Title: Exploring Customer Experiences with Robotics in Hospitality

Purpose:

To explore consumer reviews with robotics based on the five dimensions for evaluating user experiences in human-robot interactions (i.e., embodiment, emotion, human-oriented perception, feeling of security, and co-experience).

Design/approach:

This study first reviews the five dimensions for evaluating user experiences in HRI, and then analyzes user experiences with robotics at four hotels (i.e., Yotel New York, Aloft Cupertino, Henn-na Hotel Japan, and Marriott Residence Inn LAX) based on reviews on TripAdvisor, Agoda, Yelp, and Booking.com.

Findings:

The findings highlight the influence of robotic embodiment and human-oriented perceptions on consumer experiences. The findings also suggest that users and robots can co-created novel experiences, with some guests even proactively seeking new opportunities to interact and communicate with robots in order to develop a certain level of 'relationship' with them.

Research limitations/implications:

Understanding user experiences from HRIs can inform future tourism and hospitality management.

Practical implications:

This study highlights current practices with robotics in order to suggest areas of improvements for enhancing future consumer experiences.

Social implications:

Consumer experiences will change rapidly as hospitality and tourism management deploy robotics in the future.

Originality/value:
This study provides a number of theoretical and managerial implications relevant for hospitality and tourism research and practice.

KEYWORDS: user experience; human-robot interaction; embodiment; emotions; experience co-creation; consumer reviews

1. Introduction

The application of robotics is progressing rapidly, diffusing into a broad range of sectors including healthcare, education, hospitality, and tourism. Researchers and practitioners are currently testing and applying robotics across various contexts in tourism and hospitality; yet, despite growing managerial interest in the practical deployment of robotics in hospitality and tourism, few studies to-date have examined consumer experiences from real-world applications. "What are the current user experiences with robotics in hospitality?" Understanding consumer experiences with robots is critical and timely for practitioners who are considering robotic deployments in their operations in the near future.

To address this research gap, this study seeks to: (1) review the user experience model derived from the USUS (usability, social acceptance, user experience, and societal impact) evaluation framework from human-robot interactions (HRI) research; and (2) analyze consumer experiences with robots at four hotels (i.e., Yotel New York, Aloft Cupertino, Henn-na Hotel, Japan, and Residence Inn Marriott LAX Los Angeles) that were reported across four travel sites (i.e., TripAdvisor, Agoda, Yelp, and Booking.com) using this model.

This study examines what is currently being done, in order to suggest what more could be done to improve consumer experiences with robots in the future. This is critical because the essence of hospitality and tourism is the development and delivery of visitor experiences (Ritchie *et al.*, 2011). Today, hospitality and tourism managers are seeking to facilitating experiences that are memorable for consumers (Tung *et al.*, 2017). In doing so, management can enhance their competitive advantage through aspects such as brand loyalty and satisfaction (Iglesias *et al.*, 2011).

2. Literature Review

2.1. USUS Evaluation Framework

The USUS framework was developed to understand the ways human interact with robots (Weiss *et al.*, 2009). This model was developed from a human-centered perspective to cover HRI in a variety of context, which is relevant for hospitality given the service dominant and

human-oriented nature of the industry. It covers four major aspects: usability, social acceptance, user experience, and societal impact (Dautenhahn, 1998). There are a number of indicators within each aspect; for example, usability includes effectiveness, efficiency, learnability, flexibility, robustness, and utility; social acceptance contains performance expectancy, effort expectancy, attitude toward using technology, self-efficacy, forms of grouping, attachment, and reciprocity; and societal impact includes quality of life, working condition and employment, education, and cultural context (Weiss *et al.*, 2009). A review of all these aspects is beyond the scope of the present study as the primary focus of this research are user (i.e., guest) experiences with robotics based on the dimensions of embodiment, emotion, human-oriented perception, feeling of security, and co-experience (De Graaf and Allouch, 2013; Hebesberger *et al.*, 2017).

2.2. User Experience

User experience could be defined as how people use an interactive product and how well the product serves their purposes in the entire experiential context (Alben, 1996). Successful evaluation of user experience is important for managing a technology, offering design guidance, and improving the way humans interact with the technology (McNamara and Kirakowski, 2006). This could potentially impact customers' brand experiences, including their sensations, feelings, cognitions, and behavioral responses (Brakus *et al.*, 2009). In turn, this influences a number of consequences of the customer experience, including emotional, behavioral, and brand-related outcomes (Hwang and Seo, 2017).

Yet, in many ways, user experiences with robots could be different from that of other technologies, such as computers and smartphones, due to the potential social and emotional characteristics that raise from HRIs (Young *et al.*, 2011). Robots can appear lifelike and be imbued with animal and/or human characteristics across different levels of presence (Fong *et al.*, 2003). Different levels of presence and embodiment could enable users to better view a robot as an active social and physical player within the context of an interaction (Young *et al.*, 2011). For example, users can touch and be touched by a physically copresent robot such as Karotz, in contrast to a telepresent robot such as Nico, in which users would need to interact with it via a video feed (Bainbridge *et al*., 2011). In consideration of these characteristics, Weiss *et al.* (2009)

proposed five dimensions to evaluate user experiences within the USUS framework: embodiment, emotion, human-oriented perception, feeling of security, and co-experience with robots.

2.1.1. Embodiment

The concept of embodiment represents the connection among the body, control (brain), and environment (Pfeifer *et al.*, 2007). Embodiment is affected by morphology, and robotic morphology could be categorized into several groups: anthropomorphic, zoomorphic, caricatured, and functional (Fong *et al.*, 2003). Anthropomorphic robots facilitates HRI by mimicking human-like forms (Duffy, 2003). Zoomorphic robots are based on non-human living animals (e.g., a rabbit) that are used to perform human tasks (Pfeifer *et al*., 2007; Zanbaka *et al*., 2006). Caricatured robots do not resemble living things (e.g., a robot in the form of a ball), while a functional embodiment reflects the task to be performed (e.g., a robot in a form of a basket to collect used towels from guests) (Fong *et al*., 2003).

Similar to human-human interaction, the physical appearance of robots can help establish social expectations and/or bias the interaction (Weiss *et al.*, 2009). For instance, a zoomorphic robot designed based on living creatures could better establishing human–robot relationships than a functional robot as lifelike embodiment can deeply involve users emotionally (Bartneck, 2009). In contrast, if a robot is intended to perform human-based tasks, it would be better if it is structurally and functionally similar to a human than a zoomorphic agent (Adams *et al.*, 2000).

2.2.2. Emotion

Emotions play a significant role in human psychology and is a critical topic in HRI research (Fong *et al.*, 2003). Previous studies have examined emotional consequences with technology, and the role of emotions is considered as an antecedent, consequence, and mediator of technology use (Hassenzahl and Tractinsky, 2006). Emotions are aroused during an interaction with a product, and users may experience satisfaction when a product fulfills their expectations which may further escalate to joy when their expectations are exceeded (Weiss *et al.*, 2009).

The importance of emotions in HRI also has pragmatic implications for the affective requirements of robotic design (Klug and Zell, 2013). This line of research provides a robotic-centric perspective for robots to show emotions in a human-like manner (Stock, 2016). Robotic designers have programmed facial expressions so that robots can actively respond to people's affections during an interaction (e.g., Broekens, 2007). Robots should convey affective responses to users through recognition, process, and/or simulation of human feelings (Fong *et al.*, 2003; Klug and Zell, 2013). Since users tend to expect their interactions with robots to be intuitive, particularly with anthropomorphic robots, robots that can convey impressions of humanness are considered as better performers and more readily adoptable (Klug and Zell, 2013). This would translate into positive feelings such as fun and delight for users, or negative affect such as disappointment and anger when a robot does not understand their commands.

Another growing line of research, based on a human-centric perspective, is currently focusing on human responses to robotic emotions (Stock, 2016). For example, Wada et al. (2004) investigated robot-assisted therapy and found that human subjectively interpret robots' movement based on their existing knowledge and experience.

2.2.3. Human-oriented perception

Perception reflects the interpretation of sensations, and human possess powerful sensory capacities that allow us to detect and interpret events that are occurring and respond to them accordingly (Gibson and Pick, 2000). In order to facilitate meaningful HRIs, robots also need to have different perceptions. For example, a robot's ability to recognize a user's physical gestures is important, and vision-based recognition approaches, such as image motion techniques, have been adopted to achieve the ease and naturalness required in HRI (Lisetti and Schiano, 2000). Robots should also mimic the way humans sense and interpret activities and behaviours by tracking users in different environments, detecting and recognizing their gestures and speech, monitoring and classifying their activities, discerning their intent and social cues, and measuring their facial expression and feedbacks (Steinfeld *et al.*, 2006).

Recent research in HRI suggests that robots that have high human-oriented perceptions would be perceived as intelligent, and as a 'buddy' that humans would enjoy interacting with (Lin and Schmidt, 2015). For example, Eyssel *et al.* (2011) used the robot, Flobi, in their

experiment and found that users responded with less feelings of uncertainty when they drew anthropomorphic inferences from the robot. In other words, users sought to maintain a predictable and subjective experience in their social environment by attributing human-like traits to the robot.

2.2.4. Feeling of security

Users' acceptance of robots is largely influenced by their feelings of security during HRI, and an understanding of the factors that could influence their sense of security would contribute to the development of more context-sensitive robots (Buchner *et al.*, 2012; Dautenhahn *et al.*, 2002; Jindai and Watanabe, 2007). In HRI, feelings of security do not only refer to physical safety, but also includes feelings of comfort and fears of harm from robotic errors when human and robots co-exist in the same environment. This could be influenced by the user's accessibility, visual field, posture, gaze direction, and relative distance to a robot (Dautenhahn *et al.*, 2006). For example, Dautenhahn *et al*. (2006) conducted two HRI trials and found out that majority of users, when seated, preferred a robot to approach from them from the sides instead of from the front. A frontal approach was perceived by users as uncomfortable and in some cases, even threatening. Additionally, users preferred a robot that moved at a faster speed over another that moved a slower pace. Recently, Rossi *et al.* (2017) investigated user perceptions to create guidelines to enhance human trust in robots in their home environment. The authors suggest that users' trust in robots could improve if robots are able to perceive social cues during HRI.

2.2.5. Co-experience

In UX research, co-experience is defined as "experiences with products in terms of how the meanings of individual experiences emerge and change as they become part of social interaction" (Battarbee and Koskinen, 2005, p7). This suggests that an individual's experience may evolve through social interactions as co-experience is an interpretative process in which non-symbolic gestures, the interpretations of others (e.g., robots), the social needs of communication, and the maintenance of relationships are taken into account (Battarbee, 2003; Battarbee and Koskinen, 2005). UX research also views experiential co-creation as a fluid

process that is both creative and collaborative; experiences that are created collaboratively with another are considered as more interesting and unpredictable than experiences that are created individually (Nardi *et al.*, 2000).

In HRI, both users and robots are mutually responsible for shaping an experience, and current research in robotic design are investigating ways to better facilitate collaboration and interaction with users (Weiss *et al.*, 2009). Recent field experiments have demonstrated that during a collaborative process, users naturally seek interaction with robots through touch and even expect inanimate-looking robots to respond to tactile stimulation (Silvera-Tawil *et al.*, 2015). Users can even treat robots as fellow human beings without being aware of it (Eyssel *et al.*, 2011; Luczak *et al.*, 2003), by forming social perception of robots based on their physical design, voice, and appearance, and then use those physical traits to guide their experiences (Dautenhahn *et al.*, 2005). Taken together, robots that enable users to interact with it like they interact with other humans, and trigger feelings of teamwork when users engage with it, are more likely to enhance the human-robot co-experience.

2.2.6. Summary

This review presented five dimensions for evaluating user experiences based on the USUS framework to understand the ways human interact with robots (Weiss *et al.*, 2009). The dimensions are embodiment, emotion, human-oriented perception, feeling of security, and co-experience. Embodiment refers to the appearance and morphology of a robot, and emotion represents users' emotions that are aroused during HRI. Human-oriented perceptions describe a robot's ability to respond to a user's command as well as detect and interpret events that occur. Feeling of security refers to users' feelings of safety and comfort, and/or fear of harm when they co-exist with robots in the same environment. Co-experience represent experiences and relationships that develop between users and robots through social interactions. The next section describes the research design applied in the present study to explore user experiences with robotics in hospitality.

3. Methodology

Purposive sampling was adopted in this study to assess guest experiences with robots. In purposive sampling, samples that are deemed most appropriate for addressing a specific research question are selected (Buchmann, 2017). In this study, the selected samples are from four different hotels that have recently launched robotic service: Yotel in New York, Aloft Cupertino, Henn-na Hotel in Japan, and Residence Inn Marriott LAX in Los Angeles. These four hotels were selected as they reflect different types of HRIs; at Henn-na Hotel, guests can interact with humanoid and zoomorphic robots at the front desk during check-in, while at Yotel New York, YOBOT, a functional robotic arm, can help guests store their luggage. At both Residence Inn Marriott LAX and Aloft Cupertino, guests can engage with robotic butlers, Wally and Boltr, respectively, for room service deliveries.

User experiences with robots based on consumer reviews from these four hotels were collected from multiple social media websites in order to obtain a more comprehensive coverage. The websites include TripAdvisor, Agoda, Yelp, and, Booking.com. Previous hospitality research have used these platforms to study consumer-generated reviews. For example, Yu *et al.* (2017) analyzed consumer reviews from TripAdvisor. Yang *et al.* (2017) collected customer reviews from Yelp; Viglia *et al.* (2016) included consumer reviews from Booking.com; and Wu *et al.* (2017) assessed customers' experiences at hotels from Agoda.

Consumer-generated reviews are relevant because they can provide information, influence travel decisions (Inversini *et al.*, 2009; Feilieri *et al.*, 2015), and shape perceptions about tourism products (Cox *et al.*, 2009). In total, 329 online user-generated reviews were collected based on keywords such as "robot", "robotic", "Wally" (i.e., representing the specific name of the robots). The data gathering process involved the research team manually reading and re-reading each review. The reviews covered the period from September 2015 until April 2017.

This study identified excerpts from the reviews and connected them to the five dimensions of user experiences in HRI using thematic analysis. Thematic analysis is a qualitative approach useful for identifying and analyzing a dataset in rich detail (Braun and Clarke, 2006). For example, tom Dieck *et al*. (2017) used thematic analysis according to external dimensions and relevant sub-themes to capture luxury hotel guests' acceptance of social media networks. In line with this approach, this study captured informative excerpts from customer reviews in order to provide insights into how guests felt about HRI, how well they thought the robots served their purposes, and how well the robots fitted their experiential context. The

authors reviewed the extracts for each theme, and considered whether they formed a coherent pattern with identifiable distinction between themes. Next, the validity of the individual themes were considered in relation to the theoretical perspective of this study, which is based on the five dimensions for evaluating user experiences in HRIs. This refining and defining approach sought to convey the essence of what each theme (e.g., embodiment, emotions, human-oriented perceptions, feeling of security, and co-experience) is about without trying to capture too much, or becoming too diverse and complex (Braun and Clarke, 2006).

Table I provides descriptions used for analysis across the five dimensions of user experiences in HRI. Words or phrases that suggested a similar context in each dimension were extracted. For example, "disappointment", "disgust", and "anger" reflected negative emotions. Phrases that pertained to the dimension, feeling of security, included "[the robot] frightened my husband"; and "it scared me at first." Both authors reviewed the excerpts presented in this study together in order to select those narratives that could bring out rich insights. In doing so, discrepancies were resolved through discussion.

--- Insert Table I here ---

The present research recognizes that other studies in consumer-generated reviews have oftentimes presented quantitative results such as percentages of positive and negative responses per category in the findings. For example, Dickinger *et al.* (2017) summarized 3094 customer reviews from TripAdvisor into percentages of positive reviews and negative reviews. In comparison to past studies on consumer-generated reviews, the number of reviews in this study are relatively small due to the novel nature of robotics in hospitality. Consequently, extracting percentages and/or statistical tests highlighting robotics as generally "positive" (or "negative") could be potentially misleading. Arriving at such a conclusion would be problematic as research in this area is still developing. Instead, the goal of this study is to connect relevant and interesting narratives that are insightful for understanding HRI based on the five dimensions for evaluating user experiences.

4. Results

Narratives from the online reviews were categorized into the five dimensions of user experience in HRI: embodiment, emotion, human-oriented perception, feeling of security, and co-experience. Table II presents examples of narratives for each of these dimensions.

--- Insert Table II here ---

A thematic map of the results is also provided in Figure 1. As per Braun and Clarke (2006), particularly vivid examples that capture the essence of each dimension were chosen. The results also embedded extracts within an analytic narrative that illustrates a compelling story of consumer experiences with robotics in hospitality.

--- Insert Figure 1 here ---

4.1. Embodiment

A number of users commented on the physical embodiment of the robot. For example, some users were described Tuly, a tulip-shaped concierge robot at Henn-na Hotel as just a "silly doll." Others also commented on the "dinosaur" robot at the reception of Henn-na Hotel, even comparing its "popularity" with Yumeko-san, the other humanoid reception robot at Henn-na Hotel. A functional robotic arm at Yotel New York for storing luggage was considered "fun to watch" while the robotic butler at Aloft Cupertino was seen as a cool "amenity."

Although the embodiment of a robot can help users establish positive social expectations (Weiss *et al.*, 2009), it can, nevertheless, also negatively bias their user experience. For example, one user expected human-like experiences from a highly anthropomorphic robot like Yumeko-san. However, the user was left with the impression that the robot was "just a marketing gig [that] was only able to speak few sentences" and "expected way higher standard of robot technique" (Male, Germany). In contrast, users were more lenient towards service failures from Wally, a non-humanoid, functional robotic butler at Residence Inn Marriott LAX, by clearly differentiating the robot from the responsibilities of humans: "we had a few failed deliveries by the robot butler, but I won't hold it against the humans" (Female, US).

4.2. Emotion

The reviews contained a broad range of affective descriptions after HRI, covering both positive and negative emotions. Positive emotions reflecting joy and excitement were described across all four hotels, and captured by "fun", "loved", and "liked." Additionally, elements of surprise with the robot during the user experiences were described as "wow" and "novel". While some viewed robots as merely pacifiers to assuage an unrelated negative experience (e.g., "What the lack in coffee makers is made up for by robot baggage checkers" (Gender unspecified, US), others were simply excited to be in a premise with robots: "I would get excited whenever I saw [Wally] in the lobby or joining me in the elevator" (Female, US). Indeed, many users indicated that it was their first encounter with robots, and the sense of uniqueness and novelty combined with a futuristic vibe made some guests rethink what a typical hotel experience could be.

However, users also reported a number of negative emotions from their experiences, such as "disappointment", "disgust", and "anger." Users expressed their disappointments with service from the robots, describing them as being cold, impersonal and indifferent. One user even "felt that the hotel itself was dead" (Female, US). A number of guests also used words such as "irritating", "unpleasant", "maddening", and "ridiculous" to describe their frustration. Some were dissatisfied with the service charge required to use the luggage robot while another user had to go to "the next hotel to get help with the delivery service" (Male, Hungary). Indeed, some users concluded that the experience was a "waste of time" and "didn't bother trying it out" because although "the hotel does have a robot butler, as far as I could tell it was a gimmick that would be less convenient than the alternative" (Male, US).

4.3. Human-oriented perception

Robots need to exhibit natural human-oriented perceptions, such as recognizing users' voices and physical gestures, to enhance user experiences (Lisetti and Schiano, 2000). Yet, the reviews suggest that the robots across the four hotels largely undelivered in this aspect. Users were disappointed that the robots were not programmed to socialize, and claimed they were "badly in need of some humanizing" (Male, Japan).

Many guests at Henn-na Hotel experienced inconvenience as they were not able communicate with the robots due to language barriers. For instance, the robots were programmed to respond in Japanese and "the audio-controlled robot in the room didn't respond well in

English" (Male, Taiwan). Another guest suggested that although the robotic receptionist tried to interact with them, it "spoke when we were in a conversation, but it could not help us when we needed it. [We] just feel that the technology is not there yet" (Female, Singapore).

4.4. Feeling of security

A number of users provided experiences related to feelings of security. Interestingly, these comments often reflected a transition from fear and insecurity with robots prior to the interaction, to feelings of trust and comfort after the experience. For example, a number of comments were related to Wally at Residence Inn Marriott LAX. As one user commented: "The only thing that scared me at first was the Butler robot, but I got used to it" (Female, UK). Another guest echoed this experience and reflected on her husband's involvement: "Wally the robot butler is pretty awesome, he frightened my husband at first, but after he got used to it, he ended up looking for reasons to have Wally deliver something to our room. We called down for the robot butler to bring us towels and lotion" (Male, US).

Nevertheless, some users felt insecure with the thought of sharing the same physical environment with robots, particularly in areas of tight spaces (i.e., elevators). As this user commented: "The one that freaked me out (wait till you see it in action) is the robot they have that actually delivers room items to your door. Never used it, but wait until you come around the hall corner and see this thing or even worse it gets in the elevator with you. I guess I'm not ready for Star Wars yet" (Male, Country undisclosed). Furthermore, users' feelings of (in)security could extend from robotic errors. As this user reported: "The robot in the room suddenly operated late at night so we just powered [it] off when sleeping" (Female, South Korea). Another user reported: "We did store our stuff in the Robot storage, but if you overfill the bin, stuff may be stuck/jammed. We had to have maintenance come and take our bin out for fear on item would fall (it was susceptible to breaking if it had) and you have to pay to use the Robot... so bear that..." (Female, US).

4.5. Co-experience

Finally, users also commented on how their experiences with robots emerged. As one user described: "Wally is a robot butler and he is awesome. We saw him in the lobby and just had to order something so we could see him in action." Robots were also described as a good

companion: “When I entered the room, there was Churi-Chan and it was fun to be in a conversation” (Female, Japan). Users even commented on how they proactively sought to co-create new experiences with robots. After a successful initial interaction, some users made deliberate efforts to go out of their way to further interact with it. As this guest vividly recalled:

“I just have to start by gushing over Wally; I am completely enamored with that little guy! ... I noticed him in the lobby when I was inquiring about the hot tub, but thought he was simply a kiosk. After my workout I was waiting on an elevator when I realized he was heading my way; I hung back to see what he was up to. His display said that he needed to take the elevator to the 2nd floor for a delivery, so I held the elevator for him, and then on the ride up attempted to engage with him (I was so hoping he was like Hitch-Bot, I completely adored him!) … I held the door on the 2nd floor for him and sent him on his way, then spent the rest of the evening trying to think of things I needed him to deliver to our room,” (Female, US).

Co-created experiences oftentimes also involved families, connecting the parents and children with the robot. Here, a number of parents reported on their children’s reactions: “Oh and best yet the robot butler was a hit with kids” (Female, US); “Robot luggage storage had a wow factor for the kids” (Female, Australia); “Our children were captured by 'Wally' the robot butler who delivers items to the room. We ordered from Starbucks and Wally brought it to us which was great fun” (Female, UK).

The reviews also suggest that children developed close affinity with robots after their experiences at the hotel. For example, one user described his stay at Henn-na Hotel with his family: “Kids had fun with Churi-chan though it can only understand Japanese” (Male, Singapore). Likewise, another user reported: “Kids have fun, doll robot-Churi-chan, only response in Japanese” (Female, Singapore). Interestingly, one user also described how the robot at Aloft Cupertino remained a hot topic for his children even after the trip was over: “The kids still talk about the robot that delivered things to their room” (Male, U.S). This long-lasting effect of robots on children’s memorable experiences was also echoed by another user who stayed at Marriott Residence Inn LAX: “Robot brought my kids candy at night time and a blanket!! We had taken the kids to Disney all week however the only stories our kids told people were all about “Wally” the robot” (Female, Country undisclosed). Indeed, parents were even willing to embrace service delays for the sake of their children’s experience with a robot: “When checking

in with the machine, although it proceeded at a much slower pace, the children were delighted" (Female, Japan).

5. Discussion and Conclusion

This study reviewed five dimensions for evaluating user experience in HRI (i.e., embodiment, emotion, human-oriented perception, feeling of security, and co-experience), and then analyzed user experiences with robotics at four hotels (i.e., Yotel New York, Aloft Cupertino, Henn-na Hotel Japan, and Marriott Residence Inn LAX) based on reviews on TripAdvisor, Agoda, Yelp, and, Booking.com. In doing so, this study provides a number of theoretical and managerial implications relevant for hospitality and tourism research and practice.

5.1. Theoretical contributions

First, this study contributes to the field's growing interest in robotics (Yeoman, 2012; Tung and Law, 2017). For example, Kuo *et al.* (2017) identified the factors that influenced the development of service robots, and applied a service innovation strategic mindset to the hotel industry in Taiwan. The six factors are government support, capability of market development, future development of the robotics industry, capabilities for technology development, raising money and talent development. The first three of factors are associated with the demand side of the hospitality market while the other three factors are associated with the supply side of the business. Murphy *et al.* (2017) identified six areas of importance for teaching and research of robotics in hospitality and tourism to provide academics and practitioners with a foundation for envisioning the current and future state of robots in hospitality and tourism. This study contributes to this emerging area by connecting recent knowledge from HRI research that could be informative for further progressing consumer experience research.

Additionally, this study contributes to the growing literature on co-creation in tourism and hospitality by highlighting how experiential co-creation can extend beyond human-to-human interactions (e.g., Chathoth *et al.*, 2016; Torres, 2016); that is, users and robots can co-create novel experiences together. For example, some guests indicated that they went out of their way

to engage with robots by proactively seeking deliveries from them, while others even purchased products to be delivered by robots. Furthermore, some guests even described robots as companions and attempted to engage in conversations with them. These experiences suggest a certain level of 'relationship' development, and even deliberate attempts to 'bond' with robots. Indeed, relationship development and bonding are important aspects in facilitating memorable tourism experiences (Tung and Ritchie, 2011).

A number of studies in HRI are currently focusing on the dynamics between robotics and children as children are now being exposed to an increasing number of different robots during their childhood development (Okita and Schwartz, 2006). This study contributes back to research in HRI by highlighting exemplars of children-robot interactions as a number of guests reported that their children developed a close affinity with robots during their stay at the hotel. The study findings suggest that children developed an interest regardless of the robot's appearance and function; even communication barriers (e.g., language) did not dampen their enthusiasm for robots.

Finally, the study findings show that robots could potentially act as 'catalysts' for enhancing relationships between parents and children, and add value to hotel services and experiences. In part, the robots transformed the accommodation into an interactive experience where parents had fun with children playing with the robots. Parents were even willing to accept a certain extent of service failure (e.g., slower check-in) to allow their children to interact with a robot.

5.2. Practical implications

This study contributes to tourism and hospitality management by highlighting current practices and user reactions with robotics, in order to suggest areas of improvements for enhancing future guest experiences. For example, the findings suggest that users experienced discrepancies between an anthropomorphic robot that is structurally similar to a human, but which failed to perform intended, human-based tasks (e.g., help with check-in). This resulted in negative guest experiences and deterrence against services by robots as they were considered as "just a gimmick" or marketing ploy. Consequently, hotel managers need to thoroughly consider the tasks of the robot – and whether the robot is intended to perform human-based tasks – before

deciding on the robot's type of embodiment (e.g., anthropomorphic, zoomorphic, functional, or mixed) as the robot's appearance can affect guests' service expectations.

The findings also highlighted the limits of robotics in hotels in terms of human-oriented perceptions and engagement, at least with current technology. While robots were intended to enhance user experiences by recognizing their voices and physical gestures, guests regrettably reported a number of limitations, particularly with language ability and voice commands. These limitations could arouse user frustration and disappointment, especially if guests experience the same challenges multiple times. Hence, additional training for staff could be required to communicate and explain to guests the types of services that robots can or cannot perform, as well as offer both technical and non-technical assistance to guests when appropriate.

Hotel managers need to be cognizant of guests' feelings of discomfort with robotics to address potential feelings of insecurity. More specifically, management needs to remember that HRIs are still relatively novel in tourism and hospitality settings, and some guests may feel insecure with the initial thought of sharing and interacting with robots. As such, hotels need to consider guests' sense of discomfort when robots operate in the same physical space, especially in tight and closed environment such as elevators and narrow hallways. Fortunately, the findings also suggest that users' sense of trust in robots could develop after several iterations of successful interactions.

Finally, many guests who stayed at the hotels covered in this study recommended the property to other tourists with family. The family travel market is growing and currently receiving a lot of marketing attention (Li *et al.*, 2017). Tourism and hospitality practitioners who would like to compete for this market segment could consider weighing the advantages of deploying robots to attract parents and particularly their children. As one user aptly concluded: "We stayed here in the earnest hope of the children."

5.3. Limitations and future research

There are limitations and opportunities for future research. First, this study is limited by the small sample of four hotels that employed robotics for operational functions. While the hotels were selected based on uniqueness, there are nevertheless more hotels featuring different robots. Second, the findings from this study may not be generalizable to larger hotels with different service standards. Third, since reviews were collected from travel websites, the data could

exclude individuals who stayed at the hotels but did not leave a comment; hence, the results are not representative of all prior guests. Fourth, this study collected data from TripAdvisor, Agoda, Yelp, and Booking.com. Nevertheless, looking at official fan pages, conducting in-depth interviews with guests who stayed at these hotels, and capturing reviews from even more platforms such as Expedia, Hotel.com, and Trivago, could be helpful.

There are many interesting areas for future research. For example, future research could adopt a longitudinal perspective and analyze temporal changes in user experiences. User experiences from HRI could potentially show a trend overtime as the effects of novelty fade away. Future research could also seek to measure user experiences from a quantitative perspective. An assessment could provide hotel managers with insights on future areas of improvement across the five dimensions covered in this study. Finally, future research could also interview hotel managers and assess their perceptions of the potential competitive (dis)advantages of deploying robots in hospitality. Understanding and addressing the concern of industry leaders would be necessary furthering HRIs.

5.4. Conclusion

This study explored consumer experiences with robotics based on the five dimensions for evaluating user experiences from research in HRI. The five dimensions are embodiment, emotion, human-oriented perception, feeling of security, and co-experience. In doing so, this study highlighted current practices with robotics, in order to suggest areas of improvements for enhancing future customer experiences in hospitality. For example, the findings highlighted the influence of robotic embodiment and human-oriented perceptions on customer experiences, as well as how some users even sought new opportunities to interact with robots in order to develop a certain level of 'relationship' with them. Indeed, this is one of the early studies in the field, and there is no doubt that customer experiences will change rapidly, so more subsequent research could be expected, when tourism and hospitality management further deploys robotics in the future.

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