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The perils of hotel technology: The robot usage resistance model

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**Abstract**

The COVID-19 outbreak has accelerated the development of service robots. However, service robots in some hotels have been put aside despite successful adoption. This study thus focuses on hotel employees’ inhibited continuous usage intention by examining the challenges of benefiting from service robots. A robot usage resistance model (RURM) has been proposed based on the results. In this model, lack of authentic anthropomorphous features and low usability as technological characteristics could influence employees’ cognitions toward service robots, while robot-related excessive workloads, techno-insecurity, and techno-uncertainty as psychological stimuli could trigger negative emotional arousal, which in turn fosters employee resistance to service robot continuous usage. This study offers a more solid conceptual investigation into employee resistance to service robot continuous usage, thus allowing the development of strategies to better reap the rewards of hotel service robot usage.

1. Introduction

Service robots, defined as “an automated computer program that is able to sense, comprehend, and act in response to certain requests” (Xiao and Kumar, 2019), are now being diffused into various hotel sectors including front desk work, room service, and housekeeping (Prentice et al., 2020). Henn-na Hotel in Nagasaki, Japan, was the first known service robot adopter, and robots are now deployed throughout the hotel to offer reception services to guests. Additionally, in the Crowne Plaza, robots are part of the front desk team, specializing in providing travel information and delivering items to guest rooms (Rodriguez-Lizundia et al., 2015). In the wake of COVID-19, service robots, which can provide contactless services that can meet high hygienic standards and enable social distancing protocols to be observed (Xiong et al., 2021), are likely to gain additional momentum in terms of their deployment in the hospitality industry (Zeng et al., 2020). The International Robotic Foundation has predicted that the service robot market will reach US $63.8 billion by 2025 (International Federation of Robotics, 2021).

However, despite these trends, some hotels have recently stopped using service robots even after successfully adopting robotic services (Ivanov et al., 2019; Lu et al., 2020; Yu, 2020). The deployment of service robots at the adoption stage requires continuously conjoint efforts from employees and external technology providers. Service robots being put aside is a waste of organizational resources and a misfit of strategic decisions. Therefore, it is requisite to explore the causes of this situation. Service robots have received wide attention in tourism and hospitality management (Fuentes-Moraleda et al., 2020; Ho et al., 2020; Ivanov et al., 2019). However, many existing studies have focused on the antecedents of service robot acceptance in hotels. For example, trust and perceived intelligence (Pillai and Sivathanu, 2020), perceived risks (Nam et al., 2020), and market position and hotel competition (Fuentes-Moraleda et al., 2020) were found to influence service robot adoption intention. However, few studies have investigated why hotels resist continuously using service robots even after hotels have invested a lot to deploy these advanced technologies (Prentice et al., 2020; Yu, 2020).

Drawing upon relevant literature on resistance to continuous usage of technology, existing studies were mainly about traditional digital platforms and information systems (Ali et al., 2016; Kumar et al., 2020). Few studies have probed into the type of technologies that are enabled by advanced artificial intelligence (AI) techniques. Service robots, different from traditional technologies, have the following characteristics. On the one hand, service robots are mostly designed with anthropomorphic elements and empowered with high levels of artificial intelligence (Xiong et al., 2021), but there are still technological flaws that impede hotels from getting the full benefit of service robot usage, thus inviting further investigation (Yu, 2020). On the other hand, as
emerging technologies in the workplace, intelligent service robots can replace and collaborate with human labor and thus may posit a psychological challenge to employees (Ho et al., 2020; Lu et al., 2020). For example, Li et al. (2019) indicated that some employees feel anxious that they may lose their job due to AI-driven technologies, which are substitutes for human service. Considering the uniqueness of service robots, there remains a paucity of studies that have jointly investigated the technological and psychological perspectives of service robots. The potential resistant factors and relevant influential mechanisms thus need further refinement.

This study aims to provide underlying reasons for the current constraints on continuous robot usage. In addition, we raise the question about how the challenges of benefiting from service robots could inhibit hotel employees’ continuous usage intentions. To answer the research question, we proposed a robot usage resistance model (RURM) to illustrate the influencing mechanisms of identified factors and further guide scholars and practitioners in terms of employee resistance to service robot continuous usage. The remainder of this paper is structured as follows. Section 2 briefly discusses service robot development in hotels and offers a theoretical background for the research. The methodology and the process of collecting the data are then offered, followed by a discussion of the results of this study. This work’s theoretical and practical implications and limitations are then offered in a concluding Section.

2. Literature review

2.1. Service robots in hotels

Driven by the advancements in artificial intelligence (AI) and its related technologies, service robot usage has been recognized as one of the most “dramatic evolutions” in hotels (Lu et al., 2019). Service robots integrate anthropomorphism with a higher level of automation. Service robots have an appearance or behaviors that imitate human beings to allow them to perform more intelligent tasks than traditional ICTs (Xiong et al., 2021). For example, some service robots are equipped with mechanical arms, allowing them to shake hands with humans or manipulate objects, while deep-learning algorithms help service robots analyze changes in their surrounding environment to facilitate correct reactions (Ivanov et al., 2019).

According to existing hospitality literature, ample research has examined drivers and impediments of service robot adoption. For example, Kuo et al. (2017) indicate that government support, robot market development capacity, and talent development are major factors influencing employees’ robot-related knowledge. Moreover, perceived potential advantages of robot usage (e.g., reduced labor cost) and external pressure (e.g., customers’ demands) may drive employees to seek relevant knowledge (Chan and Tung, 2019; Lam and Law, 2019). Lin and Mattila (2021) posited that perceived privacy, functional benefits of service robots, and robot appearance positively influence consumers’ attitudes toward service robot adoption. Hwang et al. (2021) verified that five types of perceived risks (privacy, financial, performance, psychology, time) negatively impacted guests’ attitudes. Lin et al. (2019) identified antecedents of tourists’ acceptance of robot usage, including social influence, hedonic motivation, anthropomorphism, performance, and effort expectancy. Tussyadiah et al. (2020) focused on tourists’ trust in robot usage, while Hou et al. (2021) highlighted that high social crowding might positively influence tourist preference for service robots. However, service robots in some hotels have faced challenges in improving operational efficiency (Ivanov et al., 2019), as employees often struggle to realize robots’ real value even after successful adoption. This study thus seeks to investigate employee resistance to continuous usage of service robots.

2.2. User resistance to continuous usage of technologies

Hirschheim and Newman (1988) were the first to conceptualize user resistance to continuous usage of technologies as an adverse reaction among users to new technology implementation. Subsequently, Kim and Kankanhalli (2009) refined the concept of user resistance as referring to users’ opposition to the use of new technologies. User resistance has been one of the crucial reasons for the failure of continuous use of technologies (Vrhovec et al., 2015). Ali et al. (2016) suggest that a failure to understand user resistance could reduce productivity and efficiency, which could trigger severe problems for the further usage of technologies.

The existing literature has explored user resistance to continuous usage of technologies from both technology-oriented and user-oriented perspectives (Ali et al., 2016). A summary of the literature review is presented in Table 1. The technology-oriented perspective is inherent in technological design and performance. Alohali et al. (2020) and Hong et al. (2017) propose that function and interface design are highly related to user resistance, as unfriendly design decreases individuals’ use intentions. Similarly, users attach importance to the reliability, accuracy, assurance, and empathy of technologies, resisting those implementations that are limited by slow reactions, low technological quality, and unreliability at critical times, and that ignore users’ requests or offer little individualized attention to users (Alohali et al., 2020; Chang et al., 2019). Existing studies also have integrated the technology acceptance model to verify that perceived difficulty of use (or uselessness) causes user resistance to continuous usage (Ilie and Turel, 2020; Jia et al., 2017).

In contrast, user-oriented perspectives emphasize users’ subjective beliefs concerning technologies. Several different theoretical bases thus have been applied to explain user resistance to continuous usage of technologies from user-oriented perspectives. For example, Aggarwal et al. (2015) indicate that users who possess a low techno-related knowledge may have low continuous use intentions. From the perspective of users’ self-efficacy, Jeong et al. (2016) illustrate that technology usage requires users to achieve various skills to qualify them to use technologies from both technology-oriented and user-oriented perspectives. For example, Aggarwal et al. (2015) indicate that government support, robot market development capacity, and talent development are major factors influencing employees’ robot-related knowledge.

Table 1

| Author           | Context          | Techno-oriented factors | User-oriented factors |
|------------------|------------------|-------------------------|-----------------------|
| (Aggarwal et al., 2015) | Information system | Lack of techno-related knowledge and expertise |                       |
| (Jeong et al., 2016)    | Information system | Job relevance; self-efficacy |                       |
| (Ilie and Turel, 2020) | Information system | Cognitive failure |                       |
| (Ayaburi et al., 2020) | Technology reliability; responsibility; assurance; empathy | Perceived value |                       |
| (Ilie and Turel, 2020) | Information system | Regret avoidance; perceived value |                      |
| (Jia et al., 2017)     | Information system | User expectation; expectation disconfirmation; Technological pause |                       |
| (Alohali et al., 2020) | Information system | Design of the interface; reliability; complexity of the system; compatibility | Negative organizational environment |
| (Ilie and Turel, 2020) | Information system | Perceived ease of use; usefulness | Social influence tactics |
to complete techno-related tasks. This shortcoming may lead to a negative belief among users that they are incapable of operating such technologies. Moreover, users may also evaluate the extent to which technologies fit with their working context (i.e., job relevance). According to Hong et al. (2017), cognitive failure, serving as an individual’s attention failure, could also increase their resistance to technology usage. Meanwhile, if users perceived limited benefits brought by technology usage (i.e., that the benefits derived are not worth the costs), users would resist technology usage (Chang et al., 2019; Hsieh and Lin, 2018).

Hsieh and Lin (2018) found that users may have strong reservations regarding bad outcomes from using technologies and thus, to avoid regret, users may resist using them. In addition, technostress, serving as a factor of user resistance, reflects the idea of stressful events being endured by individuals precisely due to engagement with technologies (Maier et al., 2015). Based on expectation-disconfirmation theory, Ayaburi et al. (2020) verified that if the actual performance of technologies disconfirms users’ initial expectations, users would become dissatisfied with this technology and be less likely to continue using it. Rosenbaum and Wong (2015) indicate that technological pause (i.e., when customers avoid hotel self-service technologies during holidays) may trigger user resistance. In terms of user surroundings, the available evidence indicates that individuals’ levels of comprehension of new technologies are affected by both their external and internal environment; in particular, individuals may lose confidence in technologies due to a lack of established norms, and low employee involvement (Alohali et al., 2020; Jia et al., 2017).

Moreover, Ilie and Turel (2020) designed social influence tactics (including soft tactics and hard tactics) to manipulate user resistance. Although several attempts have been made to explore user resistance, studies in this field have yet to discuss employee resistance to service robot continuous usage in the hotel context. The potential factors and the relevant influential mechanisms thus remain in need of further refinement.

3. Methodology

3.1. Research design and data collection

This research adopted thematic analysis to identify, analyze, and report data patterns (Daengbuppha et al., 2006; Glaser, 1992). Creswell (2006) asserts that qualitative methods are preferable for studying topics in the nascent stage of theoretical development. Researchers can organize and describe data sets in rich detail by applying the thematic analysis approach. In this case, the process included conducting semi-structured interviews and creating a relevant coding system for responses. A model of employee resistance to service robot continuous usage has been developed based on the interviews.

Data were collected over four months, from January 2020 to April 2020. The sample included 19 hotel employees from China, with a relatively balanced ratio of men to women. Because responses from the last set of interviewees were similar to prior interviews, we did not conduct additional interviews, given that theoretical saturation was reached without producing new insights. The summary of demographic characteristics is presented in Table 2. In this study, respondents were all supervisors or managers who directly interacted with customers and had worked with service robots. We adopted the following methods to recruit interviewees: (1) Purposive sampling: this method is used to conduct interviews with respondents who are easy to approach (Finn et al., 2000). In this study, we first contacted eligible respondents from acquaintances. (2) Referral sampling: this method is used to contact other eligible respondents (Finn et al., 2000). In this study, additional respondents were approached according to previous respondents’ recommendations.

To qualify for the interviews, participants had to meet the following standards: (1) be working full-time in a luxury or an up-scale hotel, since such organizations are more sensitive to new technologies (Lam and Law, 2019); (2) have worked with service robots; and (3) be working in a hotel that has stopped using service robots. As for robot types, Nam (2020) classified service robots by their main roles in hotels: (1) robot staffs functioning as human staffs for concierge, front desks, and delivery; (2) room chatbots for enhancing customer experience (e.g., controlling room temperature by ordering chatbots); (3) robots for assisting employees in analyzing customer-generated data and assisting employees in maintaining daily operation. In this study, we focused on the first type because we recognized that robot staff had been put aside after successful adoption in some hotels (Lu et al., 2020), while there was no evidence that room chatbots have caused hotel employees to be put aside. Also, the third type of robot was still in its infancy in the hospitality industry and not ready for hotel operation. Semi-structured interviews were undertaken with the selected interviewees in Chinese. We rechecked the translated manuscript word by word to ensure reliability and accuracy. As for the study setting, a majority of the interviews were conducted through online meeting platforms (e.g., Tencent meeting) for the interviewees’ convenience. A few interviews were conducted face to face in the interviewees’ offices (i.e., R8, R16, R17). According to research guidelines presented in Appendix A, each interview began with the interviewee being asked to give a self-introduction and discuss basic service robot development and application. Enough time allowed interviewees to think deeply about each

| Respondent codes | Gender | Age | Working experience (years) | Department | Types of service robots | Duration of working with service robots (months) |
|------------------|--------|-----|----------------------------|------------|------------------------|-----------------------------------------------|
| R1               | Male   | 25  | 13                         | Concierge  | Concierge              | 9                                             |
| R2               | Female | 28  | 6                          | Concierge  | Concierge              | 6                                             |
| R3               | Male   | 24  | 4                          | Concierge  | Concierge              | 3                                             |
| R4               | Female | 32  | 10                         | Housekeeping | Delivery       | 9                                             |
| R5               | Male   | 34  | 12                         | Housekeeping | Delivery       | 8                                             |
| R6               | Female | 30  | 12                         | Housekeeping | Delivery       | 10                                            |
| R7               | Male   | 37  | 15                         | Housekeeping | Delivery       | 11                                            |
| R8               | Female | 27  | 5                          | Food & Beverage | Delivery       | 6                                             |
| R9               | Female | 25  | 4                          | Food & Beverage | Delivery       | 3                                             |
| R10              | Female | 29  | 7                          | Health club   | Concierge       | 7                                             |
| R11              | Male   | 35  | 10                         | Front desk   | Front desk       | 9                                             |
| R12              | Male   | 24  | 2                          | Front desk   | Front desk       | 2                                             |
| R13              | Female | 22  | 3                          | Front desk   | Front desk       | 2                                             |
| R14              | Female | 37  | 14                         | Front desk   | Front desk       | 4                                             |
| R15              | Female | 30  | 8                          | Sales        | Concierge       | 4                                             |
| R16              | Female | 41  | 19                         | Sales        | Front desk       | 6                                             |
| R17              | Male   | 22  | 10                         | Sales        | Front desk       | 3                                             |
| R18              | Male   | 43  | 19                         | Engineering  | Front desk       | 4                                             |
| R19              | Male   | 44  | 20                         | Engineering  | Concierge       | 4                                             |
question, and each interview lasted over 40 min. As permitted by interviewees, the interviews were tape-recorded, and recordings were transcribed soon after. Each respondent’s transcript was coded after their interview.

3.2. Data analysis

In this study, a grounded theory approach was adopted. According to Matteucci and Gnoth (2017), grounded theory is a method to make sense of the data and understand how interviewees handle and react to their situations. Grounded theory works on theory generation based on applying a strict and rigorous principle for data analysis, and is commonly applied in tourism and hospitality inquiries (e.g., Kim et al., 2009; Nunkoo and Ramkisson, 2016). Accordingly, this research strictly followed a prescribed set of coding processes to investigate the potential factors and influencing mechanisms of employee resistance to service robot continuous usage. Furthermore, to achieve maximum rigor, a constant comparative method was adopted during the coding processes (Goulding, 2001). This was an iterative process that required coders to go back and forth between interview transcripts and constantly compare the data between interviews to systematically identify areas of similarity and difference.

To begin, we obtained a broad understanding of the data corpus by scanning through all the transcripts. Next we conducted coding by following three major steps, as detailed below. The study initially used open coding to extract meaningful expressions based on recurring words and phrases from the data corpus. Open coding aims to acquire the general properties and specific subcategories that informants describe during a set of interviews (Strauss and Corbin, 1998). Next, line-by-line coding was used to develop concepts and properties. Finally, we labeled and organized each statement from the interview transcripts to identify several broad, meaningful concepts addressed as first-round codes. An example of the first-round code is shown in Table 3.

Axial coding was then applied in the next stage (Matteucci and Gnoth, 2017; Strauss and Corbin, 1998) by systematically connecting the identified codes into categories and structure a story on the phenomenon. In particular, similar incidents were organized into the same conceptual label. As a result, we found three categories in respect to causal condition, phenomenon, and consequence. For example, we found that robot-related excessive workload of service robot (causal condition) led to our interviewees experiencing exhaustion (phenomenon), which made our interviewees resistant to service robot continuous usage even though they had successfully adopted it (consequence). (Fig. 1).

Finally, we adopted the selective coding process. It is a necessary process of identifying core categories, while we systematically connected categories through “integration of concepts around category and the filling in of categories in need of further development and refinement” (Strauss and Corbin, 1998). For example, the driving forces of resistance to service robot usage in this study were found, including lack authentic anthropomorphous features, low usability, robot-related excessive workload, techno-insecurity, and techno-uncertainty. These factors were emphasized by respondents and resurfaced in different parts of the interview. The respondents spontaneously emphasized their specific negative reactions to the service robot when they realized the disadvantages of the robots (see Fig. 2 for details).

3.3. Validity and reliability

Validity reflects the trustworthiness of the results (Willis et al., 2007). We employed the following means to ensure validity. First, respondents were recruited from different departments (e.g., concierge and housekeeping) in different hotels to ensure data were representative. Different workplace settings would promote the trustworthiness of this study. Second, to maintain the validity of internal connection, we rigorously followed the sampling standards, as each selected respondent was required to have worked with service robots, but they had stopped using the robots. This procedure guarantees that respondents had extensive insights about employee resistance to service robot usage in hotels. Eligible respondents were required to describe detailed events and practices, to help determine the possible link between each identified theme. Also, the extent literature was reviewed; constant comparisons between the codes and the literature were made to acknowledge consistency with or departure from the literature, to improve internal validity (Creswell, 2007).

Reliability concerns how the data analysis is influenced by coders’ subjective evaluations (Willis et al., 2007). In the present inquiry, we recruited two researchers to independently engage in the coding process. In respect to inter-coder reliability, we adopted the accuracy rate approach proposed by Marques and McCall (2005). The result reflects an 85.3% accuracy rate, indicating an admissible inter-coder reliability level (Marques and McCall, 2005). Coders rechecked each coding result independently before comparing, discussing, and adjusting coding results to reach a consensus. This process was monitored by an additional investigator to resolve inconsistency in the coding process.

4. Results

In this section, we explain the results concerning the resistance factors that inhibit employees’ continuous usage intentions in terms of technological and psychological perspectives. The influential mechanisms of identified factors were identified. Lack of authentic anthropomorphous features and low usability, as objective technological characteristics of service robots, may trigger employees’ cognition toward service robots, while robot-related excessive workloads, techno-insecurity, and techno-uncertainty, as psychological stimuli, may trigger subjective emotional arousal that leads to employee resistance to service robot continuous usage.

4.1. Service robot technological characteristics

Regarding service robots’ technological characteristics, the results highlight two factors, lack of authentic anthropomorphous features and low usability, which are salient factors of employee resistance to service robot continuous usage.

4.1.1. Lack of authentic anthropomorphous features

Lack of authentic anthropomorphous features is a major antecedent of employee resistance to service robot usage. Although previous studies have indicated that service robots were imbued with humanlike appearance, actions, and emotions (Murphy et al., 2019), respondents in this study emphasized that service robots in their hotels still lacked human-like appearance. Respondents used adjectives such as “non-descript,” “weird,” and “horrible” to describe the service robots’
Fig. 1. Coding process.
appearance. One interviewee noted:

_Service robots are nondescript. I don’t know how to describe their appearance. They [robots] look so weird... like an alien or a zombie? Anyway, I don’t like robot appearance._ (R13)

_When it comes to why we decided to give up using service robots, from my perspective, at my first glance at the service robot, I think it appears horrible and awful. It doesn’t have any facial expressions, so I think the robot is too stiff and not attractive._ (R9)

Moreover, several respondents stated that although service robots were able to perform simple gestures and movements, they were unable to do so in a natural manner:

_I still remember the robot slowly and laboriously raising its arms to make a welcoming gesture. Its movement was very rigid and unnatural._ (R12)

The respondents also generally described robots as appearing “stiff,” because service robots lack facial expressions. Respondents commented on the machines’ voice design, as audio was an essential part of the human-robot interaction process. The machine-generated voices were seen as unemotional and made the employees uncomfortable:

_The concierge robots’ machine-made tone is incredibly cold, without any intonation variation or emotional changes. I feel uncomfortable when communicating with the robot, so I think that if our concierge robots as service providers cannot converse with people warmly, the attentive service atmosphere cannot be constructed._ (R2)

4.1.2. Low usability

The findings suggest that the low usability of service robots is a major factor in employee resistance to service robot continuous usage. First, according to Ezzaouia and Bulchand-Gidumal (2020), low usability was attributed to the incompatibility of service robots with other workspace facilities. The respondents stated that the service robot system was incompatible with other hotels’ ICTs, such as the property management system (PMS), thus negatively affecting hotels’ internal ICT integration. Moreover, existing infrastructures in many hotels, such as network routers, lack the ability to support service robots in their daily operations. Respondents reported more specifically:

_The system [used] by the robots is incompatible with Opera._2_The guest purchasing bills in the robot system cannot be transferred to the Opera system. Meanwhile, guests cannot use the pre-authorized deposit to purchase the hotel products through robots._ (R1)

_I think hotel infrastructures cannot support service robot’s operations. Our hotel has already operated for over ten years, lots of hotel facilities were getting old. Meanwhile, robots demand high hardware requirements. For example, the hotel wireless network has been installed for years, and the internet speed was slow. Thus, the network cannot support the service robot operations._ (R18)

Second, respondents complained about the limited functions of service robots. They stated that service robots were only capable of a few designated tasks set by robot manufacturers. This relatively limited robotic functionality made robots unable to assist employees in completing tasks that required any level of flexibility. Respondents discussed this shortcoming at length:

_The functions of service robots cannot meet our working needs. For example, the current service robots cannot flexibly recommend hotel products according to passenger demands. If customers use service robots to check in, we cannot promote our latest sales activities as the robot system cannot provide relevant information about our hotel or destination through check-in process._ (R16)

_The hotel concierge is expected to meet guests’ diverse needs, even beyond the regular content of the hotel’s services. However, our concierge robots just direct guests, which [makes it] hard to meet the need of providing personalized professional services according to guests’ requests._ (R2)

Moreover, several respondents complained about the low working efficiency of service robots. They claimed that robots have been

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2 A property management system powered by Oracle company.
incapable of providing service consistently as they frequently crash and require rebooting. In addition, the low quantity and poor quality of tasks completed by service robots were also seen as noteworthy, as robots completed simple tasks only after a long time and could not accomplish any tasks accurately and promptly.

The robots have provided little help for us because the robots could not carry large pieces of luggage, and their transportation speed was unbelievably slow. The robot even often stopped suddenly at the elevator door, which would block guests from entering the lift. (R4)

The delivery robot is just able to carry very little things one at a time. It cannot serve two or more rooms at the same time. So, our housekeeping employees deliver the items to the guest rooms most of the time, so I think they are useless. Why use robots when our staff can deliver items fast and effectively? (R7)

We have hoped service robots could help us to assist guests to check-in, but we usually have to reboot the robots because robots’ screens frequently crash, I mean goes black, and some of the buttons on the screen are usually [not working]. Because of robots’ slow response, customers usually overcrowd in front of robot facilities. Eventually, human employees are needed to help guests check-in. (R14)

4.2. Employees’ cognitions toward service robots

In light of the technological characteristics of advanced service robots, employees form cognitions toward technologies. In this study, respondents reported that the paucity of robotic humanization triggered low social presence, while the low usability of service robots was the reason for technology-misfit.

4.2.1. Low social presence

The findings suggest that lack of authentic anthropomorphic features brought about a perception of low social presence. Social presence has been defined as the degree of sensing that another authentic person would be present during a human–technology interaction process (Qiu and Benbasat, 2009). Accordingly, social presence has been discussed in several studies of individuals’ ICT usage intentions. However, as the service robots were short of human characteristics, the respondents have failed to perceive a sense of interactivity with an authentic person; respondents lacked a sense of engagement or immersion when interacting with the robots, using words such as “unpersuasive” and “unattractive” to describe the human–robot interaction process. Thus, the robots’ low social presence results in non-cohesive interactions, where employees display a reluctance to use service robots:

In my view, the service robot is a special employee in hotels. But I think communicating with the service robot is very silly, like muttering to myself. Although I want to communicate with a service robot in the same way I do with a real human, it’s still very weird, as the robot is not a real human. Thus, I don’t think interacting with service robots is novel and interesting, it’s unattractive and inauthentic. (R19)

I hope the robot could have a more attractive appearance, such as human skin and vivid expressions. It’s an important sector for robots to provide a more immersive experience for us and our guests. (R5)

4.2.2. Technology-misfit

The findings highlight that employees form a cognition of the technological misfit because of the robots’ low usability. The respondents concluded that they would be more willing to use service robots if robots could assist them in performing their daily tasks more efficiently. However, the service robots were unable to provide prompt service under most circumstances, thus, robot usage did not meet the needs of employees. Consequently, employees’ continuous usage intentions have been inhibited due to technology-misfit. One respondent commented:

The service robot is not a good product for our hotel, because it’s not well fit for our needs. Our sore point is the dissonance between the limited human workforce and the unlimited guests’ demands. Thus, we want to improve our work efficiency and better satisfy our customers. We would go for technologies that [could] provide prompt service in the right scenarios. However, the service robot has only limited functions, and it’s unable to perform its tasks efficiently. So, I think service robot usage is still a gimmick. (R1)

4.3. Psychological stimuli

The psychological stimulus refers to the creator of individuals’ particular emotional states (Wang et al., 2020). In this research, three psychological stimuli have been identified, including the excessive robot-related workload, techno-insecurity, and techno-uncertainty.

4.3.1. Excessive robot-related workload

Several respondents indicated that they were afflicted with excessive workload due to the implementation of service robots. Robot usage increased both their workloads and the level of time pressure. Respondents reported that robot-related training processes forced them to spend more time and effort on learning and understanding the robots during work hours, a process treated by employees as the extra workload. Moreover, many respondents emphasized that they had to keep trying to use the robot and to help their colleagues who were unfamiliar with robots over time, further increasing their robot-related workload. Some respondents raised several grievances:

In order to better operate the robot, I have to make time for participating in internal training. I have to balance the robot training and customer reception. Thus, participating in robot training makes my work much busier. (R11)

I majored in information system management in college, so I mastered the use skills rapidly. Nevertheless, I have to teach my colleagues how to use the robot; it’s really maddening [but] several colleagues have asked me. (R17)

I had to pick the most important points from a series of instructions to learn how to use robots. It was incredibly complicated and cumbersome. Meanwhile, I had to keep trying a trial-and-error process. (R3)

Generally, respondents reported that not only did they have to learn robot use skills, but that service robot usage actively increased their workloads, as they had to pay more attention to robot maintenance and operation, including guiding the customers in using the service robot and dealing with mechanical breakdowns. In addition, dealing with unnecessary robot-related work diverted resources from other valuable activities. One noteworthy example emphasizes such respondent experiences: in one case, the front-office staff had to introduce the service robot to customers, thus diverting their time and energy for customers’ issues toward robot usage. As a result, these employees had fewer chances to promote value-added products and services to customers, limiting service product promotion. In addition, several respondents noted an ambiguity of operational roles, which meant that the service robot’s operational and maintenance responsibilities were unclear across internal hotel departments. Thus, the employees had to take extra time and energy to communicate across departments, which further increased their workloads:

Guiding guests to use service robots adds to the workload for me. When customers encounter problems relevant to robots, I have to answer the customers’ doubts and solve the problems during their use. When the machine breaks down, my team members and I must contact the
manufacturers… It’s such a waste of time, as my daily workload is heavy. (R12)

Nowadays, we still don’t have a robotics department. It’s still controversial whether a robot belongs to technology, engineering, or the department that the robot serves. When the robot breaks down, we don’t know how to deal with the robot or where to get help. (R6)

4.3.2. Techno-insecurity

The findings reveal that the rapid development of robot labor has prompted respondents to believe that they might lose their jobs, as service robots could eventually replace them. For example, employing service robots in hotels was labeled by respondents as “uncontrollable” and “inevitable.” Thus, service robots were treated as competitors of employees. Meanwhile, other respondents thought high-level technical employees would replace them with robot-related expertise:

When customers use the service robot rather than ask for my help, I feel the machine would replace me. Especially if robots develop beyond human intelligence, I believe that many people would lose their jobs and leave the hotel industry…. I cannot control this new trend as I’m not a scientist. (R11)

I associate the service robot with the industrial revolution in the nineteenth century, when the advanced machines took over manufacturers’ work. Absolutely, the requirement for talents is getting higher. Maybe, in the near future, there will be a lot of robots or people who understand robot technology (who) will replace me. (R16)

4.3.3. Techno-uncertainty

Techno-uncertainty arises where continuing changes and rapid upgrading of service robots means that there is no time for employees to get used to a situation. Employees are confronted with more adaptational demands due to new robot functions. If employees switch from service robots to other advanced technologies, they may also spend much more time adapting to these new technologies and being confronted with potential switching costs. As one respondent noted,

Service robots are constantly improving and [being upgraded as] robotics products are changing quickly. New ones will replace the robotic products. Thus, we have to suffer the upgrading cost, and we have even to learn and adapt to the new situation of robots constantly… It sounds head-scratching. (R14)

4.4. Emotional arousal

Emotional arousal is a state of being awake or reactive to psychological stimuli (Cao and Sun, 2018). According to respondents, the excessive robot-related workload may arouse exhaustion, while techno-insecurity and techno-uncertainty may trigger anxiety; thus employees resist using service robots continuously.

4.4.1. Exhaustion

Heavy robot-related workloads can give rise to mental and physical exhaustion in employees. Respondents perceived excessive robot-related workloads as taking up a significant amount of time and energy, even just in supporting service robot routine operations. Employees thus often felt tired and had little motivation to solve tasks related to service robots, leading to perceptions of low work fulfillment. Employees sought to change this situation to comfort themselves, and consequently, they opposed using service robots. As one respondent reported,

I feel exhausted because I have to spend lots of time on robot-related tasks. I believe that the technology is theoretically used to release us from heavy workloads, but the robot makes me much busier. I do NOT want to figure out any troubles caused by service robots anymore. (R3)

4.4.2. Perceived anxiety

In this study, techno-insecurity and techno-uncertainty perceived by employees were found to trigger employees’ anxiety. Respondents stated that they have been apprehensive, fearful, or uneasy about service robots’ current or future use. This perception was generally embodied in perceiving the unforeseen situations introduced by service robots as unfavorable, based on a loss of job-related control. As respondents reported,

I really feel anxious that if my hotel chooses the service robot and expels me one day, I’ll have to look for a new job. As you know, a suitable job is not easy to find now, so I don’t want to lose my current job. (R10)

I feel really anxious thinking about frequent upgrades. To be honest, I do NOT want to enter uncertain sectors introduced by service robots even though using service robots could bring some benefits to me. (R15)

5. Discussion and conclusions

5.1. Summary of findings

The primary goal of this study was to investigate factors and relevant influencing mechanisms of resistance to service robot continuous usage. Using a qualitative approach, we found that employees’ resistance to service robot continuous usage is explained by (1) technological characteristics of service robots and (2) psychological stimuli during the usage process. Based on the identified factors, we further developed a Robot Usage Resistance Model (RURM, see Fig. 2) to theorize the influencing mechanisms (1) between technological characteristics and employees’ cognitions, and (2) between psychological stimuli and emotional arousal.

First, consistent with Hong et al. (2017), cognitive appraisal of technologies is vital for users’ resistance. In this study, anthropomorphic elements of service robots, such as robot appearance, voice, and movement, are critical dimensions influencing employees’ cognitions toward service robots. Given that service robots lack authentic anthropomorphic features, employees may be hesitant to interact and hence, to use such apparatus. This finding points to the peril of perceived low social presence during the human–technology interaction process (Qiu and Benbasat, 2009). Moreover, our results revealed that service robots fit poorly with employees’ working demands. Thus, technology-misfit derived from low usability would trigger greater resistance of such advanced technology (Ilie and Turel, 2020).

Second, through the lens of psychology, this study highlighted that using service robots would evoke employees’ negative emotions, which in turn increases the chance of usage conflict. Contrary to previous studies on the positive side of service robots, which often help relieve users’ stress in the work place (Chan and Tung, 2019; Lam and Law, 2019), we found that using service robots has forced staff to take extra responsibilities and efforts in robot operation and maintenance. With increased workload, employees could easily feel exhausted. Moreover, this study revealed the effect of techno-insecurity and techno-uncertainty on employees’ feelings of anxiety, which stems primarily from job insecurity.

5.2. Theoretical implications

This paper added new insights to the existing literature in several ways. First, considering existing studies of hotel service robots were mainly about the positive value of service robots (Chan and Tung, 2019; Lam and Law, 2019) and the user acceptance of service robot adoption (McCartney and McCartney, 2020; Pillai and Sivathanu, 2020), this
study makes an early attempt to elaborate challenges in service robot usage. By constructing the robot usage resistance model (RURM), we illustrate a number of resistant underpinnings that discourage continuous usage of the service robot. The RURM thus offers a novel explanation for why employees are hesitant to rely on robotics by simultaneously investigating the linkage (1) between technological characteristics and users’ cognitions, and (2) between psychological stimuli and emotional arousal. Thus, this study lays a solid foundation for understanding users’ continuous intentions regarding the use of advanced technologies.

Compared with the well-known cognitive-affective-conative model (Lim and Kim, 2020; Xiao et al., 2020), our study found that cognition and affection are parallel to influence conation (resistance to service robot usage), which advances our knowledge of the influencing mechanism of conation. Our results show that employees’ cognition and emotional arousal are not interactional under the context of service robot usage in hotels. Technological characteristics of service robots directly influence employees’ cognitive judgment and directly influence resistance to service robot continuous usage. In other words, hotel employees may have limited affective arousal during decision-making when technology maturity does not satisfy their needs. We call for further investigations to explore the phenomenon.

Moreover, this study contributes to existing user resistance research, as most previous studies have focused on traditional ICTs such as self-service technologies (Rosenbaum and Wong, 2015), social media (Maier et al., 2015), and mobile applications (Chen et al., 2019). Regardless of the uniqueness of service robots (Lu et al., 2019; Yu, 2020), this research extends resistance-related research by focusing on the context of service robot continuous usage in hotels. Thus, this attempt provides a better understanding of technology resistance and better assesses the peril of introducing artificial intelligence-related services.

Finally, this research contributes to the growing interest in exploring the challenges of using robots in hotel services (Ivanov et al., 2019) by further investigating hotel employees’ resistance to service robots even when they have successfully adopted them. We contribute to the understanding of robot usage resistance by exploring employees’ cognitions and emotional arousal as the influencing mechanisms that finally lead to resistance to service robot continuous usage. We advance the knowledge of service robot usage in hotels by revealing the role of social presence perception, technology-fit, emotional Exhaustion, and perceived anxiety.

5.3. Practical implications

In this study, the proposal of the RURM also provides practical insights into hotel service robot continuous usage. With the rapid development of AI and the rise in demand for contactless service caused by COVID-19, finding ways to extract value from technology improvements has become a significant topic of interest. This study provides valuable insights for other service industries facing challenges of benefiting from robot usage. The practical implications derived from this study are relevant for robot manufacturers, robot designers, and employees.

First, the proposed framework allows manufacturers to better understand the challenges of inhibiting hotel employees’ continuous usage intentions for robot manufacturers. Improving robotic appearance, intonation, and movement could make robots appear more anthropoid, as service robots with more humanized characteristics are more attractive to hotel employees, and anthropoid designs of service robots are conducive to generating more immersive human-robot interactions. Considering that current robot facilities are misaligned with employees’ needs, manufacturers must improve service robots’ adaptability and efficiency in completing various functionalities to succeed. If robot designers and manufacturers simplify robot-related working processes and develop solutions to make robots work more effectively, robots would be more suitable for hospitality operations. Manufacturers must also provide holistic maintenance solutions and background support to increase operators’ confidence in service robots, such as 24-hour instant online guidance for employees.

Second, this study also provides implications for hotel employees and employers according to frontline employees’ insights. On the one hand, hotel decision-makers may make relevant decisions to keep or stop using service robots. For decision-makers who hesitate to adopt service robots, this study may help them avoid being misled by service robot usage. On the other hand, for robot operation, this research emphasized the importance of consistency in new technology development, creating a need for suitable management of work coordination and the use of various employee-stimulating strategies (Lu et al., 2020). As for reducing insecurity and uncertainty introduced by service robot usage, it is necessary for hospitality enterprises to develop employees’ professional skills to relieve staff of the impact of new technologies adoption. Hotel employees’ professional skills include, but are not limited to, (1) proficiency in the use of mainstream technologies, (2) efficient interaction with hotel guests to satisfy the guests’ various needs, (3) analysis of target customers’ needs, including evaluating customer-related information and providing suitable products, and (4) creative thinking, including determining customer needs and facilitating conflict resolution. To improve competitiveness, employees must strive to incorporate these skills, which service robots do not possess (Li et al., 2019). A comprehensive planning strategy is necessary to remove techno-uncertainty. Hotels should establish technical specialist departments, closely connect with manufacturers, and propose appropriate robot-related regulations.

5.4. Limitations and future research

There were several limitations to this study. As this study was only conducted in luxury and upscale hotels, the sample size was limited. Additionally, the interviews were conducted in Chinese, and the interview transcripts were translated into English during the data analysis process, introducing the possibility of discrepancies due to language issues; however, many potential problems in this area were mitigated through multiple rounds of comparisons with the assistance of several bilingual speakers. This study also did not consider the individual characteristics of respondents, such as gender, age, and educational background.

Future work should incorporate quantitative research to examine the proposed framework better and allow expansion of the sample to a much more comprehensive range of employees or service robot users. Such empirical findings are required to provide validation of the robustness of the proposed model. As the respondents in the current study were all service robot users, future research should also expand its purview to technology manufacturers and other customers. Future studies should also expand the sample size and more fully consider the individual characteristics of respondents to produce a more comprehensive understanding by taking various perspectives into account.

5.5. Conclusions

This study identified five salient factors of employee resistance to service robot continuous usage. These factors are the challenges of benefiting from service robot usage. From the technological perspective, lack of authentic anthropomorphic features and low usability were identified as two salient factors. From the psychological perspective, the robot-related excessive workloads, techno-insecurity, and techno-uncertainty have been identified as important challenges. In addition, this study investigates how the challenges of benefiting from service robot usage inhibit employees’ continuous usage intentions. From the technological perspective, the lack of authentic anthropomorphic features contributes to low social presence, while low usability induces employees’ cognition of the technology-misfit. From the psychological perspective, robot-related excessive workloads increase employees’
experience of exhaustion, while techno-insecurity and technouncertainty trigger employees’ anxiety. Consequently, employees resist continued use of the service robots. The RURM has been proposed accordingly. This model advances our knowledge about users’ resistance to continuous usage of AI-facilitated technologies, and provides practical insights to robot manufacturers, hotel decision makers and hotel employees.

Data availability
Data will be made available on request.

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Appendix A. Interview guidelines

A: Introduction:
(1) Briefly introduce the purpose of this study and thank the interviewees’ time and effort.
(2) Emphasize the commitment to anonymity and confidentiality of the interviewee and provide verbal assurances that nothing would be attributed to the interviewee or the organization.
(3) Provide each interviewee with the opportunity to propose any questions about this interview.

B: Demographic Questions:
(1) Age.
(2) Working department.
(3) Job position.
(4) Years of working experience.

C: Open-ended interview questions:
(1) What kind of service robot have you used? How long have you worked with service robots?
(2) Before stopping service robots, how did you feel when interacting with the service robots?
(3) Before stopping service robots, what features of service robots do you use daily?
(4) Why did you decide to quit service robots? Could you name any specific emotions you felt?
(5) Before stopping service robots, how did service robots affect your work? What difficulties they had encountered working with service robots were? Could you name any specific emotions you felt?
(6) Are there any other reasons why your hotel chose to quit robot usage that you perceive as important, but have not discussed yet? What are they?

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