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The Rise of Service Robots in the Hospitality Industry: Some Actionable Insights

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Introduction

The current wave of service technologies is service robots, “system-based autonomous and adaptable interfaces that interact, communicate and deliver service to an organization’s customers” (Wirtz et al., 2018, p. 4). The spread of Covid-19 has boosted implementation of service robots in the hospitality industry as more consumers become more sensitive to risk of infectious disease from interpersonal interactions. Adoption of service robots could signal low interpersonal contacts, reduce perceived risk of virus transmission, which might in turn increase visit intention (Wan, Chan, & Luo, 2020). As a result, consumers show a stronger preference for robot-staffed (vs. human-staffed) hotels due to safety concerns (Kim et al., 2021; Shin & Kang, 2020). The market size for service robots in the healthcare and hospitality sectors is projected to grow by 942 million USD during 2020-2024 (Technavio, 2020).

In this article, we will first discuss different roles that can be played by service robots based on different levels of intelligence. Then, we will further discuss important factors influencing consumer adoption of service robots, followed by introducing cross-cultural aspects in service robot adoptions.

What Roles Can Service Robots Play?

Service robots can be equipped with different levels of artificial intelligence: mechanical, analytical, intuitive, and empathetic (Huang & Rust, 2018). Mechanical intelligence relates to standardized and transactional tasks, which require a minimal level of learning (e.g., YO2D2, a room service robot, at Yotel Boston). Analytical intelligence is based on systematic and rule-based learning from big data and enables logical thinking in decision-making. For example, chatbots find an appropriate answer to customer enquiry, retrieving it from big data collected from customer FAQ. Service robots with these two levels of intelligence can basically handle functional tasks such as delivering food and answering a customer's question. They free human staff from the high volume of trivial customer requests rather than taking higher-value roles.

Intuitive intelligence relates to the capability to process holistic and contextual thinking and thus provide personalized services. Empathetic intelligence refers to the ability to recognize and appropriately respond to people's emotions. This "highest" level of intelligence enables service robots to deliver socially and emotionally interactive services, which is the ultimate goal of service robotics (Rafaeli et al., 2017). These two levels of intelligence focus on emotional and social capabilities of technology to enhance consumers' service experience (Huang & Rust, 2018). Current service robot technologies have been developing a higher level of intelligence to make customer engagement with frontline robots more intuitive and natural. Alternatively, to overcome the limited social and emotional capacity of robots, human staff and service robots can collaborate so that service robots do the mechanical and analytical work, and human staff deal with emotional tasks. For instance, during the check-in process, a service robot can deliver luggage to the assigned room, while the human staff provides the guest with a warm reception.

What Makes Consumers Adopt Robots?

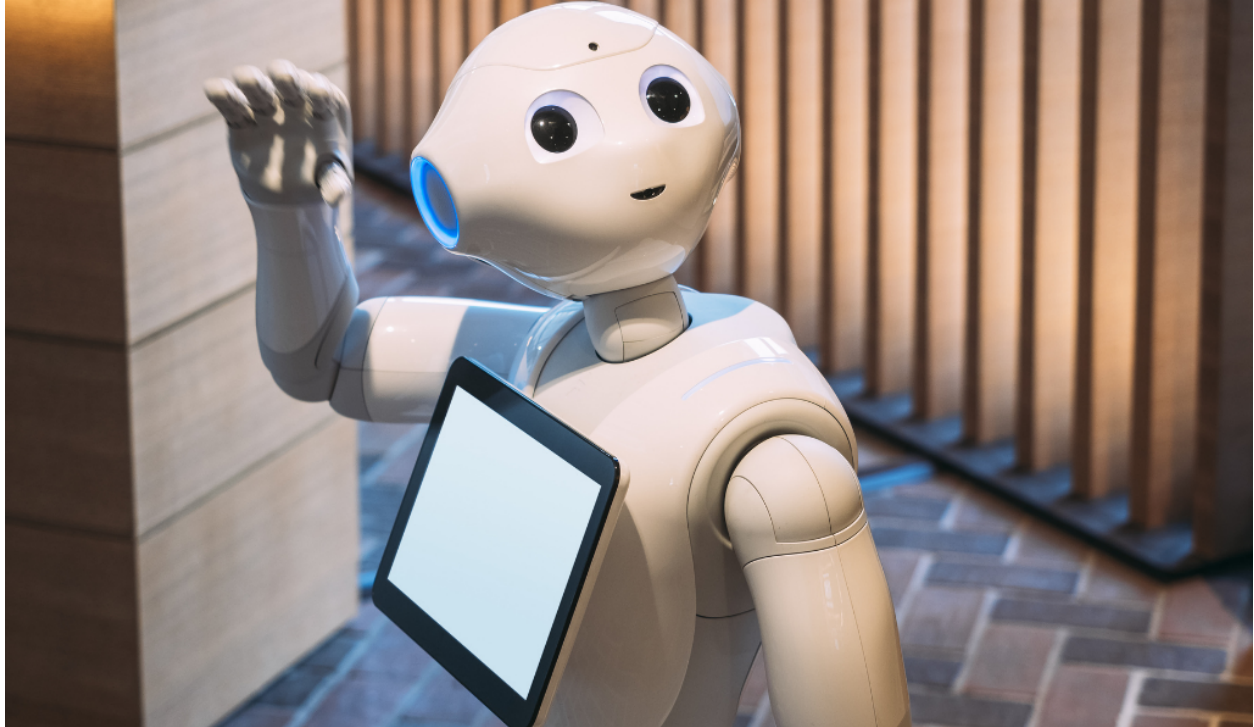
When implementing service robots, particularly customer-contact robots, companies should first consider the key factors that influence consumers' adoption/acceptance of the new technology.

Building on the classic technology acceptance model (Davis, 1989), the service robot acceptance model suggests that consumers' acceptance of service robots is determined not only by its functionality (e.g., perceived usefulness and ease of use), but also by social-emotional and relational elements that robots can provide (Wirtz et al., 2018). For the social-emotional dimension, the model shows that perceived humanness

of service robots through their appearance and social actions (e.g., smiling) can influence consumers' attitudes and willingness to interact with them (Breazeal, 2003; Tinwell et al., 2011). Moreover, for the relational dimension, consumers can trust and thus accept service robots when they feel secure and comfortable with the technology (Wirtz et al., 2018). The trust building can also be achieved by its human-like attributes including service robots' appearance and emotional displays (Tinwell et al., 2011).

Together, as service robots are able to engage consumers on a social level like human employees (Wirtz et al., 2018), their capability to meet consumers' social-emotional and relational needs is critical in consumer acceptance and perception of service robots. Service robot acceptance can be influenced by the extent to which they can provide enjoyable interactions – a feeling of care and friendliness, and personal connection to consumers (i.e., rapport). Supporting this notion, Tung and Au (2018) examined guest experiences with robots analyzing online reviews from hotels and found that a considerable number of reviewers commented on service robots' physical embodiment and social interactivity.

For this reason, a large body of previous research on service robotics explains consumer perceptions of service robots based on the extent to which consumers treat robots as human beings (i.e., *anthropomorphism*, the psychological tendency to attribute human characteristics, intentions, and emotions to nonhuman objects; Epley, Waytz, & Cacioppo, 2007). Robots with a greater number of human-like features, such as face, voice, and movement (e.g., Sophia by Hanson Robotics or Pepper by Softbank Robotics), are perceived to be more human-like than those with fewer of these features.



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Advantages of Being Human-like for Service Robots

Based on the robotics literature arguing the advantage of anthropomorphism on user involvement (Broadbent, 2017), a stream of hospitality literature demonstrates the positive impacts of human-likeness of service robots on consumer intention to adopt service robots. Scholars find that the greater consumers anthropomorphize service robots, the more positive emotions and stronger trust they feel towards the robots, thereby increasing adoption intentions (Chi, Gursoy, & Chi, 2020; Lin, Chi, & Gursoy, 2020; Shi, Gong, & Gursoy, 2020). Moreover, consumers are more likely to expect better service quality provided by human-like service robots (Christou, Simillidou, & Stylianou, 2020; Lin & Mattila, 2021; Qiu et al., 2020; Yoganathan et al., 2021). Zhu and Chang (2019) found that people expect food quality to be better when they anthropomorphize robotic chefs. More interestingly, it is found that consumers expect service robots to behave like humans when they look like human beings. For example, when interacting with human-like service robots, people evaluated the service encounter more positively when the robots used human-like language styles (Choi, Liu, & Mattila, 2019; Lu, Zhang, & Zhang, 2021). Also, consumers assume service robots and human staff are supposed to play similar roles, and thus expect service robots to engage in service recovery efforts as human staff members do (Ho, Tojib, & Tsareko, 2020). Taken together, the main takeaway of the evidence for hospitality managers is that adding human-like features in service robots may help boost consumer satisfaction in automated service encounters.

Are There Any Caveats for Being Human-like for Service Robots?

On the other hand, supporting the notion of the uncanny valley (Mori, MacDorman, & Kageki, 2012), another stream of hospitality literature argues negative or null effects of human-likeness of service robots. Compared to human staff members, consumers tend to perceive that human-like service robots lack interpersonal skills, which is in fact one of important drivers of service encounter satisfaction in the hospitality industry (Choi et al., 2020; Hu, Min, & Su, 2021). Thus, when a service failure occurs, consumers are less likely to accept a service robot's apology than a human staff member's apology (Hu et al., 2021). Moreover, some research shows that human-like appearances of service robots result in feelings of discomfort, thereby making the consumer feel reluctant to interact with the robot (Shin & Jeong, 2020; Yu, 2020). That is, hospitality managers should be more cautious in implementing (extremely) human-like service robots, particularly when they are taking care of tasks with frequent interactions with customers.

Such different responses from consumers towards humanoid service robots indicate that there are various external factors that shape consumer responses. The factors can be categorized into consumers' individual factors (e.g., innovativeness) and situational/contextual factors (e.g., crowdedness). For instance, consumers who are more innovative, open to new technologies, and less desiring of human interactions in service encounters tend to show more favorable attitudes toward humanoid service robots than their counterparts (Hu et al., 2021; Kim, Choe, & Hwang, 2020; Tussyadiah, Zach, & Wang, 2020; Yoganathan et al., 2021). Moreover, consumers show a stronger preference of adopting service robots when they have a strong motivation of social withdrawal, such as when there is a threat of contagious disease and when the area is too crowded with other people (Hou, Zhang, & Li, 2021; Kim et al., 2021).

Cross-Cultural Differences Between Consumer Reactions to Service Robots

In addition to the aforementioned factors, another influential factor that will affect consumer adoption of service robots is *culture*. Despite its importance, cross-cultural perspectives in service robotics have not yet been developed in the hospitality literature. Hence, we will introduce previous research in social robotics literature to provide an initial idea of consumer perceptions of services provided by humanoid service robots, based on cross-cultural views.

How and why do Westerners and East Asians view robots differently? First, influenced by Buddhism and Confucianism, East Asians believe not only humans but also non-human objects including gods, animals, and even stones, have their own spirit and mind. On the contrary, from the Western perspective, heavily influenced by Christianity,

humans are unique entities. Therefore, unlike Eastern cultures, those in Western cultures find it more difficult to believe and treat human-like robots as human beings (Geraci, 2006). Second, Western cultures tend to be more analytic, whereas East Asian cultures tend to be more holistic in their cognitive systems (Nisbett et al., 2001). Analytic cognition is characterized by rules-based categorization of objects and the use of formal logic in reasoning. Holistic cognition is characterized by categorizing objects based on themes and a focus on contextual information (Nisbett et al., 2001). Therefore, interacting with human-like robots may arouse more cognitive discomfort and ambivalent attitudes for Westerners than for East Asians (Dang & Liu, 2021). For instance, East Asians tend to describe robots as both highly competent and warm, while Westerners tend to describe them as competent but cold (Lee & Sabanovic, 2014). Also, Li et al. (2019) found that Chinese users tend to perceive the robots as more autonomous and flexible in decision-making, whereas American users tend to treat the robots as practical assistants following predefined orders (Lee & Sabanovic, 2014; Ray, Mondafa, & Siergwart, 2008). Moreover, during Covid-19, Chinese consumers indicate stronger preferences for robot-staffed hotels over human-staffed hotels than their American counterparts (Wan, Chan, & Luo, 2020). In other words, the use of service robots to reduce perceived risk of virus transmission and encourage visits could be more salient in collectivistic cultures (i.e. China). This could be attributed to more reliance on interpersonal cues in decision-making for collectivists.

Taken together, the evidence indicates consumers with different cultural backgrounds can respond to and treat service robots differently. This area has been underexplored by scholars so far, and thus could be potentially promising avenues for future research. Deeper understanding of these cultural differences would allow hospitality managers to strategically use different types and/or different features of service robots to maximize consumer satisfaction in automated service encounters.

Practical Implications for Hospitality Managers

Service robots are becoming more and more popular in the hospitality industry. The need to provide contactless services to consumers (e.g., robotic food ordering and delivery) further accelerates the adoption of robots. We hope to offer a few key takeaways for managers based on our current knowledge:

1. To overcome the limited social and emotional capacity of robots, human staff members and service robots can collaborate such that service robots do the mechanical and analytical work; and human staff members deal with emotional tasks.

2. Adding human-like features in service robots (e.g., face, voice, and movement) may help boost consumer satisfaction in automated service encounters. However, hospitality managers should be more cautious in implementing (extremely) human-like service robots, particularly when they are taking care of tasks with frequent customer interactions.
3. During Covid-19, Chinese consumers indicate stronger preference for robot-staffed hotels over human-staffed hotels than their American counterparts. In other words, the use of service robots to reduce perceived risk of virus transmission and encourage visits could be more effective in collectivistic cultures (i.e. China).
4. Transnational hospitality firms should consider what type of service robots to use based on the locations of the hotels to maximize the effectiveness of service robots, given the cultural differences in customer perceptions of service robots.

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