness and perceived ethical/societal reputation are moderated by individuals'  
12  
13 openness-to-change, as the moderation effects are not statistically significant. Thus, H3 and H4  
14  
15 are not supported. Effects on perceived innovativeness and perceived ethical/societal reputation  
16  
17 are not supported. Effects on perceived innovativeness and perceived ethical/societal reputation  
18  
19 are visualized in Figures 5 and 6.

20  
21  
22 INSERT FIGURES 5 AND 6 HERE  
23

24  
25 Results show support for H5a and H5b; the substitution role of FLSRs has a positive  
26  
27 indirect effect on service experience via perceived innovativeness and a negative indirect effect  
28  
29 via perceived ethical/societal reputation. However, the augmentation role does not have any  
30  
31 indirect effects on service experience. Further, substitution's effect via perceived ethical/societal  
32  
33 reputation is significant at high levels of openness-to change in both asset-builder ( $\beta=-0.0737$ ; CI:  
34  
35  $-0.1511, -0.0021$ ) and service-provider ( $\beta=-0.0841$ ; CI:  $-0.1612, -0.0148$ ) models. On the other  
36  
37 hand, substitution's effect via perceived innovativeness is also significant at high levels of  
38  
39 openness-to change, but only in the asset-builder model ( $\beta=0.0704$ ; CI:  $0.0143, 0.1321$ ). In both  
40  
41 value creation models, indirect effects via perceived innovativeness and perceived ethical/societal  
42  
43 reputation are not significant for low levels of openness to change. Indirect effects of substitution  
44  
45 are visualized in Figure 7.  
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50  
51 INSERT FIGURE 7 HERE  
52

## 53 54 55 **STUDY 2: FLSRs AND BRAND USAGE INTENT**

56  
57 ***Design, procedure and stimuli.*** To further explore the effects of substituting human  
58  
59 employees with AI, Study 2 considers the substitution role of technology as a function of  
60

1  
2 substituting AI type and service type and builds on Study 1. Accordingly, in Study 2 we  
3  
4 manipulated both the substituting AI type and service type, resulting in a 2 (Type of AI  
5  
6 substitution: *FLSR, self-service machine*) x 2 (Service type: *experience, credence*) between-subject  
7  
8 design. Respondents were randomly assigned to either the experience or credence service  
9  
10 condition.  
11  
12

13  
14 Building on the manipulations specified by Keh and Sun (2018), experience service was  
15  
16 represented by a restaurant visit whilst credence service was operationalized by the visit to an  
17  
18 insurance agency branch (specifically, to buy life insurance). Depending on the condition,  
19  
20 respondents were asked to imagine being in one of the described situations: i) “Imagine that you  
21  
22 are having dinner with some friends. You selected a restaurant, which you have not visited before.  
23  
24 This restaurant is described in the following” (experience service), or ii) “Imagine that you have  
25  
26 been considering purchasing life insurance. One day, you see an insurance agency and you decide  
27  
28 to visit the branch to find out more about it and possibly buy life insurance. The situation is further  
29  
30 described in the following” (credence service). Participants were then provided with further  
31  
32 information about the situation, which also included a specification of the AI type. Based on the  
33  
34 assigned condition, the respondents received one of the texts shown in Supplementary Table 2.  
35  
36 The descriptions were complemented with a) an image of a humanoid or FLSR or self-service  
37  
38 machine, and b) an image of a restaurant or insurance agency branch.  
39  
40  
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42  
43

44 ***Sample and measures.*** Overall, a random sample of 400 useable responses was collected  
45  
46 ( $m_{age}=34.13$  years, 56.8% female; all UK). After exposure to the stimulus, the specified constructs  
47  
48 were measured with established scales: 1) Perceived Innovativeness-Responsibility Fit (adapted  
49  
50 from Janssen et al. 2014), 2) Preference for Ethical/Responsible Service Provider (Ramasamay  
51  
52 and Yeung 2009), and 3) Brand Usage Intent (Yoo and Donthu 2001). Again, minor modifications  
53  
54 were conducted so that the items had a better fit with the presented scenarios. All scales and items  
55  
56 are documented in Supplementary Table 3 (available online).  
57  
58  
59  
60

## ***Results for Study 2: FLSRs and Brand Usage Intent***

Table 3 presents a descriptive profile of participants, while Table 4 provides an overview of responses by experimental group. The manipulation checks are significant for Type of AI Substitution ( $F= 5.69$ ;  $p<0.05$ ) and Service Type ( $F= 4.84$ ;  $p<0.05$ ), and hypothesis testing was performed adopting the same procedure as in Study 1. Four variables were controlled for when testing hypotheses by adding them as covariates in the model: experience with FLSRs ( $\beta=0.0527$ ; CI: 0.0174, 0.0879), experience with a self-service machine ( $\beta=-0.0314$ ; CI: -0.0863, 0.0235), visiting restaurants ( $\beta=0.0300$ ; CI: -0.0160, 0.0760), and experience with insurance agencies ( $\beta=-0.0121$ ; CI: -0.0457, 0.0214).

INSERT TABLES 3 AND 4 APPROX. HERE

Humanoid FLSRs (vs. self-service machines) have a significant negative effect on perceived innovativeness-responsibility fit ( $\beta=-0.3634$ ; CI: -0.5471, -0.1796), which supports H6. However, there is no significant difference in this effect between credence and experience service types; hence, H7 is not supported.

The negative effect of humanoid FLSRs (vs. self-service machine) on perceived innovativeness-responsibility fit, for credence as well as experience services, is strengthened when an individual's preference for ethical/responsible service providers is high ( $\beta=0.2368$ ; CI: 0.0741, 0.3995). Therefore, H8 is supported. Notably (see Figure 8), perceived innovativeness-responsibility fit in credence services is *low* when an individual's preference for ethical/responsible service providers is high (compared to average). In contrast, perceived innovativeness-responsibility fit in experience services is *high* when an individual's preference for ethical/responsible service providers is high (compared to average).

INSERT FIGURE 8 HERE

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Humanoid FLSRs (vs. self-service machines) do not have a direct effect on brand usage intent in either credence or experience services. Nevertheless, statistically significant and positive indirect effects were observed in credence ( $\beta=0.1901$ ; CI: 0.0843, 0.3051) and experience service types ( $\beta=0.1408$ ; CI: 0.0401, 0.2403), which supports H9. However, the indirect effects do not differ significantly based on either the service type or an individual's preference for ethical/responsible service providers.

## GENERAL DISCUSSION

There is little doubt that the introduction of FLSRs will have a profound effect on the service domain. In this paper we use the results of two main studies to show that introducing FLSRs has the following main effects: 1. Augmenting or substituting human employees with FLSRs has positive and negative consequences irrespective of value creation model, AI type, and service type; 2. FLSRs make the customer service interaction feel more innovative; 3. If human employees are replaced by FLSRs (for example for cost or other benefits), they damage the ethical/societal reputation of the service provider in terms of both service experience and brand usage intent; 4. However, personal customer characteristics (openness-to-change and preference for ethical/responsible service providers) determine the specificity and extent of these effects. Whilst some individuals value innovativeness more, others appreciate the fact that a service provider is responsible towards employees and society. Our findings alert practitioners and researchers to the need to consider seriously (from a customer perspective) how the use of FLSRs influences perceived ethical/societal reputation, particularly if they are replacing/substituting human employees. Our results have theoretical as well as managerial implications which will help to successfully launch FLSRs.

### *Theoretical Implications*

This paper addresses gaps in the extant literature by answering calls for more research focusing on FLSRs and brands (Mende et al. 2019; Wirtz et al. 2018). No previous empirical

1  
2  
3 research has explored the specific roles that FLSRs play in influencing service experience or brand  
4  
5 usage intent. By operationalizing key components of Larivière et al.'s (2017) conceptual Service  
6  
7 2.0 model, we empirically validate and extend their work by developing and testing a holistic  
8  
9 framework for understanding customer perceptions of FLSRs. Further, we illustrate the importance  
10  
11 of considering both positive and negative cognitive evaluations of customers in relation to FLSRs  
12  
13 (Čaić et al. 2018). As the role of FLSRs increases to replacing humans, customers' perception of  
14  
15 innovativeness also rises, which complements previous conceptual studies that have highlighted  
16  
17 the positive potential of FLSRs (e.g. Wirtz et al. 2018).  
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19

20  
21 Our findings also highlight the negative effect of FLSRs in terms of the ethical/societal  
22  
23 reputation of service providers, which has not been widely empirically tested, but emphasized in  
24  
25 conceptual papers owing to the nascent nature of the subject. For example, studies have  
26  
27 highlighted the potential that AI has to replace human workers and create job displacement or  
28  
29 losses (Huang and Rust 2018); robotic autonomous driverless cars (e.g. Coca-Vila 2018); robots  
30  
31 providing the elderly with care (e.g. Čaić et al. 2018; Stahl and Coeckelbergh 2016); and more  
32  
33 general concerns with FLSRs (e.g. Wirtz et al. 2018).  
34  
35

36  
37 Customers appear to expect that employees will continue to play an essential role in  
38  
39 delivering and defining frontline service encounters in a variety of service settings (De Keyser et  
40  
41 al. 2019). Our results suggest that FLSRs were perceived to be more innovative in the asset-builder  
42  
43 context of a duty-free store than the service-provider context of an airline check-in. In an asset-  
44  
45 builder context, FLSRs may add to the evaluation of the overall experience of purchasing a  
46  
47 physical product.  
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49

50  
51 By situating our study in the new and existing context of frontline service encounters and  
52  
53 exploring mediating effects, we contribute to the general literature on service experience and brand  
54  
55 usage intent (e.g. Andreini et al. 2018; Hollebeek et al. 2014; Japutra and Molinillo 2019). A  
56  
57 positive service experience and increase in brand usage intent drives brand engagement and builds  
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1  
2 brand equity (Hepola et al. 2017). The mediation effects were significant when FLSRs completely  
3  
4 replace humans, but not when they augment human service provision in a frontline service  
5  
6 encounter. It appears that customers do not perceive that it is extraordinary to have an FLSR  
7  
8 augmenting and supporting employees in frontline service encounters, or perhaps they do not  
9  
10 attach much importance to it. With regards to the mediating effect of perceived ethical/societal  
11  
12 reputation, there is a clear difference between substitution and augmentation of human  
13  
14 employees. Participants were concerned about the ethical and societal consequences of replacing  
15  
16 employees with FLSRs, particularly in a substitution context.  
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20  
21 The effect of humanoid FLSRs (vs. self-service machines) on perceived innovativeness-  
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23 responsibility fit did not significantly differ between credence and experience services, which has  
24  
25 not been explored previously. This is linked to arguably the most important finding of our  
26  
27 research, which is the overall negative influence that FLSRs have on the service experience when  
28  
29 customers are prompted to consider ethical/responsible aspects. By identifying this overall effect,  
30  
31 we have answered calls to test net effects (e.g. Čaić et al. 2018). In most circumstances, the balance  
32  
33 between the positive influence of perceived innovativeness and negative effect on perceived  
34  
35 ethical/societal reputation and innovativeness-responsibility fit means that introducing FLSRs  
36  
37 reduces a customer's overall brand experience and brand usage intent. Hence, regardless of the  
38  
39 value creation model, FLSRs taking over the roles of employees in frontline service encounters  
40  
41 and customer-brand interactions is perceived negatively. These results provide empirical support  
42  
43 for Huang and Rust (2018) and others who express concerns regarding FLSRs replacing  
44  
45 employees.  
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51 We also considered how individual customer characteristics and values influence their  
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53 perceptions of the role of FLSRs. Previous discussions have focused on customers in general;  
54  
55 however, some individuals may be more open to change (innovative) while others may continue  
56  
57 to expect traditional personal interactions with humans during a frontline service encounter.  
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3 Consistent with theory, participants who were open to change appreciate the positive aspects of  
4 innovation, while those who were less receptive to change expressed concern about the negative  
5 implications (Claudy et al. 2015; Wang et al. 2008). Furthermore, these results were conditional  
6 on the value creation model. Positive effects of perceived innovativeness are found in the asset-  
7 builder context and when openness-to-change is high. In contrast, the negative effects of perceived  
8 ethical/societal reputation are present in both the asset-builder and service-provider contexts when  
9 openness-to-change is low.  
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19 For customers who have a high preference for ethical/responsible service providers,  
20 perceived fit between the innovative and responsible aspects of humanoid FLSRs  
21 substituting/replacing human workers is low in credence services, and high in experience services.  
22 This is understandable given that credence services (e.g. insurance) are harder to evaluate,  
23 uncertain, and riskier (from a customer perspective), and therefore, customers are likely to take a  
24 harsher or more skeptical attitude in evaluating FLSR involvement in such cases. Our findings in  
25 this respect are also consistent with those from brand congruency literature (Arbouw et al. 2018;  
26 Jong and Meer 2017). Overall, if the fit between the innovative and ethical aspects of humanoid  
27 FLSRs substituting employees is established in the view of customers, this will lead to an increase  
28 in brand usage intent regardless of service type or customer preference.  
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#### 44 ***Managerial Implications***

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46 Our findings indicate that it is essential for service providers to understand how customers  
47 cognitively evaluate FLSRs and the important influence of customer characteristics, as these will  
48 have an impact on frontline service encounters. FLSRs substituting or replacing employees is  
49 perceived as a more innovative move, but FLSRs augmenting frontline service employees appears  
50 better for the ethical/societal reputation of a service provider. Also, humanoid FLSRs are perceived  
51 to be more innovative than non-humanoid self-service machines that perform the same function.  
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3 However, relative to self-service machines, humanoid FLSRs are perceived to have an incongruent  
4  
5 innovativeness-responsibility fit which results in an overall negative impact on customer intent to  
6  
7 use a brand. Further, the introduction of FLSRs is likely to be more successful in an asset-builder  
8  
9 rather than service-provider context. Specific recommendations that will help service providers  
10  
11 take advantage of the benefits and reduce the risks associated with introducing FLSRs are  
12  
13 presented in Table 5.  
14

15  
16 INSERT TABLE 5 ABOUT HERE  
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19 Service providers might well find the prospect of reduced costs, increased efficiencies and  
20  
21 the provision of an alternative customer experience associated with introducing FLSRs alluring.  
22  
23 Nonetheless, from a customer perspective, we find that the introduction of FLSRs will create a  
24  
25 double-edged phenomenon. On the one hand, it is perceived as innovative (positive), but on the  
26  
27 other, it is ethically questionable creating a poor innovativeness-responsibility fit. When  
28  
29 considered in parallel, under most circumstances, negative influences outweigh the positive  
30  
31 perceptions and lead to a decrease in the overall service experience and reduce brand usage intent.  
32  
33 Consequently, plans or strategies involving the introduction of FLSRs should be carefully  
34  
35 considered. While investment in robotics for assembly-line production in the 1980's was a broadly  
36  
37 advantageous move, the same cannot quite be said of the new wave of FLSRs now entering  
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39 frontline service. As such their adoption is set to remain contentious.  
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45 Our results are dependent on the extent to which individual customers are conservative or  
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47 open to change and their preferences for ethical/responsible service providers. This may depend  
48  
49 on cultural and country differences. For multinational corporations, introducing FLSRs in  
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51 countries where customers have higher levels of innovativeness (for example, natives of Finland  
52  
53 are seemingly in thrall to technology, whereas Germans are less positively disposed) in advance  
54  
55 of countries where levels of customer innovativeness are lower may reap rewards (e.g. Bögel et  
56  
57 al. 2018; Dobewall and Strack 2014). Service providers must realize that traditional models of  
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3 innovation diffusion may need adapting before implementation in a dynamic, disruptive world of  
4  
5 robot-based service encounters. If jobs lost to FLSRs are not as significant as doomsayers warn  
6  
7 and as customers become familiar with FLSRs, damage to ethical/societal reputation may be  
8  
9 reduced. However, education and marketing programs aimed at changing negative perceptions  
10  
11 may still be warranted. In general, service managers should be cautioned against purely FLSR-  
12  
13 driven service scenarios.  
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16 In view of the above, prior to the widespread deployment of FLSRs, we suggest that both  
17  
18 managers and policymakers should give careful consideration to the following seven principles:  
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- 20  
21 I. To ensure that the safety and wellbeing of customers are not endangered, it is essential  
22  
23 that ethical principles governing the implementation of FLSRs are developed and  
24  
25 universally adopted.  
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- 27  
28 II. Through educational initiatives, service providers should collaborate to prepare  
29  
30 customers and frontline employees for the imminent arrival of interactive FLSRs.  
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- 32  
33 III. Given the extensive nature of customer data that can be gathered through routine  
34  
35 human-robot interactions, which is then stored, mined, and utilized by organizations,  
36  
37 protecting the privacy such data must be an unshakeable tenet of FLSRs.  
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- 39  
40 IV. Since robotic AI systems often excel by developing new ways of seeing and thinking  
41  
42 that are impenetrable to human observers, service providers must strive for absolute  
43  
44 transparency and integrity in their operation.  
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- 46  
47 V. Customers should be kept informed of the capabilities of such systems, and  
48  
49 mechanisms of overseeing such capabilities and necessary control should also be made  
50  
51 available to them.  
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- 53  
54 VI. Pressures to sanction and promote the use of robotics and AI as means of increasing  
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56 productivity, while simultaneously employing less labor, create a need for  
57  
58 policymakers to remain attuned to the need to reskill and assist employees whose jobs  
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2 are threatened by FLSRs. The introduction of a 'robot tax' to fund and support these  
3 efforts may also be necessary.  
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- 6  
7 VII. Policymakers should particularly focus on the utilisation of FLSRs in credence  
8 services, where the customer may not be aware of potential substitution by FLSRs,  
9 especially if service providers deliberately avoid being transparent about the use of AI  
10 technology to protect their ethical/societal reputation.  
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### 16 ***Limitations and areas for further research***

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18 Our findings demonstrate the importance of considering positive and negative influences  
19 on AI adoption together to avoid a one-sided perspective, which may over- or underestimate  
20 customer attitudes and perceptions. While the present research shows that perceived  
21 innovativeness and ethical/societal responsibility are some of these factors, future research needs  
22 to explore a range of other drivers and barriers related to AI adoption. This may include both  
23 technology-related and customer-related characteristics.  
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32 Additional research should be conducted when FLSRs are more commonly used in  
33 frontline service encounters. Such enquiry could explore the consequences of a positive service  
34 experience and increased brand usage, directly on, for example: customer engagement (see  
35 Hollebeek, Srivastava and Chen 2016) or the roles that FLSRs could play in sharing experiences  
36 and value co-creation (Chen et al. 2018). Further, preferences for specific private versus national  
37 brands (Liu et al. 2018) or service provider versus manufacturer brands could be explored. Our  
38 scenario involved an online experiment using images of robots in various frontline service  
39 scenarios. In the future, field experiments based on the introduction of real FLSRs would support  
40 our scenario-based research and enable more tests of their positive or negative implications on the  
41 service experience, as well as other constructs of interest. For example, if and how customers'  
42 perceptions of FLSRs change during a crisis such as the recent coronavirus pandemic when face  
43 to face encounters with human employees may be risky or not possible. Perceptions of artificial  
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faces could be explored as deviation from humanness in humanoid FLSRs may have dramatic consequences (van Doorn et al. 2017; Wirtz et al. 2018). The relationships between the feeling of visceral discomfort explained by uncanny valley theory (Mori 2012) and an apparently incongruent innovativeness-responsibility fit associated with humanoid FLSRs requires exploration, as they may have contrasting or cumulative negative effects on frontline service encounters. Our paper did not directly focus on these factors, however additional research in this area would provide valuable insights for FLSR designers.

Our research focused on perceived innovativeness, perceived ethical/societal reputation, and innovativeness-responsibility fit, which were established as mediators, forming the basis of customer cognitive evaluations. It would be useful to understand how long lasting these effects are by conducting longitudinal research, which monitors changes in customer perceptions over time. Relatedly, the effects may also depend on the cultural context, namely, technology-affine cultures could be more open to the introduction of FLSRs. Our research was undertaken in the UK, but our framework could be extended to other countries and cultures. In addition, more research focusing on marketing communications is needed to identify how the implementation of FLSRs should best be communicated to customers. Our experimental study shows that as perceptions of substitution are negative, there may be a need for better education or promotion aimed at informing customers of the benefits of FLSRs or the redeployment of staff. However, as the best methods for disclosing information are yet to be determined, how would customers perceive FLSRs being the main communicator? Although we explored FLSRs in both credence and experience contexts, the extent to which perceptions of the augmentation and substitution of human employees are industry dependent should be explored in more detail. For example, the purpose of travel (holiday vs. business) may influence such perceptions and customers' willingness-to-pay for the service may vary accordingly.

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3 This paper operationalizes Larivière et al.'s (2017) model by focusing on how customer  
4 perceptions of the service experience are influenced in asset-builder and service-provider value  
5 creation models with FLSRs augmenting or substituting the role of service employees. Other parts  
6 of the model including network-orchestration and technology-creator value creation models,  
7 network facilitation, and transformation roles for customers and employees, also warrant further  
8 research and validation through empirical studies. Additional categorizations such as Huang and  
9 Rust's (2017, 2018) typology of a technology driven service, and intelligences required for service  
10 tasks model, as well as van Doorn et al.'s (2017) and Wirtz et al.'s (2018) task-type and service  
11 recipient model also warrant further empirical attention. The focus of our study was customer  
12 centric and at the micro level, rather than meso, macro, and meta level contexts (Alexander,  
13 Jaakola and Hollebeek 2018). Additional empirical research on the meso, macro, and meta levels  
14 of FLSRs across a network of dyads and actors in a servicescape would be useful.

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As the development of scales that measure effectiveness and perceptions relating to FLSRs and branding are in their infancy, perhaps future research may focus on developing new and more appropriate scales. For example, there are opportunities for developing new scales that directly measure dehumanization or privacy concerns as FLSRs increasingly drive frontline service encounters.

In conclusion, since a wave of automation will undoubtedly transform service encounters and experiences, we must strive to understand the challenges and take advantage of the opportunities they provide. As service scholars, we must continue to explore the role of FLSRs in service types, the tasks they perform, and the factors that are crucial to value creation. Hollebeek et al.'s (2016) integrative S-D logic informed framework may provide additional insights for understanding co-creation, customer resource integration and customer learning, as we embrace the inevitable future in which AI-driven interactive and dynamic servicescapes become commonplace.

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For Peer Review

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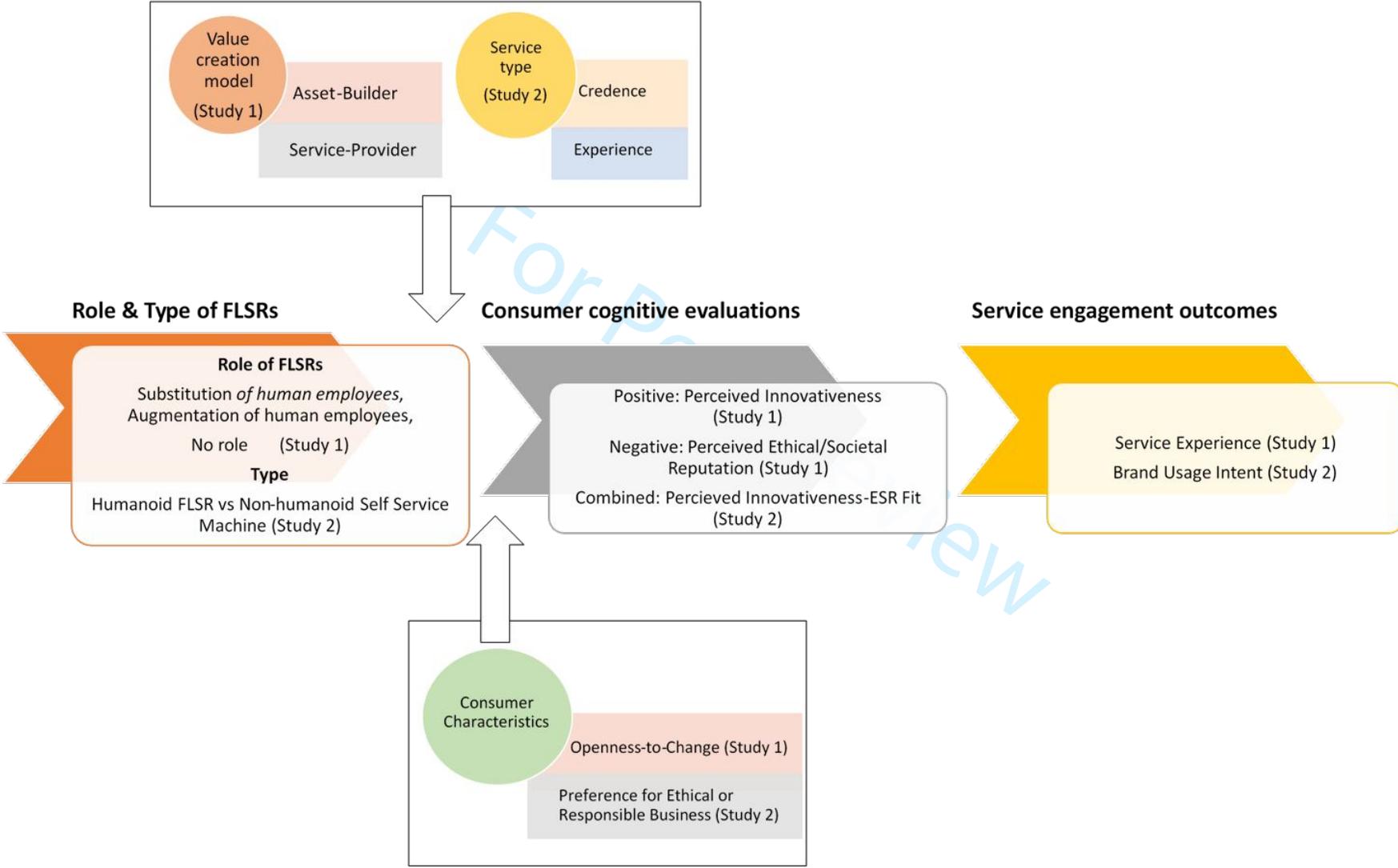
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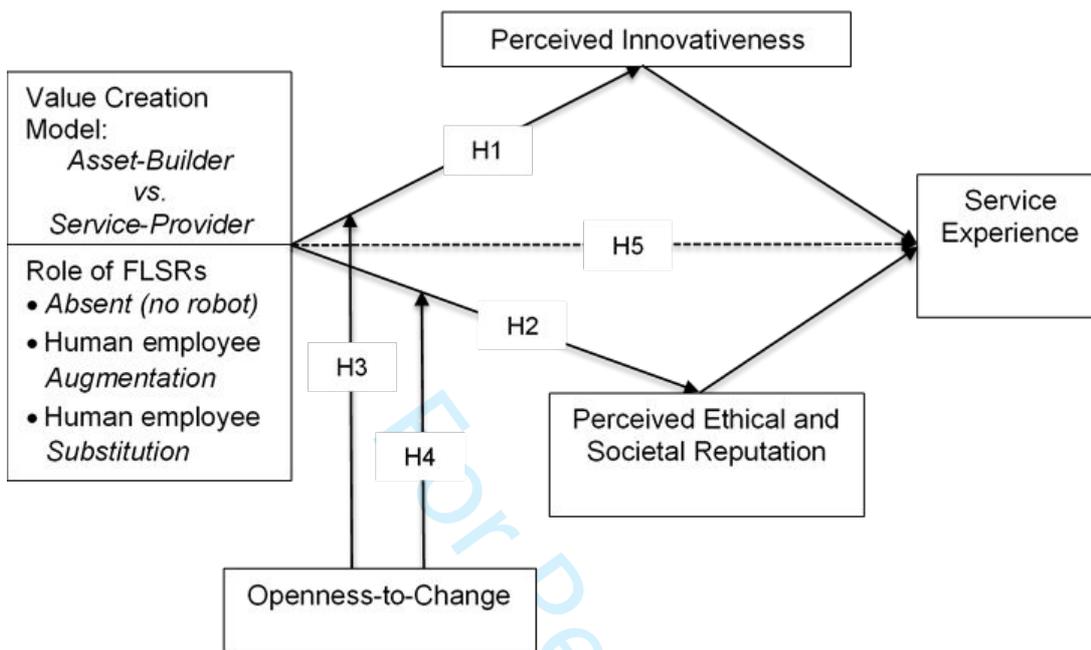
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Figure 1: A Holistic Framework for Understanding Customers' Perceptions of FLSRs



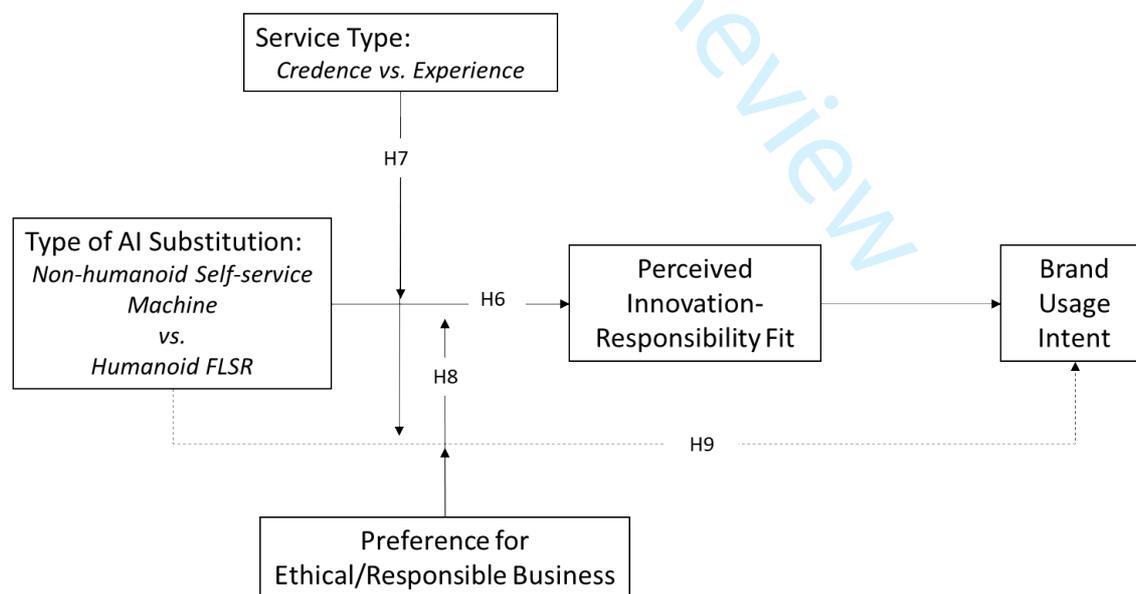
**Figure 2: Extended Conceptual Framework for Studies 1 and 2 Illustrating Hypotheses**

*Conceptual Framework for Study 1*



Note: Dotted line reflects indirect effect

*Conceptual Framework for Study 2*



Note: Dotted line reflects indirect effect

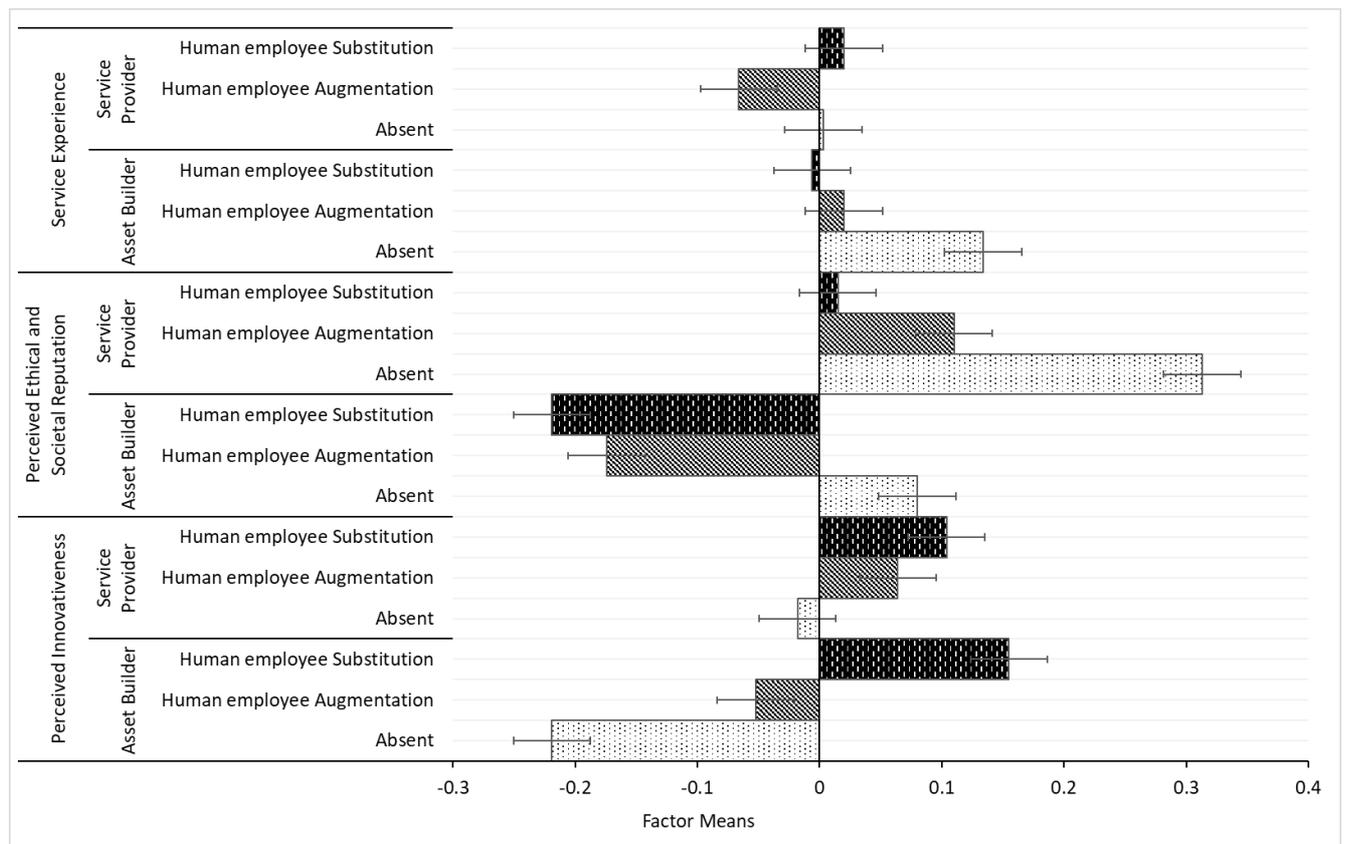
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**Figure 3: Illustrations of Humanoid FLSR and Non-Humanoid Self-Service Machine**

Humanoid Frontline Service Robot (FLSR)	Non-Humanoid Self-Service Machine
	

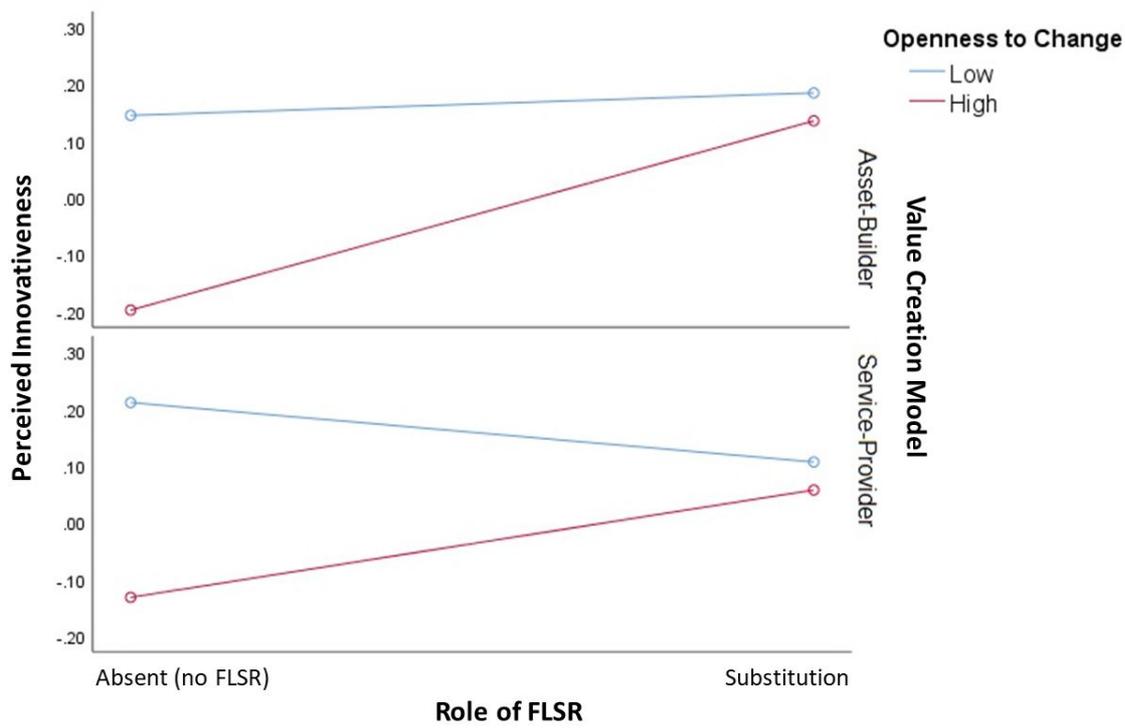
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**Figure 4: Dependent Variables as a Function of Experimental Conditions (Study 1)**



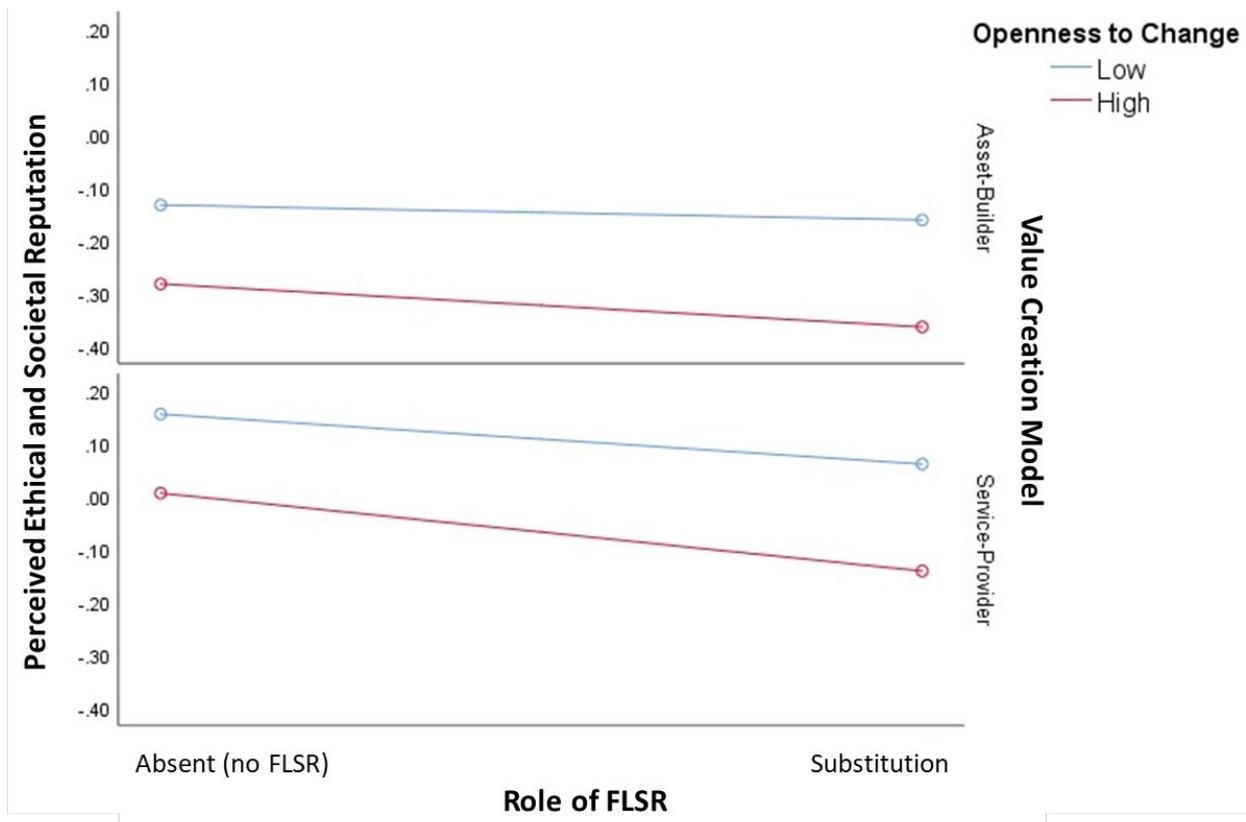
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Figure 5: Effects of Role of FLSRs on Perceived Innovativeness

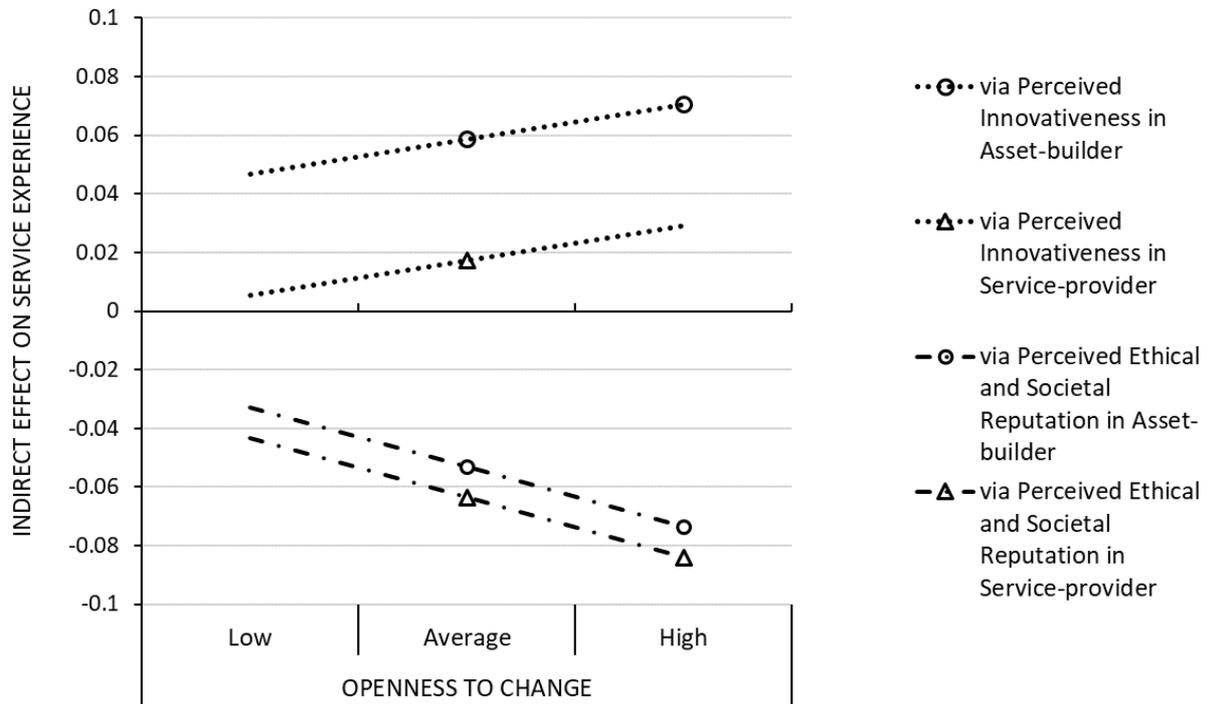


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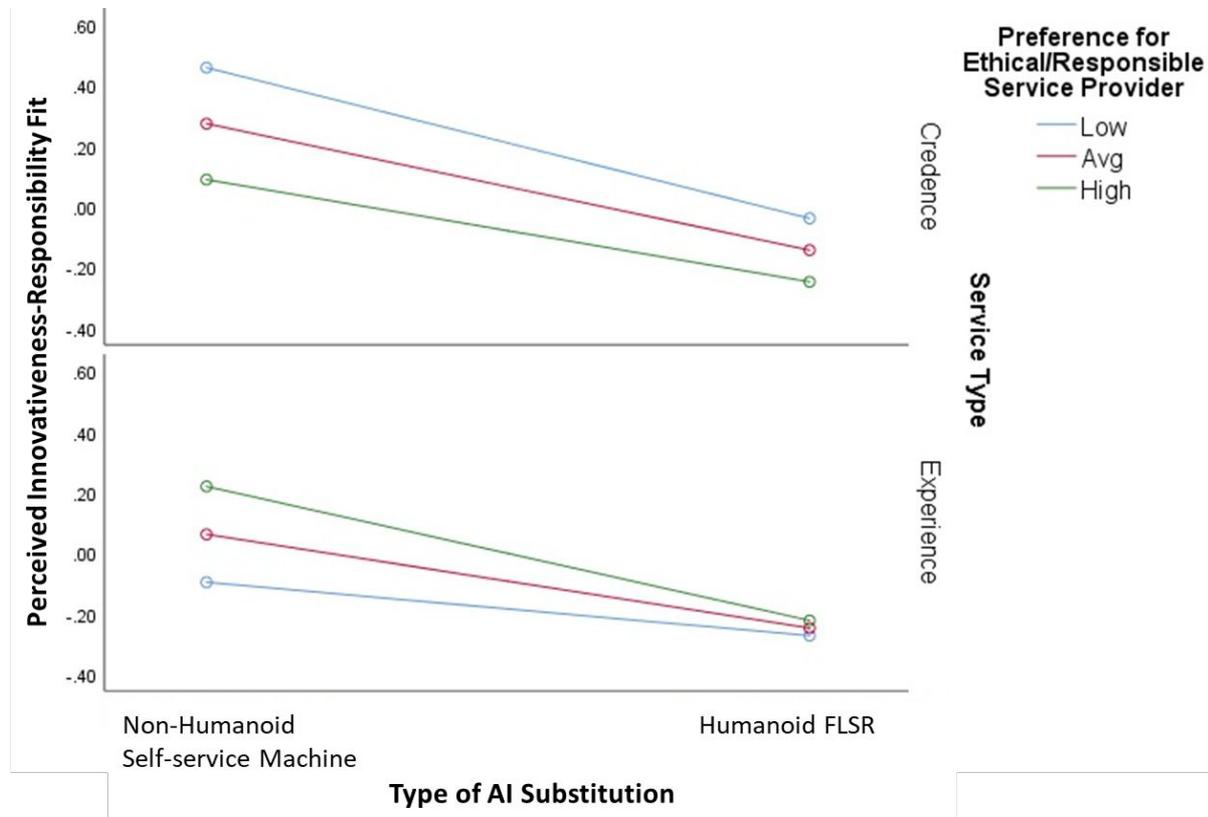
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**Figure 6: Effects of Role of FLSRs on Perceived Ethical and Societal Reputation**

**Figure 7: Indirect Effects of Substitution Role of FLSRs on Service Experience**



**Figure 8: Effects on Perceived Innovativeness-Responsibility Fit by AI Type and Preference for Ethical/Responsible Business**



Review

**Table 1: Descriptive Profile of Study 1 Participants**

	n	Mean	Std. Deviation
Age	563	42.22	11.86
Gender			
Male	268		
Female	295		
Highest level of education			
School	03		
High School	49		
College	87		
Bachelor's Degree	244		
Master's Degree	147		
Doctoral Degree	33		
Household Size	563	3.23	1.24
Household Income			
£60,001 - 90,000	325		
£90,001 - 120,000	137		
£120,001 - 150,000	56		
More than £150,000	45		
Previous experience with AI			
None	490		
Some	73		

**Table 2: No of Responses for Study 1 by Experimental Group**

Factor	Category	N
Value Creation Model	Duty-free (Asset-Builder)	279
	Airline (Service-Provider)	284
Role of FLSR	No role (absent)	206
	Human Employee Augmentation	177
	Human Employee Substitution	180

For Peer Review

**Table 3: Descriptive Profile of Study 2 Participants**

	n	Mean	Std. Deviation
Age	400	34.13	11.49
Gender			
Male	173		
Female	227		
Highest level of education			
School	01		
High School	55		
College	118		
Bachelor's Degree	157		
Master's Degree	63		
Doctoral Degree	06		
Household Size and Income	400	2.98	1.32
Less than £30,000	134		
£30,001 – 60, 000	160		
£60,001 - 90,000	71		
£90,001 - 120,000	18		
£120,001 - 150,000	06		
More than £150,000	11		
Controls (7-point scales)			
Used a service robot	400	3.36	2.08
Used a self-service machine	400	6.19	1.17
Frequently visit restaurants	400	5.16	1.48
Consulted insurance agencies	400	4.14	1.93

**Table 4: No of responses for Study 2 by Experimental Group**

Factor	Category	n
Type of AI Substitution	Self-service machine	201
	Humanoid FLRS	199
Service Type	Credence (insurance)	200
	Experience (restaurant)	200

For Peer Review

**Table 5: Managerial Guidelines for FLSRs Highlighting Perceived Benefits and Risks**

Scenario	Benefits	Risks
<b>Value Creation Model</b>		
Asset-Builder	Attempt to capitalize on positive customer perceptions of FLSRs and focus marketing communication efforts on innovators/early adopters.	For both asset-builders and service providers the negative impact on the ethical and societal reputation may outweigh the innovativeness of FLSRs replacing human workers. Asset-builders and service providers may benefit by continuing to employ traditional human staff, introducing FLSRs gradually.
Service Provider	Take advantage of the overall advantages that FLSRs provide to service providers such as individualized networked CRM systems, ability to track and analyses customer behavior, collect and share customer data, and provide highly personalized services, rather than customer-centric benefits.	
<b>Role of FLSR</b>		
Augmentation	Augmentation of employees may provide a smooth transition for service organizations seeking to introduce FLSRs, as it is not perceived to be as damaging to the ethical and societal reputation of a brand than substitution. Ensure customers are aware of FLSRs' augmentation role.	The risk of augmentation is that the innovativeness aspect may not be fully appreciated by customers. In such scenarios, FLSRs serve little more than a decorative purpose, the novelty of which can quickly dissipate; thus, reducing the return on investment. Service organizations may counter this by giving FLSRs a specific role; e.g. at the Smithsonian museum, in conjunction with FLSRs, human visitor information specialists provide valuable and inspiring information that can make customer experiences more memorable and exciting.
Substitution	When possible, focus on moving employees replaced by FLSRs to other roles where robots are unable to perform effectively and ensure customers are made aware of this to reduce reputational damage.	Be cautious when introducing FLSRs as the negative effect that robots have on ethical and societal reputation substantially outweighs the perceived positive benefits associated with innovativeness.
<b>Service Type</b>		
Credence	May prove attractive to customers due to their perceived innovativeness. Better to use FLSRs in combination with human employees given the uncertainties surrounding credence services.	As credence services are typically riskier than experience services, use FLSRs to reduce customers' perceptions of risks associated with this service type. For example, have FLSRs use AI to provide a customized experience based on access to customers' biometrics and share immediate cost and performance data, often lacking in credence service encounters (Mitra, Reiss and Capella, 1999).
Experience	May have a novelty effect and thus serve to attract customers and enhance engagement.	Reduce risk by assigning FLSRs to augmentation of services offered by human staff and avoid creating the perception that FLSRs are an attempt to avoid hiring human employees.
<b>Type of AI Substitution</b>		
Humanoid FLSR	Greater positive impact on customer engagement through increasing innovativeness perceptions.	Replacing employees with humanoid FLSRs has a negative effect on perceived innovativeness-responsibility fit. However, if a balance between innovativeness and responsibility aspects of FLSRs can be achieved (e.g. via redeployment of human employees for higher-order tasks), then the ultimate effect on customer engagement can be positive.
Non-humanoid Self-Service Machine	Less damaging in terms of achieving innovativeness-responsibility fit. Introduce non-humanoid self-service machines prior to humanoid FLSRs in order to reduce perceived incongruences.	The positive impact of innovativeness may not be realized. Better used as an augmentation device to frontline services provided by human staff.

## Supplementary online Material

### Supplementary Table 1: Scenario Descriptions for Study 1

	<b>Asset-Builder</b>	<b>Service-Provider</b>
<b>Augmentation</b> of human employees by FLSR	On your way to the new gate, you stop at a duty-free shop. Whilst shopping, you see a new service robot, Max. Max will help you find the products you are looking for. Hence, Max assists you and employees of the duty-free shop, who are otherwise often disrupted from their normal duties by passengers who are looking for products.	During your stopover, you have to go to a new departure gate. The airline you are traveling with has a new service robot, Max. Max will help you find your new gate. After scanning your boarding pass, Max will bring you to the gate, where airline staff will handle your boarding process. Hence, Max assists you and airline employees, who are otherwise often disrupted from their normal duties by passengers who cannot find the gate.
<b>Substitution</b> of human employees by FLSR	On your way to the new gate, you stop at a duty-free shop. You have completed your shopping and you want to pay. The duty-free shop has a new service robot, Max. Max will complete the full check-out process (i.e., assisting in paying and check-out for your duty-free shopping), just as it was previously done by employees of the duty-free shop.	You have reached your new departure gate and you are boarding your connecting flight. The airline you are travelling with has a new service robot, Max. Max will complete the full boarding process, including scanning your boarding pass, just as it was previously done by employees of the airline.
<b>No role</b> (no FLSR)	On your way to the new gate, you stop at a duty-free shop to do some shopping. The duty-free shop has hired more staff. They will 1) help you, 2) assist you to find the products you are looking for, and 3) complete the check-out process (i.e., assisting in paying and check-out for your duty-free shopping).	The airline you are travelling with has hired more staff. They will 1) help you, 2) direct you to your new gate, and 3) complete your boarding process.

### Supplementary Table 2: Scenario Descriptions of Study 2

	<b>Humanoid Service Robot</b>	<b>Self-Service Machine</b>
<b>Experience service</b>	When you enter the restaurant, you are welcomed by a service robot. The service robot assigns a table to you and takes the orders from you. The service robot can also be contacted in case of any questions/complaints and is used for checking out. Thus, the service robot performs all tasks, which were previously done by a human employee (waiter), who used to work for the restaurant.	When you enter the restaurant, you are welcomed by a self-service machine. The self-service machine assigns a table to you and takes the orders from you. The self-service machine can also be contacted in case of any questions/complaints and is used for checking out. Thus, the self-service machine performs all tasks which were previously done by a human employee (waiter), who used to work for the restaurant.
<b>Credence service</b>	When you enter the branch of the insurance agency, you are welcomed by a service robot. The service robot also assists you to find the right insurance solution, set up the contract, responds to any questions/complaints, and other parts of your transaction. Thus, the service robot performs all tasks, which were previously done by a human employee (insurance adviser), who used to work for the insurance agency.	When you enter the branch of the insurance agency, you are welcomed by a self-service machine. The self-service machine also assists you to find the right insurance solution, set up the contract, responds to any questions/complaints, and other parts of your transaction. Thus, the self-service machine performs all tasks which were previously done by a human employee (insurance adviser), who used to work for the insurance agency.

**Supplementary Table 3: Constructs and Items** (*R indicates reverse coded*)

<p><b>Service Experience</b> Adapted from Brakus et al.'s (2009) Brand Experience Construct</p> <p>This company makes a strong impression on my visual sense or other senses.</p> <p>I find this company interesting in a sensory way.</p> <p>This company does not appeal to my senses. (R)</p> <p>This company induces feelings and sentiments.</p> <p>I do not have strong emotions for this company. (R)</p> <p>This company is an emotional company.</p> <p>I engage in physical actions and behaviours when I use this company.</p> <p>This company results in bodily experiences.</p> <p>This company is not action oriented. (R)</p> <p>I engage in a lot of thinking when I encounter this company.</p> <p>This company does not make me think. (R)</p> <p>This company stimulates my curiosity and problem solving.</p>
<p><b>Brand Usage Intent</b> Yoo and Donthu (2001)</p> <p>It makes sense to use this restaurant/insurance agency instead of any other brand, even if they are the same.</p> <p>Even if another brand has the same features as this restaurant/insurance agency, I would prefer to use this restaurant/insurance agency.</p> <p>If there is another brand as good as this restaurant/ insurance agency, I prefer to use this restaurant/insurance agency.</p> <p>If another brand is not different from this restaurant/ insurance agency in any way, it seems smarter to use this restaurant/insurance agency.</p>
<p><b>Openness-to-Change</b> (World Values Survey)</p> <p>It is important to this person to think up new ideas and be creative; to do things one's own way. (Self-direction)</p> <p>It is important to this person to be rich; to have a lot of money and expensive things. (Power)</p> <p>Living in secure surroundings is important to this person; to avoid anything that might be dangerous. (Security)</p> <p>It is important to this person to have a good time; to "spoil" oneself. (Hedonism)</p> <p>It is important to this person to do something for the good of society. (Benevolence)</p> <p>Being very successful is important to this person; to have people recognize one's achievements. (Achievement)</p> <p>Adventure and taking risks are important to this person; to have an exciting life. (Stimulation)</p> <p>It is important to this person to always behave properly; to avoid doing anything people would say is wrong. (Conformity)</p> <p>Looking after the environment is important to this person; to care for nature and save life resources. (Universalism)</p> <p>Tradition is important to this person; to follow the customs handed down by one's religion or family. (Tradition)</p>
<p><b>Preference for Ethical/Responsible Service Provider</b> Ramasamy and Yeung (2009)</p> <p>I believe that businesses must make efforts to behave in a socially responsible manner.</p> <p>I would pay more to buy products from a socially responsible company.</p> <p>I consider the ethical reputation of businesses when I shop.</p> <p>I avoid buying products from companies that have engaged in immoral actions.</p>
<p><b>Perceived Ethical and Societal Reputation</b> Stanaland et al. (2011)</p> <p>This company is committed to well-defined ethics principles.</p> <p>This company ensures that their employees act in a legal manner.</p> <p>This company plans for their long-term success as well as society's.</p> <p>This company plays a role in our society that goes beyond the mere generation of profits.</p>
<p><b>Perceived Innovativeness-Responsibility</b> Fit Janssen et al. (2014)</p> <p>This service technology is created in a responsible way.</p> <p>This service technology is created in accordance with ethical principles.</p> <p>This service technology was created from a sustainability perspective.</p> <p>This service technology was created in accordance with moral principles.</p> <p>This service technology is eco-aware.</p> <p>This service technology allows for a comfortable life while preserving the planet.</p> <p>This service technology is not synonymous with excess and abundance.</p>
<p><b>Perceived Innovativeness</b> Kunz et al. (2011)</p> <p>This company is dynamic.</p> <p>This company is very creative.</p> <p>This company launches new products and creates market trends all the time.</p> <p>This company is a pioneer in its category.</p> <p>This company constantly generates new ideas.</p> <p>This company has changed the market with its offers.</p> <p>This company is an advanced, forward-looking firm.</p>

**Supplementary Table 4: Construct validity and reliability statistics**

Constructs and Items	Item Loadings	Average Variance Extracted	Composite Reliability
<b>Perceived Innovativeness</b>		0.94	0.99
This company is dynamic.	0.99		
This company is very creative.	0.99		
This company launches new products and creates market trends all the time.	0.96		
This company is a pioneer in its category.	0.99		
This company constantly generates new ideas.	0.96		
This company has changed the market with its offers.	0.99		
This company is an advanced, forward-looking firm.	0.95		
<b>Perceived Ethical and Societal Reputation</b>		0.65	0.88
This company is committed to well-defined ethics principles.	0.91		
This company ensures that their employees act in a legal manner.	0.79		
This company plans for their long-term success as well as society's.	0.87		
This company plays a role in our society that goes beyond the mere generation of profits.	0.87		
<b>Service Experience</b>		0.52	0.90
This company makes a strong impression on my visual sense or other senses.	0.79		
I find this company interesting in a sensory way.	0.84		
This company does not appeal to my senses. (R)	0.79		
This company induces feelings and sentiments.	0.81		
I do not have strong emotions for this company. (R)	0.70		
This company is an emotional company.	0.78		
I engage in physical actions and behaviours when I use this company.	0.74		
This company results in bodily experiences.	0.73		
This company is not action oriented. (R)	0.64		
I engage in a lot of thinking when I encounter this company.	0.84		
This company does not make me think. (R)	0.79		
This company stimulates my curiosity and problem solving.	0.86		
<b>Perceived Innovativeness- Responsibility Fit</b>		0.51	0.87
This service technology is created in a responsible way.	0.78		
This service technology is created in accordance with ethical principles.	0.83		
This service technology was created from a sustainability perspective.	0.74		
This service technology was created in accordance with moral principles.	0.82		
This service technology is eco-aware.	0.73		
This service technology allows for a comfortable life while preserving the planet.	0.81		
This service technology is not synonymous with excess and abundance.	0.53		
<b>Preference for Ethical/Responsible Service Provider</b>		0.56	0.84
I believe that businesses must make efforts to behave in a socially responsible manner.	0.72		
I would pay more to buy products from a socially responsible company.	0.84		
I consider the ethical reputation of businesses when I shop.	0.87		
I avoid buying products from companies that have engaged in immoral actions.	0.84		
<b>Brand Usage Intent</b>		0.69	0.90
It makes sense to use this restaurant/ insurance agency instead of any other brand, even if they are the same.	0.88		
Even if another brand has the same features as this restaurant/insurance agency, I would prefer to use this restaurant/ insurance agency.	0.87		
If there is another brand as good as this restaurant/ insurance agency, I prefer to use this restaurant/ insurance agency.	0.88		
If another brand is not different from this restaurant/ insurance agency in any way, it seems smarter to use this restaurant/ insurance agency.	0.87		

NOTE: Openness-to-Change is not included as it is not treated as a conventional (latent) construct. The values for it represent each respondent's position on the Schwartz value circumplex and are computed using Dobewall and Strack's (2014) procedure.

Supplementary Table 5: Effect coefficients for Study 1

	Direct effects on:			Indirect effects on Service Experience via:			
	Perceived Innovativeness	Perceived Ethical and Societal Reputation	Service Experience	Perceived Innovativeness		Perceived Ethical & Societal Reputation	
				Asset-builder	Service-provider	Asset-builder	Service-provider
Augmentation	-0.0042	0.0695	-0.0075	0.001	-0.004	0.3	0.012
Substitution	0.1779*	-0.1940*	-0.0652	0.057*	0.021	-0.083*	-0.075*
Value Creation Model	0.0501	0.2473*	-0.1853*	-	-	-	-
Perceived Innovativeness	-	-	0.3217*	-	-	-	-
Perceived Ethical and Societal Reputation	-	-	0.4277*	-	-	-	-
Openness-to-Change	-0.0644	-0.0561	-0.1238*	-	-	-	-
Covariates:							
Experience with FLSRs	-0.3477*	-0.3731*	-0.0656	-	-	-	-

NOTE: \*effect is statistically significant

**Supplementary Table 6: Effect coefficients for Study 2**

	Direct effects on:		Indirect effect on Brand Usage Intention via:	
	Perceived Innovativeness- Responsibility Fit	Brand Usage Intent	Perceived Innovativeness- Responsibility Fit	
			Credence	Experience
Humanoid FLRS	-0.3634*	0.0399	0.190*	0.141*
Service type	-0.1594	-0.1818*	-	-
Perceived Innovativeness- Responsibility Fit	-	-0.4553*	-	-
Preference for Ethical/Resp. Service Provider	-0.0265	-0.0254	-	-
Covariates:				
Experience with FLRSs	0.0121	0.0890*	-	-
Experience with a self-service machine	-0.1296*	-0.0839*	-	-
Visiting restaurants	-0.0558	0.0179	-	-
Experience with insurance agencies	0.0106	-0.0016	-	-

NOTE: \*effect is statistically significant

**Supplementary Table 7: Correlation table and average variance extracted**

	Service Experience	Perceived Innovativeness	Perceived Ethical and Societal Reputation
Service Experience	<b>0.718</b>		
Perceived Innovativeness	0.588	<b>0.969</b>	
Perceived Ethical and Societal Reputation	0.682	0.583	<b>0.804</b>
	Perceived Innovativeness-Responsibility Fit	Brand Usage Intent	Preference for Ethical/Responsible Service Provider
Perceived Innovativeness-Responsibility Fit	<b>0.712</b>		
Brand Usage Intent	0.698	<b>0.828</b>	
Preference for Ethical/Responsible Service Provider	0.029	-0.008	<b>0.751</b>

NOTE: figures in the diagonal are  $\sqrt{\text{AVE}}$ ; all other figures are correlations.

### Supplementary Material 1: Preliminary study results

A preliminary study was conducted with 85 randomly chosen participants (average age=35.7 years, 42.4% female) from the UK. They were asked to imagine the following situation: "Imagine that you are currently having a stopover at an airport whilst flying to a holiday destination. You are using the airline that you usually or frequently fly with". Using a between-subject design, role of FLSRs was manipulated in this scenario, whereby an artificially intelligent humanoid FLSR was presented as either assisting human airline staff during a check-in process (i.e. augmentation), or entirely replacing human staff to complete this process autonomously (i.e. substitution). A one-way ANOVA was used to test the effect of the main manipulation (role of FLSRs) on the service experience, based on the data collected in the preliminary study (n=85). Given the small sample size, equality of variances was tested for, and confirmed (Levene's  $W(2, 82)=.366$ ;  $p=.695$ ). The ANOVA results showed that the main effect is significant ( $F=4.591$ ;  $p<.05$ ). Overall mean differences were observed between substitution ( $m=.023$ ), augmentation ( $m=.307$ ), and the control group ( $m=-.492$ ); a Tukey's post hoc test showed that service experience was significantly higher ( $p<.05$ ) when a robot is used for augmentation, compared to the control group (i.e. no robot involvement). Service experience did not significantly differ between the augmentation and substitution of human employees by FLSRs.

### Author Bios

**Fraser McLeay** is Professor of Marketing at Sheffield University Management School and Head of Marketing, International Business, Enterprise and Strategy. He has extensive business experience in developing marketing, branding, new product/service introduction, digital marketing and sustainable/ethical consumption strategies in the service sector. Fraser's current research interests relate to hedonic versus sustainable/ethical consumption, eWOM and the barriers and opportunities associated with adopting innovative nascent new technologies including robots and autonomous vehicles. His research has been published in top journals including the *European Journal of Marketing*, *Journal of Business Research*, *Tourism Management and Information and Management*.

**Victoria-Sophie Osburg** is a Senior Lecturer (Associate Professor) in Marketing at Sheffield University Management School. Her research focuses on several topical issues within the subject areas of sustainability/ethical product marketing, digital marketing and consumer psychology.

**Vignesh Yoganathan** is a Senior Lecturer (Associate Professor) in Marketing at the Executive and Professional Education division of Sheffield University Management School. His research focuses on the intersections of technology, psychology and responsibility in marketing.

**Anthony Patterson** is a Professor of Marketing at Lancaster University Management School. Recently, his research projects have investigated components of technocapitalism, service ecosystems, and entrepreneurship as a manifestation of neoliberalism. His articles have been published in many top journals including the *Journal of Consumer Research*, *Journal of Service Research*, *Journal of Business Research*, *Psychology & Marketing* and *Marketing Theory*.

## **New study reveals how comfortable/uncomfortable customers are with robot employees**

**Researchers from Sheffield University Management School have developed a new framework to understand customers' perceptions of frontline service robots (FLSRs).**

The introduction of service robots into front line service settings is expected to increase rapidly during the 2020's, raising challenges for brands that have traditionally relied on personal touch for their success. New research, published in the Journal of Service Research, examines how customers react when employees are replaced or assisted by robots.

FLSRs will soon be capable of interacting with customers in a similar way to employees but, as the study reveals, this has both positive and negative consequences.

Some customers may perceive the introduction of FLSRs as threatening human jobs and be cautious of other issues which would damage a brand's reputation. On the other hand, some individuals will welcome the innovation brought to their experience by the service robots.

The researchers used different scenarios such as a robot-run duty-free shop, a robot-assisted flight check-in as well as robots operating in insurance agencies and restaurants to gauge the reaction of customers. They also explored potential customers' perceptions of humanoid robots in comparison to equally intelligent and functional non-humanoid service machines.

Customers viewed the wholesale replacement of employees by FLSRs negatively and as corrosive to a brand's reputation. Other studies have found this is particularly acute in a care provider context where a cold robot cannot replace human empathy. This suggests that customers will continue to expect that human employees play an essential role in delivering frontline service in a variety of settings.

However, scenarios where FLSRs were used judiciously to make the customer experience feel more innovative were viewed positively and could even add value to the customer experience. Retail encounters with robots were viewed particularly positively by customers. This opens a space for brands to creatively use FLSRs in a variety of ways and if done correctly FLSRs could even drive brand engagement.

Importantly, the researchers flag personal values such as openness-to-change or ethical values as key influencers in customer perception of the value of robots in a service encounter. How well a brand knows its customer will influence how it implements robots as part of its customer experience.

Fraser McLeay, Professor of Marketing at the University of Sheffield, said

"In the future, robots will play increasingly important roles in the service sector as they assist or replace employees at the customer interface. They do not get tired or make mistakes,

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2  
3 can process detailed customer information more quickly and effectively than human  
4 employees and potentially reduce costs. However, from a customer perspective, businesses  
5 should be cautious about introducing FLSRs as they could create a double-edged  
6 phenomenon. The results of our experiments raise questions for brands who need to  
7 balance innovation while maintaining their ethical reputation as good corporate citizens. We  
8 provide important new insights for policy makers and managerial guidelines that highlight the  
9 perceived benefits and risks associated with introducing FLSRs under different scenarios  
10 and contexts.”  
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