International Journal of Hospitality Management 108 (2023) 103380

Contents lists available at ScienceDirect

International Journal of Hospitality Management

journal homepage: www.elsevier.com/locate/ijhm

Why do hotel frontline employees use service robots in the workplace? A technology affordance theory perspective

Xi Y. Leung [a], Huiying Zhang [b,*], Jiaying Lyu [c,*], Billy Bai [d]

[a] Department of Hospitality and Tourism Management, University of North Texas, 1155 Union Circle #311100, Denton, TX 76203, USA
[b] School of Tourism Science, Beijing International Studies University, Beijing, China 100024
[c] International School of Cultural Tourism, Hangzhou City University, 310015, Hangzhou, PR China
[d] William F. Harrah College of Hospitality, University of Nevada, Las Vegas, 4505 Maryland Parkway, Las Vegas, NV 89154, USA

ARTICLE INFO

Keywords:
Service robot
Hotel frontline employee
Technology affordance theory
Socio-material perspective
Trust
Collectivism/individualism

ABSTRACT

The rapid robotization of the hotel industry faces reluctance from frontline employees. This study aims to explore frontline employees' intentions to use service robots in the hotel workplace. Combining technology affordance theory and socio-material perspective, the study conducted four experiments pre-pandemic, amid-pandemic, and post-pandemic to test the proposed framework. The results reveal that hotel employees, especially those with low collectivism (vs. high), prefer a room service robot with physical affordance to a concierge robot with cognitive affordance because the former offers more relative advantages and higher trust. This main effect remained the same both pre- and amid-pandemic. During the pandemic, the COVID-19 compliance of guests showed a significant interaction effect on the employees' intentions to use service robots in the workplace. The study findings provide meaningful implications for hoteliers selecting the correct type of robot for adoption and encouraging employees to use service robots.

1. Introduction

With the advancement of technology, service robots are increasingly introduced to hotels at a compound annual growth rate of 25.5% (Allied Analytics, 2021). We are witnessing more hotels invest in service robots to assist frontline employees in dealing with customers' requests more efficiently (Fuentes-Moraleda et al., 2020). Although service robots benefit employees through reduced routine work and enhanced productivity, whether robots can achieve full functionality depends on human employees' intention to use them at the first place. Employees' intentions to use service robots in the workplace determine how well customers' dynamic and diversified needs could be satisfied and whether the company will recover its investment in robots (Ivanov et al., 2020). However, managers notice that frontline employees possess paradoxical attitudes toward service robots in real-life practices (New York Times, 2022). On the one hand, they are happy to embrace service robots to free themselves from tedious and repetitive tasks and work efficiency has been vastly improved (Business Standard, 2020). On the other hand, frontline employees are reluctant to use robots as service failure caused by service robots places more challenges on employees to recover customers' satisfaction and prevent human employees from using robots (Ivanov et al., 2020).

In academia, even though a plethora of studies have contributed to the understanding of robot-customer interaction and co-creation (Čaić et al., 2018), limited research examines employees' role in these interactions and the reasons behind their use intentions (Ivanov et al., 2019). Although scholars confirm that service robots bring negative consequences to employees (e.g., loss of autonomy, job insecurity), the underlying mechanism behind frontline employees' reluctance and unwillingness to use service robots in the workplace are still in their infancy (Song et al., 2022). A recent publication attempted to fill the gap with an exploratory qualitative study (Paluch et al., 2022). However, an empirical examination of employees' intention to use commonly used service robots in their workplace (hotels) is still missing.

Therefore, this study intends to examine hotel frontline employees' intention to use service robots in the workplace with a multi-experiment design. Underpinned by technology affordance theory (Tussyadiah and Park, 2018), this study explores how two common affordances (physical vs. cognitive affordance) embedded and reflected in hotel service robots (Teoh et al., 2019) affect frontline employees' intention to use them in the workplace. The mediating role of relative advantage and trust are also included and tested to explain the reasons behind employees'

* Corresponding authors.
E-mail addresses: xi.leung@unt.edu (X.Y. Leung), zhanghuiying@bisu.edu.cn (H. Zhang), Jiaying_lu@zju.edu.cn (J. Lyu), billy.bai@unlv.edu (B. Bai).

https://doi.org/10.1016/j.ijhm.2022.103380
Received 29 October 2021; Received in revised form 18 October 2022; Accepted 25 October 2022
Available online 8 November 2022

preferences. Furthermore, socio-material changes simultaneously place an interactive effect to shape technology affordance (Orlikowski, 2007). In line with the socio-material perspective, we also examine the interactive effects of contextual changes brought by COVID-19 (Baum and Hai, 2020) on employees' intentions. As the socio-materiality perspective implies that the perception of technology affordance is influenced by the users' cultural values (Hutchby, 2001), the study also tests employees' cultural values (collectivism vs. individualism) as a moderator. This study contributes to our limited knowledge of the hotel frontline employees' intention to use service robots in the workplace. It empirically expands the application of technology affordance theory by incorporating the socio-material contexts. Additionally, the research findings provide ample practical guidelines for hotel managers to formulate their strategic decisions on service robot adoption and develop favorable contexts and conditions to encourage frontline employees to leverage robots.

2. Literature review

2.1. Robot research in hospitality

Service robots are defined as a system-based autonomous interface that can perform and deliver services (Wirtz et al., 2018). Various drivers that necessitate the use of service robots were noted in prior research, such as the infusion of robots with AI and machine learning; the replacement of low-skill jobs to reduce labor costs; the demand for improving the efficiency and productivity of hotels; customers' desire for novel experiences; health and safety advantages, and a desire to enhance brand reputation (Kim et al., 2021; Lee et al., 2020; Wu et al., 2021). Previous research has classified service robots based on a number of attributes. McLeay et al. (2020) highlighted the roles of service robots as augmentation or substitution or no impact on human employees. Service robots can also be differentiated by their representation, ranging from physically represented (e.g., Roomba cleaning robot) to virtually represented (e.g., Alexa) (Jia et al., 2021). In relation to anthropomorphic appearance, service robots can be human-like (e.g., Sophia) or machine-like (e.g., Roomba cleaning robot) (Tussyadiah and Park, 2018). Additionally, service robots can have various artificial intelligence levels that range from mechanical to thinking and feeling (Huang and Rust, 2018). Role-based typology suggests that functional and information sharing are two common types of robots in hotel workplaces (Wirtz et al., 2018; Fuentes-Moraleda et al., 2020). Functional robots are designed to fulfill routine, repeated tasks, such as room service and luggage delivery, while information sharing robots share and gather information with customers, such as concierge services (Ivanov et al., 2019). As the recent COVID-19 pandemic accelerated robotization in the hotel industry, more research is needed to advance the understanding of AI and robotics (Jiang and Wen, 2020). To fill this research gap, this study explores frontline employees' perceptions of and intentions to use robots in the hotel workplace. Additionally, existing studies tend to focus on functional and technical issues instead of psychological issues and situational contexts resulting from the user's goals and how the user interacts with robots. This study draws upon technology affordance theory and the socio-material perspective to provide an essential contribution in this respect.

2.2. Technology affordance theory

This study utilized the concept of affordances in understanding hotel frontline employees' accounts of the technological effects of service robots. Originated from ecological psychology, affordances refer to the action possibilities that the environment offers to animals (Gibson, 1979). The central tenet of affordance theory is that affordances are not inherent to a specific environment but exist as part of the relationship between actors and the environment. The concept of affordances was later applied and extended to socio-technical systems research. Norman (1988) employed affordance theory in the context of human-technology interaction and distinguished perceived and actual affordances. He pointed out that users can perceive and understand the affordances of a technology design based on their abilities of action and use background, while actual affordances are "designed-in" properties intentionally created by the designer.

Technology affordance has also been viewed as a "generative mechanism," which emphasizes the process of affordances actualization (Leonardi, 2011; Volkoff and Strong, 2013). In this view, technology affordance highlights the user's goals and how the user interacts with technologies to realize those goals (Leonardi, 2011). As a relational construct, technology affordance reflects its socio-material underpinnings, which challenges the separation of technology and humans at the ontological level (Barad, 2003). Socio-material perspective posits that technology and humans are inherently inseparable (Orlikowski, 2010). Instead of attributing certain effects to the technology itself, socio-materiality suggests that the effects are realized through the socio-material entanglement of the two in everyday practices (Orlikowski, 2007). Through the lens of socio-materiality, we look beyond the notion of "technology" or "human" as a centralized subject and extend our analyses to explore the contestation and negotiation of the relationship between hotel frontline employees and service robots (Lei et al., 2019). In the hospitality and tourism field, technology affordance theory has recently been adopted to understand technology-empowered services.

Lei et al. (2019) used interviews to compare the perceived technology affordance and value of hotel mobile apps between hoteliers and customers. The findings revealed that while hoteliers expect more personalized mobile apps, customers expect more functional and emotional value from mobile apps. Based on a consumer survey, Cheng et al., (2021) developed a model linking technology affordance (physical, cognitive, sensory, and functional), perceived value, technology constraint, and explorative/ exploitative use in the context of WeChat tourism mini-programs. In a conceptual paper, Deng, Benckendorff, and Wang (2021) proposed four types of affordances, including temporal, spatial, interactive, and media affordances, which support opportunities for travel live-streaming stakeholders.

While hospitality researchers have not examined the dynamics between hotel frontline employees and service robots based on the technology affordance theory, managers and researchers tend to agree that service robots can support the affordances of conservation of physical and psychological resources for employees (Tussyadiah and Park, 2018; Qiu et al., 2022). Hospitality services typically involve cognitive and physical labor (Teoh et al., 2019). Given that hotel frontline employees are confronted with demanding situations (e.g., repeated mundane tasks, understaffing, irregular working hours, lifting and handling of heavy objects, and dealing with demanding customers), employees are likely to experience work overloads, which will affect their work performance and health (Hobfoll et al., 2018). The implications of the long-term heavy workload of service industry frontline employees have been observed, such as stress, sleep disorder, and high exposure to contagious diseases. Consequently, employees can mobilize these affordances of robots in hospitality provision. Two common types of robots currently used in the hotel industry reflect cognitive and physical affordance. On the one hand, concierge robots are used to greet guests, understand various languages and accents and interact organically with guests to provide information and responses (Bowen and Morosan, 2018). The adoption of concierge robots can relieve employees from repetitive cognitive work to focus on value-creating tasks such as personalizing a guest's stay (Lei et al., 2019). On the other hand, room service robots are used to deliver guests' requests to guestrooms. Hotel employees take advantage of room service robots for physical labor help and save them time and effort in walking between guestrooms and the front desk (Choi et al., 2019).

Previous research revealed that service robots are generally viewed by employees with physical affordance instead of cognitive affordance

(Huang and Rust, 2018). Consequently, employees believe that service robots are more helpful in undertaking simple physical tasks than complicated cognitive tasks such as generating care and comprehending human emotion. In the hotel context, room-service robots have been mainly viewed as providing physical affordance, while concierge robots have focused on providing cognitive affordance for hotel frontline employees. Given that the two types of service robots offer different affordances, their acceptance will differ. In other words, the affordance of a robot is pivotal to an employee's intention to use the service robot. Therefore, we propose the following hypothesis:

H1. Hotel frontline employees have a higher intention to use robots with physical affordance (i.e., room-service robots) than robots with cognitive affordance (i.e., concierge robots) in service delivery.

Existing research has identified relative advantage as a critical predictor of technology acceptance. It refers to how new technology offers improvements over what is already available (Davis, 1986). In the context of service robots, if employees and managers think that adopting robotic technology is more advantageous than its substitutes, they prefer it (Pizam et al., 2022). The existing literature indicates that the type of robot affordance may influence employees' perception of service robots' effectiveness or relative advantage (Lin et al., 2022). In present-day hospitality practices, service robots are still seen as niche-type solutions. Service robots generally outperform employees on high-frequency tasks that are physically intense (Huang and Rust, 2018; Qiu et al., 2022). Thus, service robots' affordance, which facilitates hotel frontline employees' physical labor by completing simple tasks quickly and smoothly, generates a greater relative advantage. The potential for service robots to facilitate hotel frontline employees' cognitive labor by offering warm services with empathy has yet to be fully realized (Schepers and Streukens, 2022). Hence, service robots' affordance for cognitive labor may create a lower level of relative advantage. Overall, the relative advantage may serve as a mediator between technology affordances and acceptance intention.

Previous research also suggests that relative advantage can generate trust, affecting the decision-making of users. Prior literature findings suggest that a long-term relationship between technology and users can be established through relative advantage, which produces perceived trust regarding the technology (O'Cass and Carlson, 2012). For instance, Chetioui et al. (2021) revealed that trust towards online shopping is influenced by relative advantage. Similarly, Mann et al. (2015) reported that the general population trusts robots more than computer tablets in delivering healthcare services because they believe robots may offer benefits over and above computer tablets.

Trust has become a major research area within the field of organizational studies (Mayer et al., 1995; Rousseau et al., 1998). Studies (e.g., Mooradian et al., 2006) have found that trust leads to more positive workplace attitudes (e.g., employee satisfaction and commitment), workplace behaviors (e.g., knowledge sharing, organizational citizenship behavior), and performance outcomes (e.g., individual performance, group performance, and business-unit performance). Trust enables cooperative behavior, promotes network-based forms of organization, reduces conflicts, decreases transaction costs, facilitates the rapid formulation of ad hoc workgroups, and promotes effective responses to crises (Rousseau et al., 1998). Empirical studies have provided evidence for the mediating effect of trust between technology affordance and user behavior. For example, Tuncer (2021) found that IT affordance can positively impact social commerce intention through trust. Similarly, Shao et al. (2021) reported that through the mediation effect of trust, affordances have significant influences on the continuance intention of a virtual personal assistant. For this reason, our theorizing proposes that robots with physical (vs. cognitive) affordance provide hotel employees with a greater relative advantage, thereby heightening their trust perceptions and resulting in higher intentions to use robots in the workplace. Formally:

H2. Relative advantage and perceived trust sequentially mediates the relationship between robot affordance and hotel employees' intentions to use service robots in the workplace.

2.3. Socio-material perspective

The socio-materiality perspective highlighted the role of social context in shaping technology affordance (Orlikowski, 2007). At present, the hospitality industry is dealing with the COVID-19 pandemic, which has resulted in concerns regarding safety and human contact (Jiang and Wen, 2020). Robots are becoming more prominent in hotels to provide contactless services to reduce the potential spread of the virus. During the COVID-19 pandemic, service robots' ability to optimize service safety has been increasingly recognized by hotel employees (Bove and Benoit, 2020; Schepers & Streukens, 2021). Moreover, the preference for service robots over human staff by hotel employees has been identified (Kim et al., 2021).

Under the influence of the COVID-19 pandemic, employees prefer to reduce face-to-face contact with customers out of self-protection (Mukherjee et al., 2021). Service robots can provide a technological shield between tourists and employees (Seyitoğlu and Ivanov, 2020). Hence, employees will be more willing to use service robots when guests are not wearing masks or not following social distancing practices. Therefore, we propose the following hypothesis:

H3. Guest's COVID-19 compliance leads to different intentions to use service robots in the workplace among hotel frontline employees.

The socio-materiality perspective also indicates that the impacts of technology affordance are contingent upon social context (Orlikowski, 2007). In the context of COVID-19, studies have found that customers' acceptance of technology changes depends on the severity of the pandemic (Kim et al., 2021) or business responses to the pandemic (Shin and Kang, 2020). From an employee's viewpoint, the cognitive affordance of concierge robots would increase from simply greeting and interacting to reducing COVID anxiety and avoiding face-to-face communication between employees and guests, especially when the customers do not follow recommended COVID-19 guidance (e.g., social distancing, mask wearing). But the physical affordance of room-service robots during COVID-19 mostly remained the same as handling the delivery of room service. Therefore, we expect a positive interaction between robot affordances and COVID-19 compliance on hotel frontline employees' intentions to use service robots providing two types of affordances. Specifically, when customers do not follow recommended COVID-19 guidance, employees would use both robots in the workplace. On the contrary, when customers show COVID-19 compliance, employees would still prefer room service robots to concierge robots, just as pre-COVID. The following hypothesis states:

H4. COVID-19 compliance significantly moderates the effect of robot affordances on hotel frontline employees' intentions to use service robots in the workplace.

Service robots have been used to alleviate the various personal risks of employees (Choi et al., 2019; Qiu et al., 2020). However, the underlying mechanism that influences the employees' decision to use service robots during a health crisis remains unexplored. Hotel employees are, at times, being put at risk by people refusing to wear masks in hotel facilities. This rejection of a public health measure only adds to the threats faced by frontline employees who remain at a higher risk of COVID-19 infection. Thus, the perceived COVID-19 threat plays a vital role in influencing employees' emotions and attitudes and their evaluation of service robots (Sun, 2014). Based on this assertion, we expect that when the perceived COVID-19 threat increases, hotel employees will tend to trust service robots more and increase their intention to use them. In other words, we predict that the COVID-19 threat and trust will mediate the relationship between COVID-19 compliance and employees' intention to use service robots. As a result, we propose the

following hypothesis:

H5. Perceived COVID-19 threat and perceived trust sequentially mediates the relationship between COVID-19 compliance and employees' intentions to use service robots in the workplace.

2.4. Individual-level cultural value

The socio-materiality perspective also implies that the perception of technology affordance was partly attributed to the actors' cultural values (Hutchby, 2001). It has been suggested that individual-level cultural values can affect the adoption behavior of new technology (Tarhini et al., 2017). To date, most of the literature about cultural effects in hospitality research is based on the national level, and it is difficult to predict individual behavior because the uniformity of everyone in a country cannot be achieved (Lee et al., 2013; Sun et al., 2019). At the national level, cultural value mainly includes power distance, uncertainty avoidance, individualism versus collectivism, long-term versus short-term orientation, and masculinity versus femininity (Hofstede, 1989). This study only focuses on the impact of individualism versus collectivism as a potential moderator because this cultural construct is essential in understanding the human-robot relationship (Li et al., 2010). Individualism versus collectivism captures the relationship between the individual and the group in society. Individualism focuses on the concerns of individuals and values personal independence. People with individualistic cultural values tend to see themselves as separate from others and define themselves based on their personal traits. On the other hand, collectivism pays more attention to group concerns and values personal interdependence. People with collectivistic cultural values are more likely to see themselves as connected to others and define themselves in relationships with others.

According to Sun et al., (2019, 2020), from the hotel employee's perspective, collectivism is positively related to perceived usefulness and ease of use, which are positive predictors of technology acceptance and readiness. In the context of e-learning, Tarhini et al. (2017) investigated the moderating effect of individual-level cultural values in the technology acceptance model. They found that collectivism moderates the relationship between social norms and behavioral intention to use the system so that the relationship is stronger for users with high collectivistic cultural values. Overall, the existing studies showed that cultural values at the individual level might significantly influence hotel employees' decisions regarding service robot adoption. In this study context, we propose that hotel employees with high collectivism tend to follow hotel managers' decisions on employing service robots, thereby being willing to use both types of service robots. On the contrary, hotel employees with low collectivism are less impacted by managers' decisions and more likely to prefer service robots with physical affordance as previous research indicates that service robots are generally viewed by employees with physical affordance rather than cognitive affordance (Huang and Rust, 2018). The last hypothesis states:

H6. Hotel frontline employees' collectivism/individualism values significantly moderate the effect of robot affordance on the intention to use service robots in the workplace. Specifically, employees with low collectivism (or high individualism) show higher intentions in using robots with physical affordance (i.e., room-service robots) than robots with cognitive affordance (i.e., concierge robots) in service delivery, whereas employees with high collectivism (or low individualism) do not have any preference for robot affordance.

Four experimental studies were conducted to test the research framework and proposed hypotheses as shown in Fig. 1. Study 1 was conducted before the COVID-19 pandemic to explore prospective hotel employees' intention to use two different types of robots in the workplace, thus testing hypotheses H1, H2, and H6. Studies 2 and 3 were conducted after the outbreak of COVID-19 to examine the change in intention by hotel employees in a special socio-material context. Study 2 replicated the design of Study 1 to explore prospective hotel employees' intention to use two different types of robots in the workplace during the pandemic, thus testing hypotheses H1, H2, and H6. Study 3 extended the study sample to current hotel employees and added another manipulation, guest COVID-19 compliance, to investigate the main and interaction effects in this socio-material context. Study 3 tests all six hypotheses in the framework: H1–H6. Study 4 was conducted post-pandemic with current hospitality employees. Study 4 duplicated Study 3's design to rule out the potential confounding effects of the robot design differences, testing main and interaction effects in H1, H3, and H4.

3. Study 1

Study 1 conducted an experiment with undergraduate students who majored in hospitality as prospective hotel employees to test the effect of robot types on the intention to use service robots. Study 1 was conducted before the COVID-19 pandemic. Thus, no COVID-related variables were considered in Study 1.

3.1. Method

Study 1 employed a one-factor (robot affordance: physical (room service) vs. cognitive (concierge)) between-subjects design. Undergraduate students in hospitality majors were recruited from a large public university located in the southern region of the United States in February 2020. Hospitality students are considered prospective hotel employees and are suitable for exploring the robot usage of hotel frontline employees. A sample of 86 participants completed the study. The sample consisted of 23.3% male (76.7% female) and 52.3% White (18.6% Hispanic), with an average age of 21.6.

The participants were first told to imagine that they worked at a hotel front desk, and the hotel just decided to employ a service robot as their co-worker. They were then randomly assigned to one of two conditions to watch a video regarding a service robot working at a hotel. In the physical

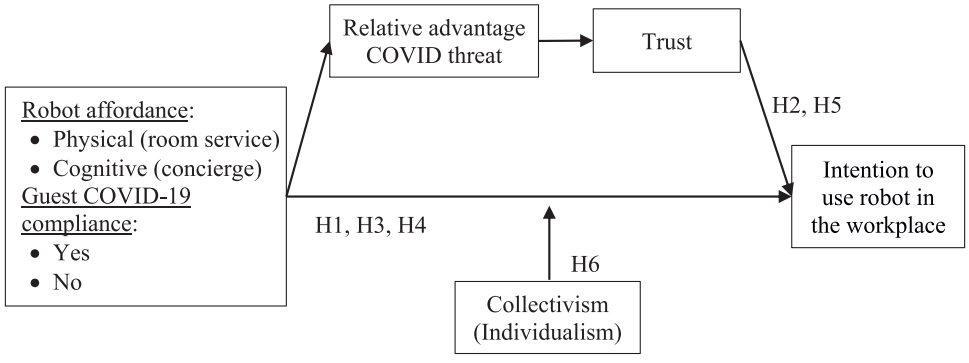

Fig. 1. Proposed research framework.

affordance condition, a room service robot delivers room service to a guest's room. In the cognitive affordance condition, a concierge robot answers guests' questions at the front desk. Both videos were edited to the same length (54 s, see https://www.youtube.com/watch?v=cKkyMT8A2Dg; https://www.youtube.com/watch?v=T0GpkRsGOdk). A pretest was conducted with 59 hospitality employees to check the robot affordance manipulation. The participants were asked to indicate whether the service robot shown in the video provided cognitive or physical labor help to the hotel on a seven-point bipolar scale (1 = "cognitive," 7 = "physical"). The independent sample *t*-test results showed a significant difference between the two groups. Employees who watched the concierge robot video identified the service robot as providing cognitive labor help, while those exposed to the room service robot video indicated it to be physical labor ($M_{concierge} = 1.43, M_{roomservice} = 6.74; t = 31.38, p < 0.001$). Therefore, the robot affordance manipulation using the two videos was successful. After watching the video, all participants were asked to complete a questionnaire. The questionnaire consisted of two sections. The first section contained questions to measure all of the constructs (see Appendix A). The second section collected their demographic information, such as gender, age, ethnicity, hotel work experience and interest, and robot experience.

The data were analyzed in SPSS using *t*-test, ANOVA, and PROCESS macro. Before the data analysis, the measurement reliability and validity were confirmed in CFA (see Appendix A). All the assumptions for the *t*-test and ANOVA (independence, normality, homoscedasticity) were met.

3.2. Results

3.2.1. Main effect

After controlling for the participant's hotel work and robot experience, the ANOVA results showed a significant main effect for robot affordance ($F = 4.91, p = 0.029$). Specifically, the participants preferred a room service robot (M = 4.82) to a concierge robot (M = 3.88), which supports H1.

3.2.2. Mediating and moderating effects

To test the proposed mediating effects in the research framework (H2), PROCESS macro model 6 was conducted. The results indicated that relative advantage and trust together fully mediate the relationships between robot affordance and the intention to use robots in the workplace ($B = 0.28$, 95% CI [0.03, 0.44]), which supports H2.

PROCESS macro model 1 was then conducted to test the proposed moderating effect of H6 using the collectivism culture value as a moderator. The results revealed that the collectivism value significantly moderates the effect of robot affordance on the intention to use a robot ($F = 3.14$, $p = 0.080$), which supports H6. The Johnson-Neyman test results indicate that participants with low collectivism (value < 4.37) were inclined to use the room service robot (physical affordance) more than the concierge robot (cognitive affordance), while employees with high collectivism did not show any preference between the two robots.

3.3. Discussion

Study 1 used a student sample as prospective hotel employees and provided evidence supporting the main, moderating, and mediating effects of the proposed research model. Before the pandemic, prospective hotel employees, especially those with low collectivism (high individualism), had higher intentions to use robots with physical affordance (vs. cognitive affordance) in the workplace. This higher intention could be explained by higher trust, triggered by more relative advantage when employees use a room service robot for service delivery. Because Study 1 was conducted before the COVID-19 pandemic, Study 2 sought to replicate the effect of the robot type using a similar student sample during the COVID-19 pandemic.

4. Study 2

Study 2 aimed to replicate the causal evidence for the effect of robot type on the intention to use service robots during the COVID-19 pandemic. Study 2 used undergraduate students in a hospitality major as prospective hotel employees for the study sample.

4.1. Method

Similar to Study 1, Study 2 employed a one-factor (robot affordance: physical (room service) vs. cognitive (concierge)) between-subjects design. Undergraduate students in a hospitality major were recruited from a different large public university located in the western region of the United States in February 2021. A sample of 129 participants completed the study. The sample consisted of 27.1% male (70.5% female) and 71.3% White (17.8% Hispanic) with an average age of 21.6.

The participants were randomly assigned to one of two conditions to watch a service robot video. After watching the video, all participants were asked to complete a questionnaire. Aside from the questions in Study 1, Study 2 also asked about their perception of COVID-19 severity as a control variable. The data were analyzed in the same steps as those in Study 1.

4.2. Results

4.2.1. Main effect

After controlling for the participant's hotel work experience, robot experience, and perceived COVID-19 severity, the ANOVA results showed a significant main effect for robot affordance ($F = 10.47$, $p = 0.002$). In accordance with Study 1, the participants preferred the room service robot providing physical affordance (M = 5.26) to the concierge robot providing cognitive affordance (M = 4.39), which supports H1.

Interestingly, an independent sample *t*-test revealed that participants generally had a higher intention to use robots in the workplace after the COVID-19 pandemic than pre-COVID-19 ($M_{pre} = 4.38$, $M_{post} = 4.83$; $t = 1.85$, $p = 0.066$).

4.2.2. Mediating and moderating effects

To test the proposed mediating effects in the research framework (H2), PROCESS macro model 6 was conducted. Same as Study 1, the results indicated that relative advantage and trust together fully mediate the relationships between the robot type and the intention to use robots in the workplace ($B = 0.06$, 95% CI [0.00, 0.17]), which supports H2.

PROCESS macro model 1 was then conducted to test the proposed moderating effect of H6 using the collectivism culture value as a moderator. In agreement with Study 1, the results revealed that the collectivism value significantly moderated the effect of robot affordance on the intention to use service robots in the workplace ($F = 3.57$, $p = 0.061$), which supports H6. Participants with low collectivism (value < 5.41) were inclined to use room service robots with physical affordance more than concierge robots with cognitive affordance, while employees with high collectivism did not show any preference between the two robots.

4.3. Discussion

Study 2 replicated the design of Study 1 after the COVID-19 outbreak using another student sample as prospective hotel employees. The results supported all of the findings in Study 1. After the pandemic, prospective hotel employees, particularly those with low collectivism (high individualism), had higher intentions to use physical affordance robots (vs. cognitive affordance robots). Same as Study 1, this higher intention could be explained by higher trust, triggered by more relative advantage when using a room service robot. Additionally, a comparison between Study 1 and Study 2 indicated that prospective hotel employees tend to

use more service robots in the workplace after the COVID-19 pandemic. Because Study 1 and Study 2 were both conducted on student (prospective employee) samples, Study 3 aimed to use actual (current) hotel frontline employee samples to replicate the robot affordance effect. To further explore the impact of the pandemic, Study 3 investigated a potential moderator of customers' compliance with COVID-19 safety protocols in interacting with the robot affordance effect.

5. Study 3

Study 3 conducted an experiment with current hotel frontline employees. Additionally, Study 3 adds scenarios regarding whether customers follow COVID-19 precautions as another manipulation in the experiment design on top of the robot affordance manipulation. Thus, Study 3 explores both the main and interaction effects for the two manipulating variables – robot affordance and COVID-19 compliance. Similar to previous studies, Study 3 also investigates the mediating and moderating effects specified in the research framework.

5.1. Method

Study 3 employed a 2 (robot affordance: physical (room service) vs. cognitive (concierge)) × 2 (customer compliance vs. non-compliance) between-subjects design. Current hotel frontline employees were recruited by Amazon Mechanical Turk (MTurk; www.mturk.com) in April and May 2020. To recruit current hotel frontline employees, we used five screening steps. First, we used MTurk premium qualifications (employment status: cost $0.40 per respondent) to rule out MTurk workers who were unemployed. Second, we provided a list of 14 industries so the respondent could select their current employment industry. Only those who chose the hotel industry were allowed to continue the study. Third, the respondents were asked to choose the hotel department they currently worked in from a list of 11 departments. Only those who chose one of the three hotel frontline departments (front desk, concierge, and food and beverage) were allowed to continue the study. Fourth, the respondents had to be hourly employees in their department to qualify. Last, the respondents were asked to write down their hotel names at the beginning and the end of the survey. We manually checked their answers to ensure the hotel exists and the names match.

The survey was taken 2395 times, and a final sample of 212 respondents was validated. The sample consisted of 46.7% male (53.3% female) and 76.9% White (10.8% African American), with an average age of 33. The average length of working in the hotel industry was 4.3 years and four months.

The participants were randomly assigned to one of four conditions. The two robot affordance conditions used the same videos as in Study 1. In the customer compliance condition, the participants were given a picture of a male customer standing near the room door (or standing at the front desk, depending on the robot video they watched) with a mask on and following social distancing. In the customer noncompliance condition, the participants were given a picture with a male customer standing near the room door (or standing at the front desk, depending on which robot video they watched) without a mask on and not following social distancing. After receiving all of the stimuli, the participants were asked to complete a questionnaire. In addition to the questions in Study 2, Study 3 also measured the construct of the perceived COVID-19 threat (see Appendix A). The data were analyzed in SPSS using *t*-test, MANOVA, and PROCESS macro.

5.2. Results

5.2.1. Manipulation check

Study 3 uses one seven-point Likert-scale item ("does the hotel guest in the picture above follow preventive measures for COVID-19?") to check the manipulation for COVID-19 compliance. The *t*-test results showed a significant difference between the compliance and noncompliance groups ($M_{compliance} = 5.84$, $M_{noncompliance} = 2.43$; $t = 12.70$, $p < 0.001$), and there was no difference between the two types of robot affordances ($M_{physical} = 4.20$, $M_{cognitive} = 4.07$; $t = 0.35$, $p = 0.724$). Thus, the COVID-19 compliance manipulation was successful.

5.2.2. Main and interaction effects

The MANOVA results showed a significant main effect for robot affordance ($F = 6.82$, $p = 0.010$). Similar to previous studies, the employees preferred the room service robot with physical affordance (M = 5.89) to the concierge robot with cognitive affordance (M = 5.44), supporting H1. Although there was no significant main effect for COVID-19 compliance ($F = 1.80$, $p = 0.181$), the results revealed a marginally significant interaction effect between robot affordance and COVID-19 compliance ($F = 3.03$, $p = 0.083$). As shown in Fig. 2, when guests followed COVID-19 safety precautions and procedures, employees were more likely to use room service robots providing physical affordance than concierge robots providing cognitive affordance ($M_{physical} = 5.91$, $M_{cognitive} = 5.18$, $t = 2.57$, $p = 0.011$). However, when guests did not follow COVID-19 guidance, the employees tended to use both types of robots ($t = 0.84$, $p = 0.402$). Yet, concierge robots received higher employee usage intentions when guests were not following COVID-19 guidelines ($M_{compliance} = 5.18$, $M_{noncompliance} = 5.70$; $t = 2.01$, $p = 0.047$), while room service robots was welcomed in both situations ($t = 0.11$, $p = 0.909$). Therefore, H4 was supported while H3 was rejected.

5.2.3. Mediating and moderating effects

To test the proposed mediating effects in the research framework (H2 and H5), PROCESS macro model 6 was conducted. As shown in Fig. 3, relative advantage and trust together fully mediated the relationships between robot affordance and the intention to use robots in the workplace ($B = 0.21$, 95% CI [0.10, 0.35]). Additionally, the perceived COVID-19 threat and trust together also fully mediated the relationship between COVID-19 compliance and the intention to use robots in the workplace ($B = -0.11$, 95% CI [−0.18, −0.04]). Therefore, both H2 and H5 were supported.

PROCESS macro model 1 was conducted to test the proposed moderating effect of H6 using the collectivism culture value as a moderator. Similar to previous studies, the culture value showed a significant moderating effect on the relationship between the robot affordance and the intention to use a robot in the workplace ($F = 5.02$, $p = 0.026$), which supports H6. As shown in Fig. 4, employees with low collectivism (value < 5.26) were inclined to use room service robots more than concierge robots, while employees with high collectivism did not show a preference between the two robots, although they showed a high intention to use service robots.

5.3. Discussion

Study 3 extended the previous design to a different sample of current hotel employees. Again, the empirical findings were consistent with all of the results in the previous two studies. During the pandemic, hotel

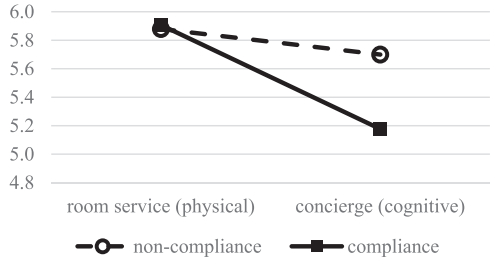

Fig. 2. Interaction effect between robot affordance and COVID compliance.

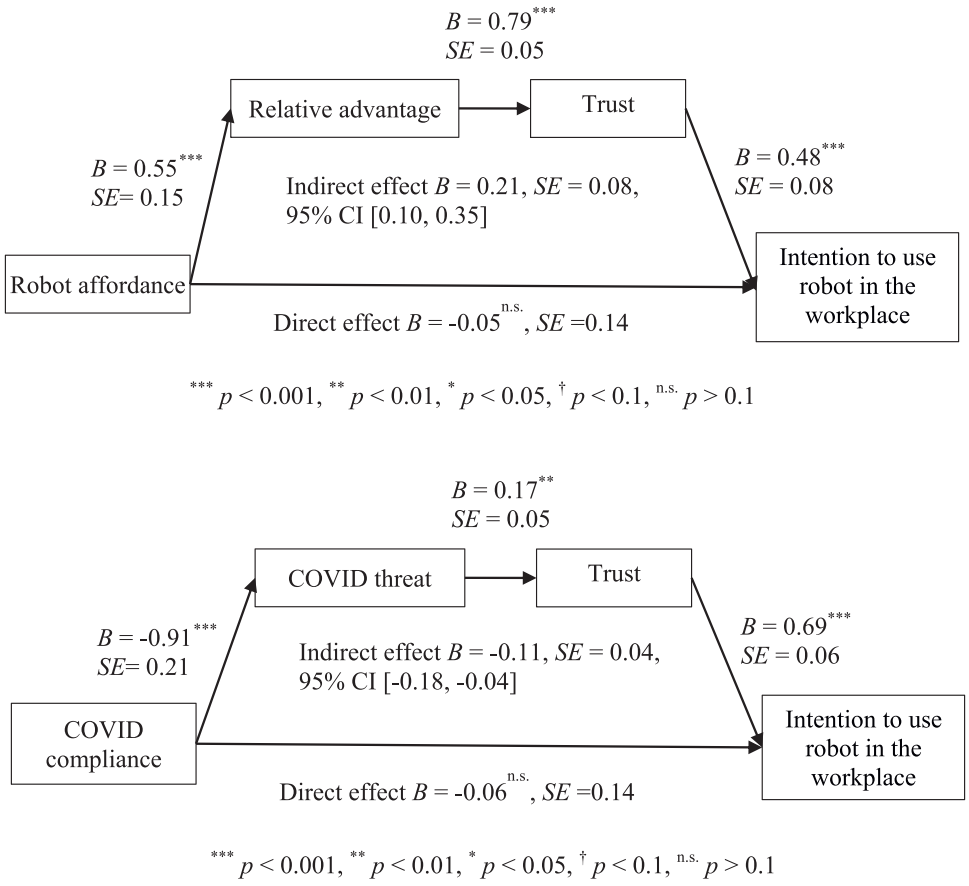

Fig. 3. Mediation effects.

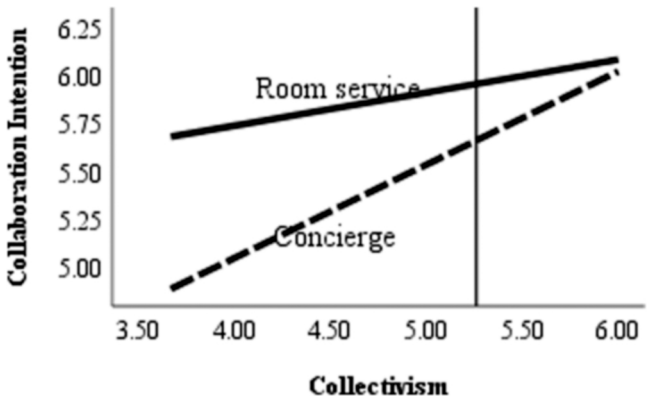

Fig. 4. Moderation effect of collectivism.

employees, particularly those with low collectivism (or high individualism), have higher intentions to use room service robots with physical affordance (vs. concierge robots with cognitive affordance) in the workplace. The higher usage intention could be explained by higher trust, triggered by more relative advantage when using a room service robot as well as more increased perceived threats when customers did not comply with the COVID-19 safety protocols (such as wearing a mask and maintaining social distance). However, a customer's COVID-19 compliance did not directly affect hotel employees' usage of robots. The previous two studies showed that the COVID-19 pandemic increased hotel employees' intention to use service robots. The results of Study 3 indicated that this increased intention may not be generally attributed to customers' compliance behavior. Instead, hotel employees tend to use more concierge robots when customers show COVID-19 noncompliance (vs. compliance). In both situations, the intention to use room service robots did not change.

6. Study 4

Although we used two common robots used by current hotels as our study stimuli to increase the external validity of the study results, the two robots have very different designs and appearance. Thus, study 4 duplicated Study 3's scenario design to conduct a follow-up experiment to rule out the potential confounding effects of the robot design differences.

6.1. Method

Study 4 employed the same 2 (robot affordance: physical (room service) vs. cognitive (concierge)) × 2 (customer compliance vs. non-compliance) between-subjects design as Study 3. U.S employees with hospitality industry experiences were recruited by Prolific (https://www.prolific.co) in September 2022. Prolific past employment pre-screening criteria was utilized to screen the potential participants. A final sample of 177 respondents was collected. The sample consisted of 51.4% male (47.5% female) and 76.8% White (7.3% African American) with an average age of 38.4. The average length of working in the hospitality industry is six years and 7.2 months.

The participants were randomly assigned to one of four conditions as in Study 3. After receiving all of the stimuli, the participants were asked to complete a questionnaire. In addition to the questions in Study 3, Study 4 also measured the three constructs related to robot perceptions – anthropomorphism, intelligence, and likeability – to control the potential influences due to the different robot designs (see Appendix A). The data were analyzed in SPSS using *t*-test and MANOVA.

6.2. Results

Study 4 used the same manipulation check questions as Study 3. The *t*-test results showed a significant difference between the compliance and noncompliance groups ($M_{compliance} = 6.62$, $M_{noncompliance} = 1.32$; $t = 37.09$, $p < 0.001$) for COVID-19 compliance manipulation. Similarly, there was also a significant difference between physical and cognitive robot affordance groups ($M_{physical} = 6.56$, $M_{cognitive} = 1.35$; $t = 48.59$, $p < 0.001$) for robot affordance manipulation. Thus, both manipulations worked as expected.

After controlling for robot anthropomorphism, intelligence, and likeability, the ANOCA test yielded similar results. The results showed a significant main effect for robot affordance ($M_{physical} = 6.03$, $M_{cognitive} = 5.03$, $F = 38.06$, $p < 0.001$), while no significant main effect existed for COVID-19 compliance ($F = 2.32$, $p = 0.129$). Thus, H1 was supported, while H3 was rejected. The results also revealed a marginally significant interaction effect between robot affordance and COVID-19 compliance ($F = 3.33$, $p = 0.070$). As shown in Fig. 2, concierge robots received higher employee usage intentions when guests were not following COVID-19 guidelines ($M_{compliance} = 4.65$, $M_{noncompliance} = 5.42$; $t = 2.37$, $p = 0.019$), while room service robots were welcomed in both situations ($t = 0.39$, $p = 0.699$). Therefore, H4 was supported.

6.3. Discussion

Study 4's study ruled out the potential confounding effects of two robot designs on employees' intentions to use robots in the workplace, and thus strengthened Study 3's findings. Hotel employees extended the previous design to a different sample of current hotel employees. Even after the pandemic, hotel employees still have higher intentions to use room service robots with physical affordance (vs. concierge robots with cognitive affordance) in the workplace. Although a customer's COVID-19 compliance did not directly affect hotel employees' usage of robots, hotel employees tend to use more concierge robots when customers show COVID-19 noncompliance (vs. compliance). In both situations, employees' intentions to use room service robots did not change.

7. Discussion and implications

7.1. General discussion

This study examines the underlying mechanism behind hotel frontline employees' intentions to use service robots in the workplace. Across the four experimental studies, we first explored prospective frontline employees' reactions to two robot affordances in the pre-COVID-19 pandemic context (Study 1) and amid the COVID-19 pandemic (Study 2). Then, we extended the experiments with current frontline employees amid the pandemic (Study 3) and post-pandemic (Study 4) to examine the interaction between robot affordance and guests' COVID-19 compliance. Studies also examined the moderating role of the employees' cultural values in the process. The hypothesis testing results are summarized in Table 1.

The present paper reveals that different affordance reflected by two types of service robots affects hotel frontline employees' intention to use them in the workplace. This finding extends the technology affordance theory and empirically verifies the main hypothesis. The findings further indicate that a room service robot with physical affordance (vs. a concierge robot with cognitive affordance) is more efficacious in improving the frontline employees' usage intentions. The result is consistent with the previous work indicating that customers are more optimistic about those service robots that are useful and competent (Wirtz et al., 2018). Room service robot (physical affordance) is generally perceived as more useful and efficient than other types (Fuentes-Moraleda et al., 2020). Therefore, our results confirm and extend current research findings to the population of hotel frontline employees with an affordance approach.

Table 1
Results of hypothesis testing.

Hypotheses	Study 1 (Pre-COVID Prospective)	Study 2 (Amid-COVID Prospective)	Study 3 (Amid-COVID Current)	Study 4 (Post-COVID Current)
H1: Robot affordance →Usage intention	**Support**	**Support**	**Support**	**Support**
H2: Robot affordance → Relative advantage → Trust → Usage intention	**Support**	**Support**	**Support**	–
H3: Guest COVID compliance → Usage intention	–	–	Reject	Reject
H4: Robot affordance × Guest COVID compliance →Usage intention	–	–	**Support**	**Support**
H5: Guest COVID compliance → COVID threat → Trust → Usage intention	–	–	**Support**	–
H6: Robot affordance × Culture value → Usage intention	**Support**	**Support**	**Support**	–

Additionally, the hospitality literature suggests that customers' acceptance of service robots is highly linked to their perceived relative advantage and feelings of trust toward services robots (Qiu et al., 2020; Wirtz et al., 2018). Similarly, this study empirically confirms that the relative advantage generated from technology affordance and trust aroused from perceived relative advantage explain employees' different intentions to use service robots in the workplace. When employees perceive more relative advantages from robot affordance, they tend to have more confidence in service robots to fulfill service functions and, therefore, demonstrate a higher usage intention. Furthermore, because robots primarily deliver services that satisfy the functional needs of humans (Song et al., 2022), physical affordance generates a more significant relative advantage than its cognitive part (Schepers and Streukens, 2022). As relative advantage heightens trust (Mayer et al., 1995), our study confirms that trust mediates affordance and usage intention. In other words, frontline employees tend to hold a higher degree of trust in robots offering physical affordance (room service robots) over those offering cognitive affordance (concierge robots), resulting in higher intentions to use the robot in the workplace.

Moreover, this study corroborates the entanglement impact of the socio-material context on individuals' judgment and decision-making (Orlikowski, 2007). The results show that frontline employees favor using service robots when guests do not comply with COVID-19 safety protocols (such as wearing masks and maintaining social distancing) during the pandemic. Although the socio-material context (guests' COVID-19 compliance behavior) alone does not directly affect employees' intention to use service robots in the workplace, a significant interaction effect of robot affordances and guest COVID-19 compliance on the frontline workers' decision to use robots is found. This finding provides empirical support to socio-material non-separation between technology and humans (Orlikowski, 2010) and earlier research findings that the COVID-19 threat significantly mediates the relationship between technology innovation (i.e., robots) and customers' booking intentions (Shin and Kang, 2020). Our study echoes the previous literature

with evidence from the employee side and further advances the existing conclusions by differentiating employees' preferences from robot affordances.

Additionally, the reasons behind the employees' varying choices are explored and empirically supported by trust and the contextual COVID-19 threat that stemmed from customers' COVID-19 compliance behavior. The findings reveal that when all guests follow COVID-19 safety precautions and procedures (low COVID-19 threat), employers are more likely to use room service robots than concierge robots. Meanwhile, employees use both types of robots in noncompliance (high COVID-19 threat) scenarios. Previous literature suggests that the COVID-19 threat arouses customers' concerns for safety and, in turn, accelerates their trust in using robots (Zeng et al., 2020). Similarly, the customers' compliance behavior imposes different COVID-19 health threats on frontline employees, which further induces employees' trust in using service robots instead of having in-person or close contact with customers.

Our results also uncover that cultural value at the individual level significantly moderates the effect of robot affordance on frontline employees' intention to use robots in the workplace. In particular, employees with collectivist values tend to obey rules and follow instructions in the workplace. Therefore, they tend to have more technology readiness and an acceptance toward defending the group benefits (Sun et al., 2019). In contrast, employees with individualism prefer to decide based on their demands or traits (Sun et al., 2020). Our research findings confirm the conclusions from Sun et al., (2019, 2020) that individuals with a collectivist cultural orientation are more likely to be technologically ready to adopt both types of service robots. On the other hand, hotel employees with low collectivism (vs. high individualism) demonstrate a higher usage intention with room service robots (vs. concierge robots). Such research findings further support previous research on how cultural values may shape users' attitudes and acceptance (Belanche et al., 2019). Some studies show that individuals' stance toward collectivism is more prone to accept robots and generates a higher degree of inclusion intention (Marchesi et al., 2021; Rau et al., 2009). In contrast, individualism may lead to positive reactions, but uncertainty avoidance could lead to negative refusion (Belanche et al., 2019). Our study confirms that employees with individualism tend to show lower usage intention with concierge robots (vs. room service robots) as perceived relative advantages and trust are insufficient, which offers evidence for the uncertainty avoidance approach.

7.2. Theoretical implications

Our theoretical framework and findings deepen the understanding of the reasons behind the frontline employees' choice of using service robots in hotels. This research highlights the application of the technology affordance theory and further explores the influence of the socio-material context and the individual cultural values on employees' use intention. The research findings contribute to the hospitality and robot literature in several ways.

First, this research contributes to the limited knowledge of frontline employees' acceptance and intention to use service robots at hotels and empirically expands the application of technology affordance theory. Technology affordance has been extensively discussed in the hospitality literature to understand customers' preferences or experiences with service robots (e.g., Jia et al., 2021; Kim et al., 2008; Wirtz et al., 2018), but little in regard to employees. This study fills this gap through four interdependent experiments to explore hidden mechanisms. Instead of generally examining service robots at hotels, researchers differentiate the technology affordance behind two significant types of robots (Wirtz et al., 2018) – a room service robot providing physical affordance and a concierge robot providing cognitive affordance. In addition to consolidating the effects of technology affordance behind robot types, different levels of relative advantage and trust aroused in the process have been confirmed to mediate employees' intention to use service robots in the workplace. In this way, our research unveils the hidden reasons behind frontline employees' choices.

Second, the study presents an integrated theoretical framework incorporating the socio-material perspective and individual cultural value with the technology affordance theory. This integration advances the application of technology affordance theory with the current hospitality context (COVID-19 pandemic) and broadens the theoretical foundation by considering employees' individual value preferences. The discussion on the contextual environment offers a new perspective on understanding the affordance of service robots through the lens of socio-materiality. The study confirms that customers' COVID-19 compliance exerts significant influence on hotel employees' intention to embrace service robots at their workplace. Similarly, we explore how employees' different cultural value orientations (collectivism versus individualism) moderates the effects of technology affordance on their use intention. In this regard, our study is one of the pioneer studies to address hotel frontline employees' usage intention and investigates the influence of social materiality and individual cultural value in the process. This design offers a closer look by simulating the real-world situation and understanding the underlying mechanism behind employees' preferences; thus, it elevates the hospitality human resource literature to a new level.

Third, the present study adopts a multi-experiment design to examine how the changes in contextual socio-materiality impact the employees' intention to use robots. The multi-experimental design has been applied in both hospitality and business studies to compare the effects of incentives or corporate initiatives on employees' work performance (e.g., Ai et al., 2022). However, scant research assesses and compares the impact of contextual changes (i.e., the COVID-19 pandemic) on hotel employees' performances or reactions. Our study bridges this gap by identifying the COVID-19 pandemic as a significant shift. Because COVID-19 has created unprecedented challenges for the hotel industry, it generates disturbing changes to the study context (Gursoy and Chi, 2020). Primarily, this prolonged pandemic has resulted in changes in employees' wellness, ability, and willingness to work in the hotel industry (Agarwal, 2021; Stergiou and Farmaki, 2021) and affected hoteliers' perceptions toward the use of robots (Ivanov et al., 2020). In relation to the COVID-19 context, our study conducts a series of experiments to compare changes (pre- versus amid-COVID-19) in frontline employees' intention to use service robots in the workplace. From this perspective, the current study makes an innovative attempt to consolidate the findings with comparisons, filling the gap in the hospitality literature and advancing research regarding hotel employees.

7.3. Practical implications

Our findings offer actionable implications for hotel employers. From a managerial perspective, hotel managers should be aware of the different relative advantages and trust behind different affordances reflected by different types of robots. The current research results confirm that frontline employees respond more favorably to room service robots (physical affordance) than concierge robots (cognitive affordance). Similarly, our study confirms the underlying mechanism behind employees' preference for a more significant relative advantage in fulfilling tasks. As most participants perceive physical robots (e.g., room service robots) to possess a higher relative advantage in delivering hotel services, service robots that offer sufficient physical affordance should be prioritized in hotels' investment and purchase lists. Also, managers can expect better usage intention from frontline employees to complete daily tasks without resistance or reluctance.

Notably, such a preference for service robots with physical affordance is not constant and fixed. Research finds that insufficient relative advantage and the absence of trust hinder the customers' adoption of robots (Van Pinxteren et al., 2019). With technology upgrades and the evolving development of artificial intelligence, a concierge robot could be favorable to frontline employees in the future. Therefore,

trust-building and relative advantage perceptions of employees should be one of the priorities of hotels when implementing cognitive service robots. Accordingly, we suggest that hotel managers first invite employees to "test" the cognitive service robots in terms of their efficiency, accuracy, and productivity. This enables employees to understand their relative advantage and build their confidence in cognitive robots to fulfill interactive tasks in hotels. In this way, hotels would find more appropriate and suitable service robots to work with frontline employees and improve their intention to use service robots.

In addition to selecting the proper service robots, it is essential to notice the influence of contextual changes on employees' choices. The results of our research indicate that the COVID-19 pandemic, as a general socio-materiality context, plays a mediating role in affecting employees' intentions. The significant interaction effect of robot affordance and contextual changes in socio-materiality means hotel managers should carefully monitor environmental changes and decide the best way to introduce service robots to their frontline employees. By doing this, hotel managers can dynamically monitor the major contextual shifts and evaluate the possible effects along with the robot selection and introduction. We recommend room service robots as a better choice for frontline employees versus concierge robots amid COVID-19. When the pandemic ends and the attached health threat disappears, managers should emphasize service robots' strength (relative advantage) and invite them to "play" with robots (trust-building) to encourage frontline employees' use of service robots.

Additionally, our results suggest that the intention to use service robots may differ according to the individual cultural value of frontline employees. Specifically, when facing health threats (i.e., COVID-19 compliance), higher affordance and trust in a room service robot can be expected in those employees with individualism value. In contrast, those with a collectivist orientation do not prefer the same experiment scenarios because they place the group's welfare first and trust the benefits offered by the service robots. As a result, hotel managers must understand frontline employees' value orientations before strategically selecting and introducing different service robots into hotels. Additionally, individual value orientation tests are recommended to better understand employees' behaviors and choices.

7.4. Limitations and future research

This study has several limitations. First, this study only compared the impact of the two most common robot affordances (physical and cognitive) in hotels. However, it should be noted that multiple classifications of robot affordance exist in the literature. Future research could test other affordance classifications to provide more comprehensive insight into hotel service robot applications. Second, this study collected data from the United States with a dominant individualistic culture. Whether frontline employees' perceptions and intentions will change in other countries (such as China, where collectivism prevails) is uncertain. Future research can also extend our analysis by comparing whether different value orientations affect frontline employees' preference for service robot use in hotels. Last, data collection was conducted by watching embedded videos about robot services in hotels. As videos may not completely simulate real-life scenarios, future studies may consider conducting field experiments to retest the research framework.

Appendix A

Constructs & Measurement items	Cronbach's Alpha		
	Study 1	Study 2	Study 3
Intention to use robot in the workplace (Davis, 1986)	0.974	0.924	0.905
If my hotel is adopting the robot, I will be likely to use it on a regular basis in the future.			
If my hotel is adopting the robot, I will probably use it on a regular basis in the future.			
If my hotel is adopting the robot, I will certainly use it on a regular basis.			
Relative advantage (Moore and Benbasat, 1991)	0.948	0.900	0.920
Using the robot at my hotel enables me to accomplish tasks more quickly.			
Using the robot at my hotel improves the quality of work I do.			
Using the robot at my hotel makes it easier to do my job.			
Using the robot at my hotel enhances my effectiveness on the job.			
Trust (Jian et al., 2000)	0.860	0.898	0.913
I am confident in the robot.			
The robot is dependable.			
The robot is reliable.			
I can trust the robot.			
COVID threat (Shin and Kang, 2020)	N/A	N/A	0.938
I feel nervous about going to work because of health concerns.			
Working at the hotel is a risky decision for my health.			
I feel uncomfortable working at the hotel because of my health safety.			
There is a high probability that working at the hotel would lead to a health problem.			
Collectivism/Individualism (Yoo et al., 2011)	0.744	0.862	0.903
Individuals should sacrifice self-interest for the group.			
Individuals should stick with the group even through difficulties.			
Group welfare is more important than individual rewards.			
Group success is more important than individual success.			
Individuals should only pursue their goals after considering the welfare of the group.			
Group loyalty should be encouraged even if individual goals suffer.			

References

Agarwal, P., 2021. Shattered but smiling: human resource management and the wellbeing of hotel employees during COVID-19. Int. J. Hosp. Manag. 93, 102765.
Ai, J., Gursoy, D., Liu, Y., Lv, X., 2022. Effects of offering incentives for reviews on trust: role of review quality and incentive source. Int. J. Hosp. Manag. 100, 103101.
Allied Analytics, 2021. Hospitality robots market by type and end user sales channel: global opportunity analysis and industry. Forecast *2021–2030*.
Barad, K., 2003. Posthumanist performativity: toward an understanding of how matter comes to matter. Signs 28 (3), 801–831.
Baum, T., Hai, N.T.T., 2020. Hospitality, tourism, human rights and the impact of COVID-19. Int. J. Contemp. Hosp. Manag. 32 (7), 2397–2407.

Belanche, D., Casaló, L.V., Flavián, C., 2019. Artificial Intelligence in FinTech: understanding robo-advisors adoption among customers. Ind. Manag. Data Syst. 119 (7), 1411–1430.
Bove, L.L., Benoit, S., 2020. Restrict, clean and protect: signaling consumer safety during the pandemic and beyond. J. Serv. Manag. 31 (6), 1185–1202.
Bowen, J., Morosan, C., 2018. Beware hospitality industry: the robots are coming. Worldw. Hosp. Tour. Themes 10 (6), 726–733.
Business Standard. (2020). Service robots may increase efficiency of Covid-19 impacted hotels: Report. Retrieved from ⟨https://www.business-standard.com/article/economic-revival/service-robots-may-increase-efficiency-of-covid-19-impacted-hotels-report-120060800984_1.html⟩.
Čaić, M., Odekerken-Schröder, G., Mahr, D., 2018. Service robots: value co-creation and co-destruction in elderly care networks. J. Serv. Manag. 29 (2), 178–205.
Cheng, A., Koo, C., Yoon, H., 2021. The use of travel-related WeChat mini-programs in china: an affordance theory perspective. J. Smart Tour. 1 (2), 37–46.
Chetioui, Y., Lebdaoui, H., Chetioui, H., 2021. Factors influencing consumer attitudes toward online shopping: the mediating effect of trust. Eur. J. Bus. 16 (4), 544–563.
Choi, Y., Choi, M., Oh, M.M., Kim, S.S., 2019. Service robots in hotels: understanding the service quality perceptions of human-robot interaction. J. Hosp. Mark. Manag. 29 (6), 1–23.
Davis, F.D. (1986). Technology acceptance model for empirically testing new end-user information systems: Theory and results [Unpublished doctoral dissertation]. Massachussetts Institute of Technology.
Deng, Z., Benckendorff, P., Wang, J., 2021. Travel live streaming: an affordance perspective. Inf. Technol. Tour. 23 (2), 189–207.
Fuentes-Moraleda, L., Díaz-Pérez, P., Orea-Giner, A., Muñoz- Mazón, A., Villacé-Molinero, T., 2020. Interaction between hotel service robots and humans: a hotel-specific Service Robot Acceptance Model (sRAM). Tour. Manag. Perspect. 36, 100751.
Gibson, J.J., 1979. The Ecological Approach to Visual Perception. Houghton Mifflin.
Gursoy, D., Chi, C.G., 2020. Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda. J. Hosp. Mark. Manag. 29 (5), 527–529.
Hobfoll, S.E., Halbesleben, J., Neveu, J.P., Westman, M., 2018. Conservation of resources in the organizational contexT: The reality of resources and their consequences. Annu. Rev. Organ. Psychol. Organ. Behav. 5, 103–128.
Hofstede, G., 1989. Organising for cultural diversity. Eur. Manag. J. 7 (4), 390–397.
Huang, M.H., Rust, R.T., 2018. Artificial intelligence in service. J. Serv. Res. 21 (2), 155–172.
Hutchby, I., 2001. Technologies, texts and affordances. Sociology 35 (2), 441–456.
Ivanov, S., Gretzel, U., Berezina, K., Sigala, M., Webster, C., 2019. Progress on robotics in hospitality and tourism: a review of the literature. J. Hosp. Tour. Technol. 10 (4), 489–521.
Ivanov, S., Seyitoğlu, F., Markova, M., 2020. Hotel managers' perceptions towards the use of robots: a mixed-methods approach. Inf. Technol. Tour. 22 (4), 505–535.
Jia, J.W., Chung, N., Hwang, J., 2021. Assessing the hotel service robot interaction on tourists' behaviour: the role of anthropomorphism. Ind. Manag. Data Syst. 121 (6), 1457–1478.
Jian, J.Y., Bisantz, A.M., Drury, C.G., 2000. Foundations for an empirically determined scale of trust in automated systems. Int. J. Cogn. Ergon. 4 (1), 53–71.
Jiang, Y., Wen, J., 2020. Effects of COVID-19 on hotel marketing and management: a perspective article. Int. J. Contemp. Hosp. Manag. 32 (8), 2563–2573.
Kim, S.S., Kim, J., Badu-Baiden, F., Giroux, M., Choi, Y., 2021. Preference for robot service or human service in hotels? Impacts of the Covid-19 pandemic. Int. J. Hosp. Manag. 93, 102795.
Kim, T.G., Lee, J.H., Law, R., 2008. An empirical examination of the acceptance behaviour of hotel front office systems: an extended technology acceptance model. Tour. Manag. 29 (3), 500–513.
Lee, S.G., Trimi, S., Kim, C., 2013. The impact of cultural differences on technology adoption. J. World Bus. 48 (1), 20–29.
Lee, W.J., Kwag, S.I., Ko, Y.D., 2020. Optimal capacity and operation design of a robot logistics system for the hotel industry. Tour. Manag. 76, 103971.
Lei, S.I., Wang, D., Law, R., 2019. Perceived technology affordance and value of hotel mobile apps: a comparison of hoteliers and customers. J. Hosp. Tour. Manag. 39, 201–211.
Leonardi, P.M., 2011. When flexible routines meet flexible technologies: affordance, constraint, and the imbrication of human and material agencies. MIS Q. 35 (1), 147–167.
Li, D., Rau, P., Ye, L., 2010. A cross-cultural study: effect of robot appearance and task. Int. J. Soc. Robot. 2 (2), 175–186.
Lin, X., Shao, B., Wang, X., 2022. Employees' perceptions of chatbots in B2B marketing: affordances vs. disaffordances. Ind. Mark. Manag. 101, 45–56.
Mann, J.A., MacDonald, B.A., Kuo, I.H., Li, X., Broadbent, E., 2015. People respond better to robots than computer tablets delivering healthcare instructions. Comput. Hum. Behav. 43, 112–117.
Marchesi, Roselli, C., Wykowska, A., 2021. Cultural values, but not nationality, predict social inclusion of robots. Social Robotics. Springer International Publishing, pp. 48–57.
Mayer, R.C., Davis, J.H., Schoorman, F.D., 1995. An integrative model of organizational trust. Acad. Manag. Rev. 20 (3), 709–734.
McLeay, F., Osburg, V.S., Yoganathan, V., Patterson, A., 2020. Replaced by a robot: service implications in the age of the machine. J. Serv. Res. 24 (1), 104–121.
Mooradian, T., Renzl, B., Matzler, K., 2006. Who trusts? Personality, trust and knowledge sharing. Manag. Learn. 37 (4), 523–540.
Moore, G.C., Benbasat, I., 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. Inf. Syst. Res. 2 (3), 192–222.
Mukherjee, S., Baral, M.M., Venkataiah, C., Pal, S.K., Nagariya, R., 2021. Service robots are an option for contactless services due to the COVID-19 pandemic in the hotels. Decision 48 (4), 445–460.
New York Times. (2022). Will Robots Really Destroy the Future of Work? Retrieved from ⟨https://www.nytimes.com/2022/01/24/opinion/unions-jobs-robots-ai.html⟩.
Norman, D.A., 1988. The psychology of everyday things. Basic Books, US.
O'Cass, A., Carlson, J., 2012. An e-retailing assessment of perceived website-service innovativeness: implications for website quality evaluations, trust, loyalty and word of mouth. Australas. Mark. J. 20 (1), 28–36.
Orlikowski, W.J., 2007. Sociomaterial practices: exploring technology at work. Organ. Stud. 28 (9), 1435–1448.
Orlikowski, W.J., 2010. The sociomateriality of organisational life: considering technology in management research. Camb. J. Econ. 34, 125–141.
Paluch, S., Tuzovic, S., Holz, H.F., Kies, A., Jörling, M., 2022. "My colleague is a robot" – exploring frontline employees' willingness to work with collaborative service robots. J. Serv. Manag. 33 (2), 363–388.
Pizam, A., Ozturk, A.B., Balderas-Cejudo, A., Buhalis, D., Fuchs, G., Hara, T., Meira, J., García Revilla, M.R., Sethi, D., Shen, Y., State, O., Hacikara, A., Chaulagain, S., 2022. Factors affecting hotel managers' intentions to adopt robotic technologies: a global study. Int. J. Hosp. Manag. 102, 103139.
Qiu, H., Li, M., Shu, B., Bai, B., 2020. Enhancing hospitality experience with service robots: the mediating role of rapport building. J. Hosp. Mark. Manag. 29, 247–268.
Qiu, H., Li, M., Bai, B., Wang, N., Li, Y., 2022. The impact of AI-enabled service attributes on service hospitableness: the role of employee physical and psychological workload. Int. J. Contemp. Hosp. Manag.
Rau, P.P., Li, Y., Li, D., 2009. Effects of communication style and culture on ability to accept recommendations from robots. Comput. Hum. Behav. 25 (2), 587–595.
Rousseau, D.M., Sitkin, S.B., Burt, R.S., Camerer, C., 1998. Not so different after all: a cross-discipline view of trust. Acad. Manag. Rev. 23 (3), 393–404.
Schepers, J., Streukens, S., 2022. To serve and protect: a typology of service robots and their role in physically safe services. J. Serv. Manag.
Seyitoğlu, F., Ivanov, S., 2020. Service robots as a tool for physical distancing in tourism. Curr. Issues Tour. 24, 1631–1634.
Shao, Zhen; Zhang, Jing; Zhang, Lin; and Chen, Kuanchin, Technology Affordance, Trust and Continuance Intention in Virtual Personal Assistants: Differences between High and Low Frequency Users" (2021). ICIS 2021 Proceedings. 4.
Shin, H., Kang, J., 2020. Reducing perceived health risk to attract hotel customers in the COVID-19 pandemic era: focused on technology innovation for social distancing and cleanliness. Int. J. Hosp. Manag. 91, 102664.
Song, Y., Zhang, M., Hu, J., Cao, X., 2022. Dancing with service robots: the impacts of employee-robot collaboration on hotel employees' job crafting. Int. J. Hosp. Manag. 103, 103220.
Stergiou, A.P., Farmaki, A., 2021. Ability and willingness to work during COVID-19 pandemic: perspectives of frontline hotel employees. Int. J. Hosp. Manag. 93, 102770.
Sun, J., 2014. How risky are services? An empirical investigation on the antecedents and consequences of perceived risk for hotel service. Int. J. Hosp. Manag. 37, 171–179.
Sun, S., Lee, P., Law, R., 2019. Impact of cultural values on technology acceptance and technology readiness. Int. J. Hosp. Manag. 77, 89–96.
Sun, S., Lee, P.C., Law, R., Zhong, L., 2020. The impact of cultural values on the acceptance of hotel technology adoption from the perspective of hotel employees. J. Hosp. Tour. Manag. 44, 61–69.
Tarhini, A., Hone, K., Liu, X., Tarhini, T., 2017. Examining the moderating effect of individual-level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model. Interact. Learn. Environ. 25 (3), 306–328.
Teoh, M.W., Wang, Y., Kwek, A., 2019. Coping with emotional labor in high stress hospitality work environments. J. Hosp. Mark. Manag. 28 (8), 883–904.
Tuncer, I., 2021. The relationship between IT affordance, flow experience, trust, and social commerce intention: An exploration using the S-O-R paradigm. Technol. Soc. 65, 101567.
Tussyadiah, I., Park, S., 2018. Consumer evaluation of hotel service robots. In: Stangl, B., Pesonen, J. (Eds.), Information and communication technologies in tourism, 2018. Springer, Cham.
Van Pinxteren, M.M.E., Wetzels, R.W.H., Rüger, J., Pluymaekers, M., Wetzels, M., 2019. Trust in humanoid robots: implications for services marketing. J. Serv. Mark. 33 (4), 507–518.
Volkoff, O., Strong, D.M., 2013. Critical realism and affordances: theorizing IT-associated organizational change processes. MIS Q. 819–834.
Wirtz, J., Patterson, P.G., Kunz, W.H., Gruber, T., Lu, V.N., et al., 2018. Brave new world: service robots in the frontline. Journal of Service Management 29 (5), 907–931.
Wu, L., Fan, A., Yang, Y., He, Z., 2021. Robotic involvement in the service encounter: a value-centric experience framework and empirical validation. J. Serv. Manag. 32 (5), 783–812.
Yoo, B., Donthu, N., Lenartowicz, T., 2011. Measuring hofstede's five dimensions of cultural values at the individual level: Development and validation of CVSCALE. J. Int. Consum. Mark. 23 (3–4), 193–210.
Zeng, Z., Chen, P.J., Lew, A.A., 2020. From high-touch to high-tech: COVID-19 drives robotics adoption. Tour. Geogr. 22 (3), 724–734.