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Customer experiences with service robots in hotels: a review and research agenda

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ABSTRACT

This study consolidates the limited research on real-life customer experiences with hotels that have integrated service robots (SR) grounded in the Usability, Social Acceptance, User experience, and Societal Impact (USUS) Framework. Employing a systematic and thematic review across 42 articles, the findings reveal discrepancies in customer experience (CX) across dimensions like embodiment, emotions, human-oriented perceptions, security, and co-experience. Theoretically, the results suggest that long-term CX may be more grounded in pragmatic aspects rather than SR novelty. The review also cautions against indiscriminate SR integration, which can lead to unpredictable CX. The study contributes to academic discourse by identifying critical CX aspects, providing a future research agenda, and a foundation for developing robust theoretical frameworks. For practitioners, the insights offer guidance on effectively integrating AI technologies to enhance CX, such as focusing on SR functionality, optimal SR-human service offerings, and considering evolving CX for innovative technological integrations in hotels.

摘要

本研究整合了对酒店真实客户体验的有限研究,这些酒店基于可用性、社会接受度、用户体验和社会影响(USUS)框架集成了服务机器人(SR)。通过对42篇文章进行系统性和主题性的回顾,研究结果揭示了客户体验(CX)在体现、情感、以人为本的感知、安全性和共同体体验等维度上的差异。理论上,研究表明,长期客户体验可能更多地基于实用方面,而不是SR新颖性。该审查还警告不要不加选择地进行SR集成,这可能会导致不可预测的CX。该研究通过识别关键的顾客体验方面,为学术话语做出了贡献,提供了未来的研究议程,并为制定强有力的理论框架奠定了基础。对于从业者来说,这些见解为有效整合人工智能技术以增强客户体验提供了指导,例如专注于SR功能、优化SR人工服务产品,以及考虑在酒店创新技术集成中不断发展客户体验。

KEYWORDS

Human-robot interaction; service robots; artificial intelligence; customer experience; hospitality; acceptance; hotel industry

Introduction

Existing literature in hospitality has indicated a growing interest in Artificial Intelligence (AI) and robotics technology to transform the service landscape (Agarwal et al., 2024;

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Talwar et al., 2023). An example of this is wholly or partially automated frontline service robots. Literature has defined Service Robots (SR) as AI-enabled agents that interact, communicate, and deliver customer services (Choi et al., 2020; X. S. Liu et al., 2022). Customers interacting with SR in frontline hospitality services constitute customer-centric Human-Robot Interaction (henceforth, HRI). HRI is further transforming the service sector, causing an industrial revolution that aims to eliminate the barriers between humans and technology (M.-H. Huang & Rust, 2021). Hotels are at the advent of SR integration, paving the way for transforming the traditional service landscape. For instance, M. Mariani and Borghi (2021) state that the hotel landscape is currently undergoing an increase in SR adoption. Likewise, industry reports reveal that the hospitality service robot market is bound to increase by \$471.77 million between 2023 and 2028, with hotels constituting a significant share of the market growth (Technavio, 2024).

Accordingly, the integration of SR in the hotel industry is rapidly advancing, yet there is a significant gap in understanding how these technologies impact customers. Customer interaction with SR is rooted in the broader concept of Customer Experience (CX), widely recognized as a multifaceted construct. For instance, Lemon and Verhoef (2016) suggest that CX includes customers' sensory, emotional, cognitive, behavioral, and social responses based on the interaction with service offerings, in this case, SR. Specific to customer-SR interaction, Weiss et al. (2009) relate user experiences to how people interact and perceive an interactive product within the broader usage context. Furthermore, Tung and Au (2018) posit that CX with SR differs substantially from other AI-based technologies due to their unique social and emotional features that are inherent to such interactions. Accordingly, Salminen and Milenkovic (2020) suggest that the evaluation and examination of CX form a current trend in the HRI literature that is focused on socially interactive robots.

Nevertheless, extant literature examining HRI suggests that the outcome of this interaction is widely unknown (Choi et al., 2021). Likewise, the integration of SR in hotels is met with doubt and hesitation where customers consider SR a mere marketing gimmick (Tung & Au, 2018) or hotel managers and employees alike hold negative attitudes toward SR implementation (Zhong et al., 2022). The interaction between a service provider and receiver determines the hotel's success factors (Hwang & Seo, 2016). Given varying customer preferences toward service automation, scholars emphasize the need to better understand customer reactions to AI-enabled services such as SR (M.-H. Huang & Rust, 2021; Tung & Law, 2017). In the case of SR-integrated hotels, P. Wang et al. (2024) postulate that CX shifts from human-centered one-way interactive to human-object two-way interactive experience. Therefore, HRI has essential implications for CX (Fuentes-Moraleda et al., 2020).

Although there have been attempts to examine the impact of HRI on CX (Wirtz et al., 2018), efforts have yet to be directed toward examining HRI based on real-life experiences. This aligns with existing literature examining customer reactions mainly through hypothetical scenarios and stimuli with little emphasis on actual CX (Filiari et al., 2022; Kazandzhieva & Filipova, 2019). Additionally, studies examining actual versus potential HRI reveal substantial discrepancies (Borghi & Mariani, 2022), negating over-reliance on customer intentions to understand HRI outcomes. SRs are further redefining CX in the post-consumption phase (M.-H. Huang & Rust, 2021); thus, scholars have emphasized the need to assess HRI outcomes in the hospitality and tourism context (Choi et al., 2021; Lu et al., 2019; Tung & Au, 2018; I. Tussyadiah, 2020).

Moreover, the CX of SR-enabled services is often complex (Orea-Giner et al., 2022; X. Wu & Huo, 2023). Thus, evaluating CX is critical in addressing the doubts and hesitation surrounding SR integration in hotels. However, I. Tussyadiah (2020) postulates the shortcomings in the existing literature, highlighting the need for a holistic understanding of the impact of SR integrations. Further, a critical gap persists in understanding the multifaceted nature of customer perceptions, evaluative outcomes, and post-purchase consequences stemming from customer interactions with SR (Steins et al., 2024). This necessitates a deeper investigation into the comprehensive impact of robot-assisted services on the overall CX within the hospitality context, particularly hotels. Unpacking the nuances of how customers respond to and make sense of their interactions with SR can provide crucial insights to guide the successful integration of this transformative technology. While prior review studies have collectively examined HRI (Gaur et al., 2021; D. Huang et al., 2021; Iranmanesh et al., 2022), this review emphasizes on capturing real-life SR interactions in the context of hotels. Accordingly, Mende et al. (2019) postulate that real-life service contexts, in contrast to stimulus, provide a richer understanding of HRI and CX. Therefore, the need to review real-life CX with SR-integrated hotels is substantiated (Tung & Law, 2017; I. Tussyadiah, 2020).

In light of the research gaps identified, this study aims to systematically examine the multifaceted nature of CX with SR in the hospitality literature. Consistent with Tung and Au (2018), this review seeks to answer the overarching research question “What are the current user experiences with robotics in hotels?.” Consequently, the research objectives of the study are to 1) identify and synthesize the prevailing themes and trends in the literature examining customer-SR interactions in hotels in light of the Usability, Social Acceptance, User experience, and Societal Impact (USUS) framework, 2) evaluate the theoretical frameworks and methodologies employed to assess and evaluate CX, 3) identify and discuss the gaps and limitations in existing research to inform the future research agenda, and 4) provide theoretical and practical implications of CX with SR in hotels. To address the overarching research question and objectives, a review of the existing literature provides a critical and timely guide for researchers and practitioners alike based on CX with SR-integrated hotels through a real-world perspective.

Consequently, this research is highly relevant as it addresses the implications of SR on CX, which is a critical aspect of hotel service delivery. Given the fast-paced advancements in the hotel industry, there is an urgent need to understand the real-life CX with SR. Understanding CX can help researchers and practitioners to leverage and understand SR interactions more effectively. Moreover, this review is necessary to consolidate existing research examining real-life CX. For academics, this paper provides a thematic review grounded in the USUS Framework, emphasizing and identifying the micro-level indicators for evaluating CX.

Additionally, the review provides several research implications, probing scholars with research questions that can be addressed in the future to develop the field of customer-SR interaction in the wider hospitality and tourism domain. Moreover, by synthesizing existing research, this study can provide valuable insights into how hotel customers currently perceive SRs. This understanding can help hoteliers and policymakers make informed decisions toward integrating SR in hotels to enhance customer service experiences. This study further informs the strategic aspects of enhancing customer-SR interactions and hotel CX to overcome the increasing skepticism toward SR integration. Therefore, this review provides guidelines for practitioners and suggestions for future researchers to understand and shape a better understanding of CX in SR-integrated hotels.

The remainder of this paper is structured as follows: Section *Theoretical Background* highlights the theoretical background of the study, followed by the review methodology in Section *Review Methodology*. Section *Literature Review* provides the results of the study with a descriptive overview and a thematic review. Section *Discussion* provides a discussion incorporating the conceptual mapping of the determinants of CX with SR in hotels, along with its theoretical and practical implications. This is followed by the study's limitations and future research agenda in Section *Limitations and Future Research Agenda*. Lastly, Section *Conclusions* concludes the paper.

Theoretical background

The general hospitality and tourism literature has witnessed a plethora of theoretical frameworks and models examining customer experiences (Veloso & Gomez-Suarez, 2023; Zha et al., 2024). Nevertheless, these theoretical frameworks largely focus on traditional employee-customer interactions. The emergence of the *Industry 4.0* paradigm, characterized by the convergence of technologies such as Artificial Intelligence (AI) and robotics in service-oriented sectors (Bakirtas & Baser, 2024; Hollebeek et al., 2021), has introduced novel dynamics that challenge our existing understanding of customer experiences within the hospitality and tourism industry. Specifically, the hospitality industry has seen significant advancements in incorporating service robots to enhance guest experiences (Cain et al., 2019). This transition necessitates revisiting and expanding existing theoretical models to account for the evolving nature of customer experiences in light of technological disruptions.

Accordingly, existing literature examining customer experiences with SR in hotels reveals the need to evaluate user experiences from a multi-dimensional perspective (Tung & Au, 2018). Consequently, scholars have utilized various theoretical underpinnings to assess customer experiences. For instance, D. Huang et al. (2021) leverage the cognitive-affective-conative model, grounded in appraisal theory (Lazarus, 1991), to explore customer experiences with SRs in hotels across sensory, cognitive, affective, and conative dimensions. Building upon the cognitive-affective-conative model, D. Huang et al. (2023) further examine customer experiences with service robots across five key cognitive dimensions: perceived cuteness, coolness, courtesy, utility, and autonomy. Likewise, L. Wu et al. (2021) draw upon service role theory and consumption value theory to assess customer experience with robots across seven dimensions: sensorial, utilitarian, hedonic, social, agentic, epistemic, and aesthetic dimensions.

Despite the salience of these theoretical frameworks, a comprehensive conceptual model accounting for the multifaceted nature of customer experiences with SRs in hospitality remains elusive. Accordingly, the USUS evaluation framework, which encompasses usability, social acceptance, user experience, and societal impact, provides a comprehensive understanding of customer experiences with service robots (Weiss et al., 2009, 2011). This framework is particularly effective in evaluating the interaction between customers and service robots, as it helps shed light on how individuals experience service robots as part of a collaborative process and how they accept them as integrated members of society (Tung & Au, 2018; Weiss et al., 2009). In comparison, the cognitive appraisal theory, while useful in understanding customer perceptions of robotic service quality and authenticity (H. B. Song et al., 2023), does not provide a holistic view of the customer experience. The USUS framework's focus

on user experience makes it better suited for understanding the implications of SR integration, making it a prominent and valuable model for evaluating human-robot interaction (HRI) in the hospitality industry (Wallström & Lindblom, 2020). The existing literature on customer experiences with service robots in hospitality contexts further substantiates the applicability and relevance of the USUS evaluation framework (Tung & Au, 2018).

The USUS evaluation framework

The USUS evaluation framework proposed by Weiss et al. (2009, 2011) is a multi-level indicator model explicitly designed to evaluate human-robot interaction. The primary purpose of the framework is to capture the essence of how users experience and interact with robots and to promote the acceptance of robots in society. Constituting four key factors, namely, 1) Usability, 2) Social Acceptance, 3) User Experience, and 4) Societal Impact, the framework provides various indicators for each of its factors to ensure comparability of the success of robotic implementation. The four factors are thus split into several indicators as follows: Usability is measured based on effectiveness, efficiency, learnability, flexibility, robustness, and utility; Social Acceptance is measured based on performance expectancy, effort expectancy, attitude toward technology, self-efficacy, forms of grouping, attachment, and reciprocity; User Experience is measured based on embodiment, emotion, human-oriented perception, feeling of security, and co-experience; and lastly, societal impact is measured based on quality of life, working condition and employment, education, and cultural context (Weiss et al., 2009). Consistent with the scope of this study, HRI evaluation is conducted with regard to the user experience of SR in hotels.

User (customer) experiences (CX) with technologies have been identified as a multifaceted concept in the HRI literature (Weiss et al., 2009). At a holistic level, CX is defined as how users engage and use an interactive product, further constituting dimensions such as feel, functionality, and purpose in a specific context (Alben, 1996). In the context of this research, CX pertains to how customers engage and interact with service robots in hotels. According to X. Wu and Huo (2023), integrating SR in the hotel industry has transformed CX and the evaluation of the service offerings. Consequently, the evaluation of CX has been substantiated in the literature as a critical component of ensuring the long-term success of technological integrations. This is further evident in the growing interest in the literature on how SR can enhance CX (Lu et al., 2019). Accordingly, Weiss et al. (2009) propose the evaluation of CX based on five indicators, namely, 1) embodiment, 2) emotion, 3) human-oriented perception, 4) feeling of security, and 5) co-experience.

Review methodology

To achieve the objectives of this research, the authors utilized a two-stage methodological approach. The first stage involved a comprehensive and systematic literature review to identify relevant literature examining customer experiences with service robots in hotels. Our review further resonated with the PRISMA guidelines, ensuring the validity and accuracy of the process. The process comprises of four stages: identification, screening, eligibility, and inclusion. [Figure 1](#) demonstrates the detailed article selection

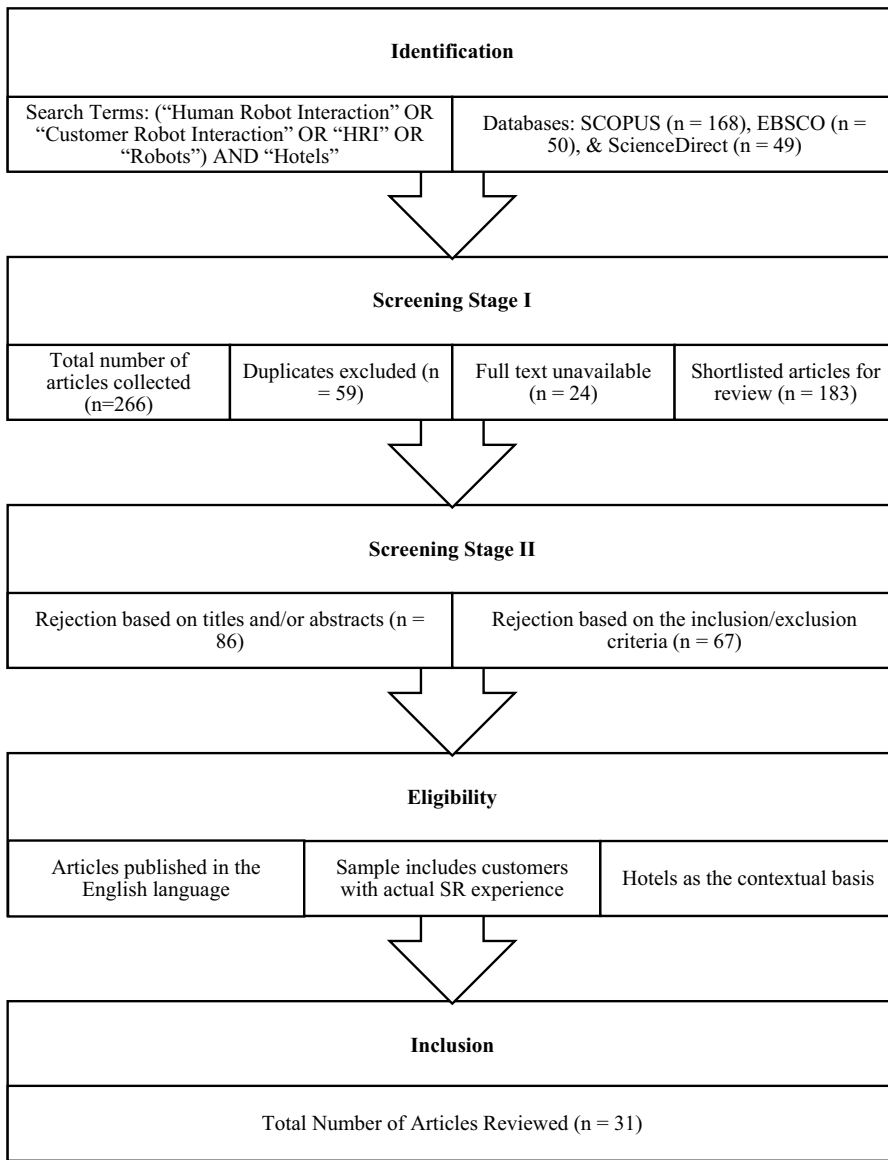


Figure 1. Filtration of relevant papers for review.

process. Search queries with a predefined set of keywords relating to customer-centric HRI, with the contextual keyword “hotel,” were used across four databases, Scopus, EBSCO, and Science Direct, to conclude the structure literature search. This search criterion is consistent with prior review studies examining the general HRI literature (Chi et al., 2020; Hollebeek et al., 2024; Ivanov et al., 2019) as well as the literature examining customer experiences in the hotel industry (Velooso & Gomez-Suarez, 2023). No time restriction was applied to the search to maximize the number of articles for consideration.

Further, only four subject areas were included in the process, namely, 1) Business, Management, & Accounting, 2) Social Sciences, 3) Psychology, and 4) Arts & Humanities. The initial search resulted in a total of 267 articles assessed based on the title and abstract and shortlisted as per the inclusion criteria: 1) articles published in the English language, 2) study sample includes customers with actual SR experience, and 3) studies examining customer experiences with SR in hotels. Given the limited studies on customer experiences with SR in the mainstream hospitality and tourism literature (Tung & Law, 2017), particularly examining hotels, no journal criteria were placed. Consequently, a total of 31 articles were initially reviewed under this study. Due to the limited number of articles initially identified, the authors conducted an unstructured search on Google Scholar, which resulted in the inclusion of an additional 11 articles from journals, conference proceedings, theses, and dissertations, bringing the total number of articles reviewed to 42.

In the second stage, the authors employed a thematic qualitative analysis to delve deeper into the customer experience literature. Through this in-depth approach, this review sought to capture the core nuances and themes within the existing body of work, enabling a richer comparison of the various narratives emerging from the literature. The authors closely read and analyzed the selected 42 articles to map and interpret the findings across the USUS framework, which encompasses five critical dimensions of user experience: embodiment, emotion, human-oriented perception, feeling of security, and co-experience. Discrepancies, if any, were discussed collaboratively to ensure consistency and reliability of thematic interpretations. This multifaceted analysis allowed the authors to uncover and synthesize the key aspects of customer interactions with service robots in the hotel context.

Literature review

Descriptive overview

Scholars have increasingly highlighted the growing nature of the HRI literature (D. Huang et al., 2021; Ivanov & Webster, 2020). This is further evident with the increasing number of article publications examining service robots and customer interactions in hotels (see Figure 2). Although HRI literature has existed for the past decade, it is evident that the

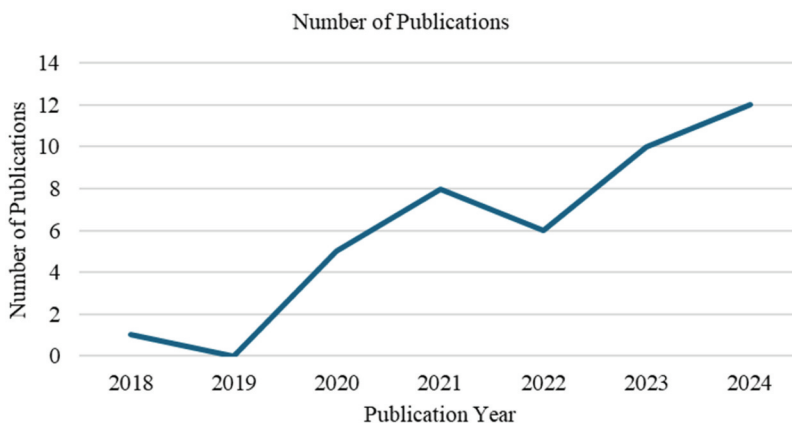


Figure 2. Publication trends.

COVID-19 pandemic has catalyzed the growing academic interest (Pillai et al., 2021; R. T. Qiu et al., 2024). In terms of journal distribution, the articles under review highlight a wider spread across highly ranked journals, with the highest number of publications in the *International Journal of Contemporary Hospitality Management*, followed by *Technological Forecasting and Social Change*, *International Journal of Hospitality Management*, *Journal of Hospitality Marketing & Management*, and *Journal of Hospitality & Tourism Management* (see Table 1). Additionally, 71% of the studies highlighted the use of user-generated content in the form of online reviews to best capture CX with SR in hotels (Park et al., 2024). 28% of studies use alternative methodological approaches such as questionnaire surveys, interviews, and experimental field studies (D. Huang et al., 2023; Phang et al., 2023).

In terms of theoretical frameworks and models (refer to Table 2), the literature reveals the salience of the uncanny valley theory, which seems to be particularly apparent in the case of SR embodiment (Bakirtas & Baser, 2024; Filieri et al., 2022). This theory posits that as artificial entities become more humanlike, they elicit more positive feelings and affinity until a certain point, at which they instead evoke feelings of unease and eeriness (Mori et al., 2012). The next most frequently examined theoretical basis in the literature is the cognitive appraisal theory and the cognitive-affective-conative framework (Steins et al., 2024; Wong et al., 2023). These paradigms suggest that emotional responses are not just innate reactions but rather the result of complex cognitive processes that assess the relevance of a stimulus to one's needs, goals, and values. This theory is particularly relevant in terms of understanding customer experiences with SR interactions. Other notable theories include the social perception theory (Ding et al., 2024) and the three-factor theory of customer satisfaction (X. Wu & Huo, 2023). In terms of HRI-specific frameworks and models, the literature reveals the use of the Service Robot Acceptance Model (SRAM) (Borghi et al., 2023) and the

Table 1. Publication outlets.

Top Publication Outlets	Number of Studies	Ranking	
		ABDC (2019)	AJG (2021)
International Journal of Contemporary Hospitality Management	4	A	3
Technological Forecasting and Social Change	3	A	3
International Journal of Hospitality Management	2	A*	3
Journal of Hospitality Marketing & Management	2	A	1
Journal of Hospitality & Tourism Management	2	A	2
Theses & Dissertations	4	-	-
Conference Proceedings	4	-	-

Table 2. Theoretical frameworks & models.

Theoretical Frameworks/Models	Frequency
Uncanny Valley Theory	8
Cognitive Appraisal Theory	4
Cognitive-Affective-Conative Framework	
Three-Factor Theory of Customer Satisfaction	3
Social Perception Theory	2
Diffusion of Innovation Theory	2
Service Robot Acceptance Model (SRAM)	2
Usability, Social Acceptance, User Experience, and Societal Impact (USUS) Evaluation Framework	2
Unified Theory of Acceptance and Use of Technology (UTAUT)	2
Grounded Theory	2
Atheoretical	8
Others	13

USUS Evaluation framework (S. Wang, 2020). Nevertheless, it is evident that a substantial portion of scholarly work remains atheoretical in nature, necessitating the pressing need to advance theoretical development within the field.

Thematic review

The thematic review is conducted in accordance with the USUS framework, particularly the dimension of user experiences or customer experience (CX). CX is further constituent of five subdivisions, namely, 1) embodiment, 2) emotion, 3) human-oriented perception, 4) feeling of security, and 5) co-experience. The findings across these five dimensions are further summarized in Table 3.

Embodiment

The concept of embodiment has been heavily acknowledged in HRI literature, primarily in association with robotic morphology or robotic appearances (Alsaad, 2023; Orea-Giner et al., 2022). Accordingly, Weiss et al. (2009) postulate that the relationship between robots and their environment can be measured based on SR appearances that thus influence social expectations. In other words, it is argued that robotic morphologies influence customers’ social expectations akin to traditional human-based interactions. The literature examining robotics has identified various types of robot morphologies such as anthropomorphic (humanlike), zoomorphic (animal-like), caricatured (animation-like), and functional

Table 3. Key points of thematic review.

Themes	Key Points
Embodiment	<ul style="list-style-type: none"> ● Robotic morphologies (anthropomorphic, zoomorphic, caricatured, functional) influence social expectations and customer experiences in hotels ● Anthropomorphic robots with human-like features can evoke positive social responses, enhance trust and comfort, and create memorable experiences ● High anthropomorphism can also disappoint customers due to limited functionality and make some feel “weird,” “creepy,” or “uncomfortable”
Emotions	<ul style="list-style-type: none"> ● Customers often report positive emotions like trust, anticipation, and joy when interacting with service robots
Human Oriented Perception	<ul style="list-style-type: none"> ● Service robots should be able to track emotions, recognize expressions, and interpret speech to exhibit human-like service qualities ● Successful robot integration requires observing social norms, discerning cues, displaying emotions, and acting based on customer needs ● Anthropomorphic features can foster human-oriented perceptions by generating positive social reactions ● Ingratiation tactics like flattery and humor can enhance human-oriented perceptions and customer satisfaction ● Characteristics like warmth, friendliness, and helpfulness are key for positive customer emotions and experiences ● Service robots often fall short in matching human providers’ emotional intelligence and social capabilities ● Limitations of SR include language barriers, inability to understand non-verbal needs, and inappropriate interactions, resulting in frustrating experiences
Feeling of Security	<ul style="list-style-type: none"> ● Customers have various safety concerns, including fears about privacy, unknown capabilities, and the uncanny valley effect ● Customers are concerned about societal issues and threats to human identity, perceiving service robots as undermining uniqueness and personalization ● Deploying service robots without adequate support can have detrimental consequences and unintended negative outcomes
Co-Experience	<ul style="list-style-type: none"> ● Scholars emphasize the importance of understanding the social aspects of service robots and how they can shape positive co-experiences

(machine-like) (Fong et al., 2003; Tung & Au, 2018; Zhang et al., 2021). Real-world applications of these robotic morphologies include *Yumeko*, an anthropomorphized female robot (Henn-na Hotel); *Karotz*, a rabbit-shaped robot; *Tuly*, a tulip-shaped robot (Henn-na Hotel); and *Yobot*, a robotic arm that helps hotel guests store their luggage (Yotel, New York).

Drawing on accounts of SR-integrated hotels, the literature captures varying customer experiences with SR that shape their perceptions. For instance, customers report increased levels of enjoyment in the presence of SR where the shape and function of SR offers the “wow factor” in hotels (Borghi & Mariani, 2021; Said et al., 2024). Studies also highlight CX with different types of robotic morphologies whereby customers consider SR as “fun to watch” (Tung & Au, 2018) and a “cool” (Filiari et al., 2022) addition to hotel service offerings. Additionally, extant literature suggests that SR’s appearance is a significant contributor to creating a unique CX (Chang et al., 2022; Ding et al., 2024). Therefore, scholars have increasingly emphasized how the presence of SR leads to positive customer evaluation of hospitality services (Gursoy et al., 2019; Roy et al., 2020). This is in line with D. Huang et al. (2021), who state that customers use the physical appearance of SR as an essential factor in the judgment and subsequent evaluation of SR offerings. Nevertheless, a few discrepancies emerge in the literature where while some scholars suggest that embodiment does not influence CX (B. Song et al., 2023), the vast majority suggest the alternative (Borghi & Mariani, 2024; Tung & Au, 2018). Despite the salience of embodiment in shaping user experiences, the literature remains unclear on its implications in shaping positive or negative customer experiences (Bakirtas & Baser, 2024; Borghi et al., 2023).

In the hospitality context, the appearance of anthropomorphic robots is particularly relevant (Zhang et al., 2021). Anthropomorphism, across literature, has been defined as the degree to which customers attribute humanlike traits and characteristics to SR (Blut et al., 2021). Examples of anthropomorphic robots include *Connie* in Hilton Hotels & Resorts (Filiari et al., 2022), *Botlr* in Aloft Hotels (Luo et al., 2021), and *Pepper* in Mandarin Oriental Hotel (Seo, 2022). Anthropomorphism conjures humanlike abilities in SR in favor of positive customer experiences (Borghi & Mariani, 2024; Christou et al., 2020; Martin et al., 2020; Mehmood et al., 2024). Researchers have identified various humanlike characteristics of SR, such as voice, gender, language style, and expressions (Fang et al., 2024; Giger et al., 2019). Additionally, studies have highlighted other anthropomorphic features, including physical appearance, cognitive and emotional intelligence, moral reasoning, social presence, and empathy (W. Liu & Zhang, 2024; Mehmood et al., 2024). Therefore, the anthropomorphic appearance of SRs can provide visual and non-verbal social cues, such as facial expressions, that can evoke positive social responses from customers (Borghi & Mariani, 2022; Premathilake & Li, 2024). For instance, scholars postulate that the aesthetic appearance of SR leads to positive CX due to its “cuteness” appeal (D. Huang et al., 2023; Mäenpää, 2024).

Additionally, SRs that resemble human employees, with humanlike features such as voice and physical appearance, are generally more trusted than mechanical counterparts as they facilitate human interaction (Mäenpää, 2024; Premathilake & Li, 2024). Anthropomorphic SRs are further generally viewed more favorably in scenarios involving service failures and facilitate more engaging human interactions (Fan et al., 2020; Fang et al., 2024). Furthermore, anthropomorphism can reduce customers’ anxiety regarding the usability

barriers and can enhance trust and comfort associated with SRs (Duffy, 2003; Frick, 2015). Consistent with job-gender congruency, Seo (2022) postulates that female SRs in hotels lead to greater satisfaction that increases when SRs are anthropomorphized and display human-like features. Specifically, the embodiment of SR has been identified as a crucial factor for the elderly demographic, with female SR more likely to be perceived positively by customers due to their perceived warmth (Borau et al., 2021; Portugal et al., 2019). Likewise, anthropomorphic SRs lead to more memorable experiences that enhance customer satisfaction (Tung & Au, 2018).

Nevertheless, the anthropomorphism of SR in hotels is a double-edged sword. Higher anthropomorphism leads to greater SR competence perception and service excellence expectations (X. Song et al., 2024; Wirtz et al., 2018). However, higher competence perceptions have often left customers disappointed with SR, which is considered a mere marketing gimmick due to limited SR functionality (Tung & Au, 2018). Therefore, research suggests that anthropomorphism may elicit strong negative reactions, however, it is highly dependent of the nature of task in which the service robot is utilized (Lin et al., 2022). Further, some customer experiences with anthropomorphic robots are considered “weird,” “creepy,” and “scary” (Borghi & Mariani, 2022; Yu, 2020), making hotel guests usually uncomfortable (Mäenpää, 2024; Park et al., 2024). Accordingly, in line with the uncanny valley effect, the literature highlights a preference for partially anthropomorphic SR to mitigate the uncanny valley effect (Chang et al., 2022; Jia et al., 2021). Moving beyond anthropomorphism, the literature reveals an emphasis on zoomorphic SR that may lead to more positive customer experiences, specifically among children (Fuentes-Moraleda et al., 2020; Yu, 2020). Likewise, Bakirtas and Baser (2024) posit that zoomorphic robots have been shown to have a more positive impact on customer emotions compared to anthropomorphic robots. Nonetheless, caution is warranted for overtly animated robots owing to potentially negative CX (I. P. Tussyadiah & Park, 2018).

Emotion

Emotion is a byproduct of social interactions. A critical topic in HRI (Borghi & Mariani, 2022; Fong et al., 2003), emotions are defined as a mental state that arises from cognitive appraisals of SR interactions that are accompanied by physiological processes that result in specific actions (Cakar & Aykol, 2021; Filieri et al., 2022). Technological advancements such as service robots evoke an emotional response among customers, however, the valence of the emotion is contingent on the effective deployment of the technology (Filep et al., 2024). For instance, when hotel guests interact with an SR that fulfills user expectations, customers experience satisfaction often represented in the form of joy, excitement, and surprise (Fuentes-Moraleda et al., 2020). Furthermore, consumer psychology literature highlights tenants of customer emotions expressed in the form of expressions such as feelings of joy, surprise, fun, cute, trust, love, interest, excitement, anticipation, eagerness, security, happiness, anger, disgust, sadness, fear, discontent, and frustration in response to either positive or negative social interactions (Bakirtas & Baser, 2024; Premathilake et al., 2023; Steins et al., 2024).

Existing research has extensively explored how customer emotions stemming from interactions with service robots (SR) can shape customer behavior and evaluations of service offerings (Belanche et al., 2020; Van Doorn et al., 2017). Consequently, a deeper examination of customer emotions can provide a more holistic understanding of CX and customer perceptions of SR within the hotel industry. For instance, customers interacting

with SR have reported heartwarming experiences such as feeling relieved, non-lonely, brighter, and warm from their interactions with humanoid robots (Nakanishi et al., 2018). This comprehensive perspective offers valuable insights for enhancing customer-centric service delivery and improving overall service quality. Literature examining customer emotions arising from HRI suggests that customers generally experience relatively positive emotions (Chang et al., 2022; Gursoy et al., 2019; R. Li & Long, 2024). The most frequently highlighted emotions that arise include trust, anticipation, and joy. These positive emotional responses are particularly emphasized in the context of CX, specifically regarding the functionality (Chang et al., 2022; D. Li et al., 2010), sociability, and friendliness of the SR (Park et al., 2024). Notably, the positive emotions toward SR outweigh the negative ones, reflecting the emotional engagement through these interactive experiences.

On the contrary, while the occurrence of negative emotions may be relatively infrequent, they have a significant and detrimental impact on customer perceptions and experience (Borghetti & Mariani, 2022). These findings align with Choi et al. (2021), whereby online customer reviews reveal that HRI is not always perceived positively, with customers leaving several negative comments. Interestingly, negative emotions appear to be particularly heightened in operational areas of SR deployment. For instance, customers have indicated encounters with service robots in hotels as inconvenient and disappointing (Fuentes-Moraleda et al., 2020), eliciting feelings of anger (Premathilake & Li, 2024), disgust, sadness (Orea-Giner et al., 2022; Tung & Au, 2018). Additionally, robotic errors generally lead to feelings of insecurity, frustration, and stress. Accordingly, scholars highlight the emotional complexity of HRI, leading to a strong emphasis on addressing negative customer emotions (Bagozzi et al., 2022; Steins et al., 2024).

While customer interactions with human vs. SR are similar to a certain extent, SR fails to understand the complexities of customer needs and emotions (Fang et al., 2024). Thus, consistent with extant literature, current robotic technologies have yet to meet the expectations for personalized services, particularly in the hospitality and tourism sectors, due to their limited capabilities and functionality in addressing guest queries (Gençer, 2023; Reis et al., 2020). Therefore, consistent with prior literature, this review indicates that customers can have a nuanced and complex response to SR, leading to both positive and negative emotions (D. Huang et al., 2023). These findings highlight the dichotomous nature of customer experiences whereby positive and negative emotional responses coexist as technology continues to evolve and improve in its capabilities to meet the unique demands of human-robot interaction.

Human oriented perception

When the interaction between robots and humans increases, people treat robots as humans (Reeves & Nass, 1996). Consequently, Weiss et al. (2009) posit that SR should be able to track changes in human emotions, recognize facial expressions, and interpret human speech. In other words, SRs ought to exhibit the qualities of a traditional human service provider. Human-oriented perception further describes and measures the robot's ability to respond to and interpret events. In robotics literature, human-oriented perception is the intelligence of SR in terms of their ability to learn from their experiences and environments while interacting with users (M.-H. Huang & Rust, 2018). Therefore, successful SR integration relies on robots observing societal norms, discerning social cues, displaying appropriate emotions, and conducting actions per customers' needs (Wirtz et al., 2018).

Given that hotels have an extensively interactive service orientation, the relational ability of the SR becomes a priority. Linking human traits to SR has been a common effect of HRI (S. Y. Kim et al., 2019). In accordance with the “Computers are Social Actors” paradigm, people tend to respond to service robots socially, much like they would with human service providers (Nass et al., 1994). Likewise, human-oriented perception pertains to SR’s ability to promptly respond to human commands, understand gestures, interpret events, and respond to social cues (Tung & Au, 2018). Further, Lisetti and Schiano (2000) suggest that human-oriented perception is an essential prerequisite to enhancing CX. Similarly, D. Huang et al. (2021) suggest that SR’s capability to communicate both verbally and non-verbally could help foster a meaningful relationship with customers and subsequently enhance customer satisfaction.

Moreover, consistent with the social response theory (Nass & Moon, 2000), the social presence of SR or the feeling of interacting with another entity provides a human-oriented perception. Accordingly, the anthropomorphic features in robots cater to human-oriented perceptions, as they function as social cues analogous to those exhibited by traditional human service providers (Premathilake & Li, 2024). The humanoid appearance of service robots can generate positive social reactions through the provision of visual and non-verbal social cues, such as facial expressions, voice, gender, language style, and expressions (Borghetti & Mariani, 2022; Premathilake & Li, 2024). This is in line with Złotowski et al. (2018) whereby anthropomorphic robots can more effectively respond to social cues by mimicking their human counterparts.

Scholars have also acknowledged the role of ingratiation in SR, such as flattery (D. Huang et al., 2021) and a sense of humor (Shan et al., 2024; Zhang et al., 2021), that provide accentuated means of human-oriented perceptions and satisfaction. Additionally, characteristics such as warmth that reflect attributes such as friendliness, kindness, and helpfulness have been identified as essential elements in ensuring human-oriented perceptions that further shape customer emotions, CX, and customer satisfaction (Fiske et al., 2007; Van Doorn et al., 2017; X. Wu & Huo, 2023). For instance, Nakanishi et al. (2018) found that customers perceived interactions with *heartwarming* SRs as thoughtful and enjoyable. However, the results indicate variability in customer perceptions, as some customers appreciated this experience while others considered it unnecessary. Further, SR intelligence helps build positive CX (H. Kim et al., 2022; H. Qiu et al., 2020).

Nevertheless, the majority of literature highlights several shortcomings in SR capabilities in matching their human counterparts, often resulting in failure to meet customer expectations (Belanche et al., 2020; X. X. Song et al., 2024). Accordingly, CX with SR starts at the first meeting point; thus, there is increasing emphasis on SR greetings to start HRI in a socially acceptable way (Fuentes-Moraleda et al., 2020). Here, CX suggests an eminent need for SR to have more expressive faces to imitate humanlike qualities when interacting with customers (Bruce et al., 2002). HRI literature recognizes these as kinetic cues whereby SRs can perform symbolic and conversational gestures that enhance CX. Additionally, customer accounts of HRI highlight SR shortcomings in conducting two-way communication and engaging in conversations (Chang et al., 2022). Users further encountered several inconveniences due to the limited multilingual capabilities of SR, such as struggling to respond to and understand conversations in English (Fuentes-Moraleda et al., 2020; Tung & Au, 2018).

Given that hotels cater to diverse customers, language barriers could hinder the optimal service experience, often frustrating customers. Further, SRs in hotels fail to act intelligently in understanding non-verbal customer needs where SR responses are mainly “cold” and “unemotional” (Cakar & Aykol, 2021; Yu, 2020). In other instances, CX suggests that robots kept talking when not required and interacted at the wrong times (Borghini & Mariani, 2022). Alternatively, customers also faced difficulties understanding what the SR tried to communicate (Fuentes-Moraleda et al., 2020). Likewise, Luo et al. (2021) postulate that SR communications tend to be among the primary underperforming attributes of HRI. Therefore, the literature reveals the SR’s inability to offer genuine customer service.

Feeling of security

Robots have long been scrutinized as a threat to human identity. Factors such as fear, harm, and uncertainty are often categorized in the literature as barriers to SR integration in the form of customer resistance (X. Wang et al., 2023). Therefore, the acceptance of SR and the subsequent HRI is significantly affected by feelings of security. Additionally, the literature highlights the role of users’ perceived security in the development of context-sensitive robots (Buchner et al., 2012; Tung & Au, 2018). For instance, SRs with unattractive appearances in the hospitality sector are regarded as a factor impacting customer resistance (X. Wang et al., 2023). The feeling of security, safety, and comfort during HRI is essential in shaping positive CX and willingness to interact with SR (Blut et al., 2021; Said et al., 2024; I. P. Tussyadiah & Park, 2018). For instance, Jia et al. (2021) postulate that increased customer safety perception leads to higher satisfaction and positively impacts hotel evaluations. Accordingly, feelings of security constitute multiple factors, including physical safety, robotic failures and errors, comfort, and visual appearance (H. Kim et al., 2022; Wirtz et al., 2018).

Literature examining customer perceptions of safety indicates that CX leads to increased fears concerning privacy and the vast unknown of what SR is capable of (J. Kim et al., 2024; Yu, 2020). For instance, customers expressed fears about their personal information being compromised (R. Li & Long, 2024). At a surface level, these fears become apparent regarding SR appearances, specifically when they resemble humans (Fileri et al., 2022). Consistent with the uncanny valley theory (Mori et al., 2012), these SRs amplify discomfort and eeriness (Mende et al., 2019). Moreover, scholars have also noted instances where customers deliberately refused to make eye contact with the SR and signs of apprehension and discomfort when having sharing physical spaces with the SR (Tung & Au, 2018). Real-life accounts of CX in hotel settings further highlight how negative interactions with SR can elicit strong feelings of fear, shock, and distress among customers (Bakirtas & Baser, 2024; Gençer, 2023; Steins et al., 2024).

Furthermore, some scholars suggest that customers’ fear and concern regarding service robots tend to diminish over time as individuals become more familiar and comfortable with the SR (Steins et al., 2024; Tung & Au, 2018). In other words, customers gain experience interacting with service robots, their initial fear often transitions to a sense of trust, security, and safety. Likewise, Park et al. (2024) note comfortable CX where SR were treated akin to family and friends. However, the literature also indicates that even as customers become more accustomed to SR, they may still maintain a degree of cautious wariness during their encounters (Borghini & Mariani, 2022). Interestingly, scholars find that initial favorable attitudes toward SR can sometimes later turn to hostility with instances

where customers mistreat SR through acts of aggression and bullying (Gnambs & Appel, 2019; Oravec, 2023). Therefore, the opposing perspectives in the literature reveal a prevalent undercurrent of fear and trepidation that customers exhibit toward using SR.

Security and safety concerns are also highlighted regarding SR functionalities and potential service failures, highlighting a lack of reliability and accuracy of SR, leading to disappointment (Choi et al., 2021; Filieri et al., 2022). Likewise, existing literature has highlighted significant concerns about the functional shortcomings of SR, finding them incapable of effectively resolving customer problems (Gençer, 2023). In such cases, service robots may potentially result in value co-destruction owing to operational inefficiencies (Yang et al., 2024). SRs are often unable to provide customers with the necessary information and resources to address their needs, leading to a subpar overall performance that falls short of customer expectations (R. Li & Long, 2024; W. Liu & Zhang, 2024). Accordingly, failures in SR performance can lead to unintended consequences due to inadequate and untimely service recovery that exacerbate customer dissatisfaction and lead to negative CX (Ding et al., 2024). Furthermore, customers who struggle to engage with SR report an elevated sense of embarrassment (L. L. Wu & Mattila, 2013).

Moreover, Borghi and Mariani (2024) also bring to light societal issues such as inequality, unemployment, and ethical considerations that contribute to customer apprehensions toward SR. Likewise, customers believe that SRs are a threat to human identity and the existing hospitality workforce (D. Huang et al., 2023). For instance, Alsaad (2023) highlight customer fears over the power of robots as a threat to human existence influenced by speculative fiction films. Examining service robots in the context of tourism, scholars posit that consumers may perceive robots as out-groups that threaten aspects of uniqueness, leading to dehumanization and depersonalization of services (Fusté-Forné, 2021; Reis et al., 2020). In other words, SR could lead to psychological resistance in the form of uniqueness neglect, whereby customers' unique needs are overlooked (Longoni et al., 2019). Likewise, D. Huang et al. (2021) assessed resistance behavior due to HRI and found that lack of personal attention, friendliness, warmth, and communication were the most crucial factors hindering customer satisfaction with service robots. This is consistent with Steins et al. (2024), whereby the deployment of frontline SR without adequate support can have detrimental consequences, potentially leading to unintended negative outcomes.

Co-experience

The interaction between customers and service robots has resulted in the co-creation of service experience (M.-H. Huang & Rust, 2018). Accordingly, co-experience is developing personal experiences based on social interactions (Weiss et al., 2009). Hotel guests and SR interaction are subsets of the broader field of HRI, which encompasses the multifaceted communication, collaboration, and relationship-forming between humans and robots that shape positive or negative CX (Fang et al., 2024). Accordingly, co-experience considers the characteristics and functions of robotic personalities and how they can mediate interactions with different users and subsequently form social perceptions (Xie et al., 2022). Likewise, scholars posit that SR interactions are at the heart of CX and play a distinctive part in shaping positive co-experiences (D. Huang et al., 2021; M. Mariani & Borghi, 2021). An example of this are the robotic butlers at the Henn-na Hotel in Japan, which has enabled the co-creation of customized customer experiences (Tung & Au, 2018). Thus, it would be wise

to ascertain the role of social aspects of SR and customers' need for interactivity in the process of co-experiences.

Prior research has shown that customers' use of hotel robots is often driven by curiosity. Scholars postulate that SRs offer an excitement factor to hotels that add value and enable the co-creation of CX (Borghi & Mariani, 2022, 2024; Jain, 2021; Orea-Giner et al., 2022). The literature is further in consensus over the excitement and anticipation of interacting with SR among customers (Cakar & Aykol, 2021; Lee et al., 2021; Phang et al., 2023). This could correlate to the novelty effect associated with SR and subsequent HRI experiences (Fileri et al., 2022). The novelty effect can be described as the initial anticipation and curiosity associated with the innovativeness of service robots, leading to a positive customer experience (Borghi & Mariani, 2021; Mitas & Bastiaansen, 2018). Accordingly, novelty emerging from customer-SR interactions is essential for forming memorable co-experiences.

Moreover, SRs are highly valued in the contest of hotels for their ability to engage with customers and co-create enriching experiences through their unique social capabilities (Ding et al., 2024; M. Li et al., 2024). Therefore, SRs are no longer merely linked to the novelty effect but rather have become an integral part of hotel service experience (Ivanov et al., 2019). An important dimension of the customer co-experience is the SRs' social-emotional characteristics, which encompass their social skills, ability to detect and respond to customer emotions, high social intelligence, and a strong sense of social presence (Ding et al., 2024). These attributes enable SRs to foster meaningful, personalized interactions that deepen customer relationships and enhance the overall co-creation of experiences. Similarly, an excellent rapport between customers and SR builds positive hospitality experiences and improves customer satisfaction (Borghi & Mariani, 2024; Borghi et al., 2023; H. Qiu et al., 2020). Here, rapport pertains to enjoyable HRI, which leads to a close relationship between SR and customers (Fernandes & Oliveira, 2021; H. Kim et al., 2022; Wirtz et al., 2018). Additionally, research has shown that anthropomorphism can lead to perceptions of warmth and competence, which are fundamental to social perceptions and influence co-experience (Frank & Otterbring, 2023; Premathilake & Li, 2024).

Additionally, the literature has illustrated the need for SRs to consider the unique needs of customers to better adapt to the formation of co-experience in their interaction (Pollmann et al., 2023). Interestingly, while positive co-experiences increase customer satisfaction (S. Wang, 2020; X. Wu & Huo, 2023), M. M. Mariani and Borghi (2023) postulate that negative service encounters do not significantly impact customer satisfaction and subsequent evaluation of SR. These findings indicate an asymmetric relationship that acts as a supporting factor for SR implementation. However, it is essential to note that while service failure has an insubstantial impact on customer satisfaction, this effect might only be short-lived and highly subjective. For instance, a service failure encounter at the front desk has a higher propensity to impact CX negatively than non-essential services (Luo et al., 2021). Furthermore, customers are more likely to accept SRs' functional and social-emotional aspects when contact frequency is low, as high contact frequency can create uncertainties and reduce service efficiency in complex situations (Ding et al., 2024). Consequently, Steins et al. (2024) posit that an emphasis on SR capabilities can elevate CX.

Nevertheless, studies suggest that despite the salience of collaborative engagement between customers and SR, robots may fall short in delivering effective co-experience compared to human service providers (Chan & Tung, 2019; Choi et al., 2021; Filep et al., 2024). Accordingly, while instances of positive co-experience are well documented with

customers appreciating SR's socio-emotional capabilities and novelty (Fuentes-Moraleda et al., 2020), human service providers are necessary and beneficial for collaborative service delivery (Ding et al., 2024). This is further supported by extant literature suggesting that emotional aspects such as empathy still remain lacking in the case of SR (Fang et al., 2024; Wirtz et al., 2018). While SRs excel at standardized tasks due to their mechanical and analytical capabilities, they have not yet achieved the desired technological maturity to proficiently replace human staff, especially in scenarios requiring extensive customer engagement or problem-solving.

Furthermore, emphasizing the digital divide among customer segments, scholars suggest that co-experience is affected by customer segments such as the elderly, children, people with disabilities, and those with low technological literacy (Ding et al., 2024; Portugal et al., 2019). Consequently, the literature suggests that the value of co-experiences with SRs is made prominent in the case of children. Children are more likely to interact with SR and look forward to playing with them (Borghi & Mariani, 2022; Chang et al., 2022; Fuentes-Moraleda et al., 2020). This aligns with extant HRI literature whereby SR interactions are deemed playful and entertaining amongst children and youth (McCartney & McCartney, 2020; Parasuraman & Colby, 2015). Additionally, SR acts as a catalyst in enhancing the relationship between parents and children, leading to more positive CX where parents are more likely to forgive service failures of SR (Chang et al., 2022; Filieri et al., 2022; Tung & Law, 2017). Assessing customers' co-experience with service robots, Steins et al. (2024) highlight the pivotal role of collective service experiences. In these shared experiences, customers interact with service robots alongside their peers, and this collective interaction significantly influences their perceptions, emotions, and overall reactions to the service encounter. Similarly, the collective nature of the service experience shapes how parents and children perceive and respond to the service robots, underscoring the importance of considering the social dynamics at play in these interactions. Likewise, differences in co-experience are also highlighted in terms of gender with female guests indicating a more favorable experience with SR (Nakanishi et al., 2018).

Adding cultural consideration to the co-experience literature, Said et al. (2024) suggest that customers from East Asian parts of the world are more comfortable with SR and thus have more remarkable experiences. However, Choi et al. (2021) postulate that Japanese customers, characterized by high exposure to SR interactions, display lower customer satisfaction toward the functional aspects of SR. With the exposure to the Henn-Na Hotel situated in Japan, the novelty effect of SR may diminish with changing customer expectations that subsequently influence customer satisfaction. This is in line with research suggesting that the novelty of service robots may fade over time, underscoring the need to continuously reinvent and enhance service innovation and customer experience (Xie et al., 2022). Similarly, Mehmood et al. (2024) assess differences in customer experiences across India and Canada, indicating that customers in Canada display greater acceptance and engagement with anthropomorphic service robots compared to those in India. This difference is attributed to the cultural context, where cultures like Canada prioritize social capabilities and emotional interactions with SR, while cultures like India emphasize contextual emotional and moral behaviors. Further, co-experience is highly subjected to the context in which SR is used and customer-centric characteristics such as technological readiness (Mende et al., 2019). These cultural and contextual nuances are important to

consider when designing and deploying SRs to enhance customer satisfaction and co-creation of experiences.

Discussion

Given the utmost importance of customers in hospitality, HRI can make or break the overall consumer service experience (Fusté-Forné, 2021). When considering service-intensive industries, such as hotels, customers pay attention to the services received and, more importantly, to the process and experience of receiving the service. The lack of studies examining customer perceptions in the post-SR integration stages has been an obstacle to understanding its implications in hotels. Accordingly, this study sought to account for the existing CX in SR-integrated hotels. The USUS framework provides a guiding principle to evaluate user experiences with HRI in light of five key dimensions: embodiment, emotions, human-oriented perception, feelings of security, and co-experience (Weiss et al., 2009). Each dimension brought about a unique aspect of the outcome of HRI. This section presents the conceptual mapping of factors influencing customer experiences with service robots in hotels, followed by the theoretical and practical implications derived from the review.

Conceptual mapping: evaluation of CX with SR in hotels

Grounded in the USUS framework, Figure 3 conceptually maps out the aspects of CX that have emerged as a result of the thematic analysis. It further enhances the USUS framework at a micro-level by identifying attributes under each of its five indicators. The conceptual mapping based on the extant review provides a holistic understanding of CX in hotels and feeds the future research agenda. Nevertheless, consistent with prior literature, the review of CX literature pertaining to SRs in hotels is deemed suitable for establishing a theoretical contribution and subsequent roadmap for future research (McCartney & McCartney, 2020). Moreover, conceptual mapping incorporates potential mediators, moderators, and socio-demographic aspects impacting CX. All in all, the conceptual mapping provides a micro-level overview of the aspects pertaining to CX with SR interactions in hotels. Accordingly, the literature reveals several valuable insights.

Theoretical implications

This study bridges the HRI and hospitality literature, uncovering insightful interdisciplinary findings. Unlike prior review studies that relied on conceptual or hypothetical customer-service robot (SR) interactions, this study focuses on the outcome phases of actual SR interactions in hotels. By conducting a systematic and thematic review of such studies, the authors capture the complex nature of real-life CX with SRs. This is important as customers who have directly interacted with SRs tend to have different perspectives compared to those derived from studies using imaginary scenarios or stimuli (Borghi & Mariani, 2022). Furthermore, the insights from this review offer a more detailed and contextualized understanding, diverging from the extant literature which has primarily provided a broad overview of potential customer interactions. This could be misleading when it comes to the actual deployment of SRs in hotels. By emphasizing this aspect, the authors underscore the

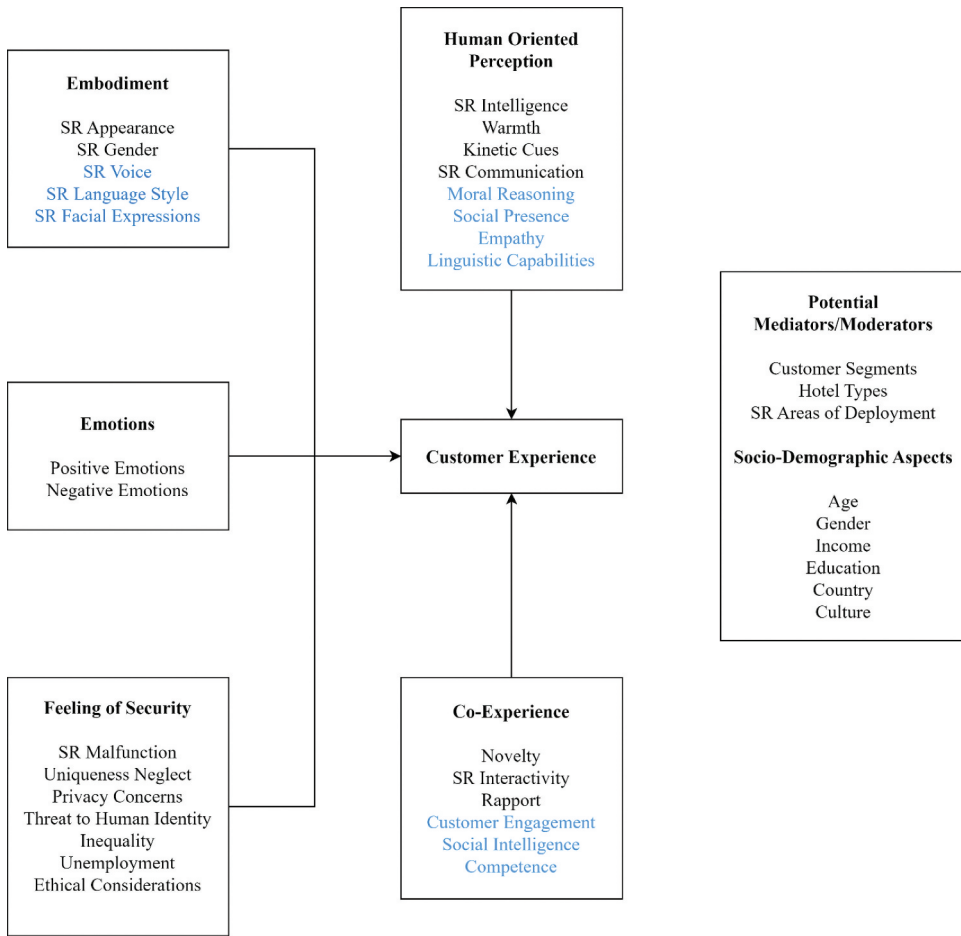


Figure 3. Conceptual mapping: evaluation of CX with SR in hotels.

need for a more nuanced and contextual comprehension of CX with SRs in the hospitality industry. The insights from real-life CX with SR further support the development of post-consumption HRI literature that had previously been lacking.

Consequently, the findings of the review highlight discrepancies in CX across dimensions such as embodiment, emotions, human-oriented perceptions, feelings of security, and co-experience. By examining the five dimensions of CX, the review ascertains the importance of SR functionality in the long run. While other factors, such as SR appearance, SR relational abilities, and customer anticipation toward SR interactions, remain useful, it is evident that CX is negatively impacted primarily by poor SR functionality. This remains consistent across all five dimensions of CX. Theoretically, these findings suggest that long-term or actual user experiences might be more grounded in pragmatic aspects over SR as a novelty or marketing gimmick. The overall literature also cautions against the indiscriminate use of SR rendering CX widely unpredictable.

Additionally, the review highlights the salience of certain theories, such as the uncanny valley, social perception theory, and the cognitive appraisal theory, in examining CX. Moreover, the

review underscores the importance of various contextual variables, such as customer segments, socio-demographic aspects, and cultural differences, that can offer insights into varying CX. Additionally, the review reveals an over-reliance on user-generated content to capture CX; hence, exploring other methodological alternatives such as surveys, in-depth interviews, and focus groups would be interesting. Further, the literature could benefit from an assessment and empirical validation of CX with SR in the hotel industry.

Moreover, by using the USUS framework, particularly the dimension of CX, the study provides a theoretical lens to viewing actual CX with SR in hotels. Additionally, based on thematic analysis, the authors pinpoint certain constructs that could be examined in the future to assess their respective impact in shaping customer experiences. Thus, the CX framework mapping provides a guide for future research to capture the nuances of customer-SR interactions through the development of new models and the potential refinement of existing theories. It further helps consolidate the aspects of CX evaluation and thus enhances the conceptual understanding of SR integration in hotels. The preliminary framework also provides strong reasoning for future investigations on CX to highlight a comprehensive assessment of HRI. It is important to note that the conceptual map particularly highlights potential constructs that need to be examined in relation to CX, however, the scale development and validation remains subject to future research when appropriate. Additionally, some of the constructs identified (SR appearance, interactivity, social presence, rapport, and emotions) garner support from existing frameworks and models such as the Service Robot Acceptance Model (SRAM) (Wirtz et al., 2018) and the Artificially Intelligent Device Use Acceptance (AIDUA) model (Gursoy et al., 2019). Thus, the review contributes to the USUS framework, particularly CX, by capturing the multi-dimensional aspects of CX through the identification of various indicators at a micro level, specifically within the context of SR-integrated hotels. The findings provide a foundation for developing a comprehensive CX evaluation framework for SR-integrated hotels, which can objectively assess the efficacy of such technologies.

Table 4. Future research agenda.

Theme	Future Research Agenda
User Experience	How can SR ensure memorable customer experience? How do customer experiences differ between human vs. robotic service provider? Which dimensions of customer experience are more significantly impacted by the integration of SR? How do socio-demographic factors of customers alter user experiences with SR? How do hotel characteristics (hotel type and size) impact user experiences with SR?
Embodiment	What are the factors that determine the optimal similarity threshold for anthropomorphic SR? How do customer experiences differ across different embodiment types (anthropomorphic, zoomorphic, caricatured, functional)?
Emotions	How do customer emotions evolve over time? How do customer emotions differ between human vs. robotic service provider? How does culture impact customer emotions pertain to SR? How do negative customer emotions impact customer evaluation of SR-enabled hospitality services?
Human Oriented Perceptions	When should SR be complemented with human employees? What tasks or areas of deployment best suit SR in ensuring a smooth customer experience?
Feelings of Security	How can we prevent human inequalities and the dehumanization of services with SR integration? How can ethical and privacy issues of customers pertaining to SR be addressed? What factors contribute to customer resistance toward SR interactions? How do SR related service failures impact customer experiences? What are the negative aspects of HRI?
Co-Experience	What customer segments are more likely to have positive experiences with SR (Technological readiness, traveler typologies, gender, different age groups)? What are the implications of SR on vulnerable consumer groups such as children, elderly, or the disabled?

Lastly, [Table 4](#) provides the future research agenda based on the conclusions drawn from this review. Overall, this study contributes to the HRI literature in general and hospitality literature in particular in providing a comprehensive understanding of CX in hotels.

Practical implications

SR integration has been met with a degree of doubt and hesitation. Consequently, the practical implications of this study seek to offer practitioners an overview of the existing CX based on real-life interactions with SR with practical and actionable insights. Firstly, embodiment or the appearance of SR plays a significant role in shaping CX in hotels. Anthropomorphic robots are quite prevalent in the hotel industry, eliciting positive reactions from customers. However, emphasis must be drawn toward mitigating the uncanny valley effect by developing a “similarity threshold” for anthropomorphic robots. Tackling higher SR competence in anthropomorphic robots could prevent disappointing customer interactions. Additionally, consideration of other non-anthropomorphic SR could yield favorable outcomes based on the customer segments to which hotels cater. Thus, careful consideration of the design element is crucial to ensure positive CX and mitigate unintended consequences.

In terms of emotions, extant literature reveals several positive and negative emotions arising from HRI. However, negative emotions particularly arise as a result of poor SR functionality. Likewise, examining the human-oriented perception, the literature reveals that SR often fails to match human capabilities, particularly in the form of communication difficulties and the lack of emotional intelligence, leading to suboptimal CX. Accordingly, to overcome limited SR capabilities, it would be wise to ensure SRs are accompanied by human staff to make up for the lack of efficiency of the SR, at both an emotional and functional level (Chang et al., 2022). This would also ensure a reduction in the threat of SR replacing humans. Consistent with Blut et al. (2021), when SRs complement human employees, it provides an optimal blend of machine-like efficiency and humanlike characteristics that can help achieve effective HRI. CX and HRI are also conditional on various socio-demographic factors the hotels cater to. Therefore, hotels should consider aspects such as traveler typologies, customer segmentation, and cultural and country-based contextual factors (Fileri et al., 2022; Jung et al., 2023; X. Wu & Huo, 2023). Another consideration could be the integration of SR in different hotel segments, such as luxury hotels, where customized service offerings are valued more. Considering the ever-evolving CX, long-term evaluation of customer emotions pertaining to SR integration could provide fruitful insights.

As for customer concerns over the use of SR in hotels, security and privacy are the most critical factors influencing CX. It is also noted that customers remain cautious of their interaction with SR owing to fears of malfunction and the potential dehumanization of service offerings. Here, it is essential to acknowledge that SRs are novel to the H&T industry, and a large influx of customers may not be familiar with them, leading to several insecurities and discomfort. In this case, hotels need to actively communicate the capabilities of SR and disclose the relevant privacy policies and data protection measures. Additionally, SR should be designed to provide a sense of predictability during HRI (M. Li et al., 2022), helping to alleviate customers’ concerns and fostering a positive CX.

Further, it would be beneficial for hotels to offer technical and non-technical support to users interacting with SR. As for co-experience, integrating SR in hotels offers a chance to

provide customers with an interactive service experience, leading to customer satisfaction. Accordingly, customers look forward to an innovative SR-centric service experience. The integration of SR is particularly relevant for families with children; however, cultural considerations also play an important role in determining positive CX. Despite customers' positive outlook on SR, it is essential to emphasize its functional capabilities. With rapid SR deployment, CX is bound to change rapidly. Thus, emphasis needs to be placed on the continuous improvement of guest experiences with robots. Therefore, given the proper considerations, the integration of SR offers promising avenues for hotels to provide an innovative experience to their customers while simultaneously leveraging AI in their operations.

Limitations and future research agenda

The literature reviewed in this paper is relevant but certainly not exhaustive, thus presenting certain limitations. To begin with, the limited articles examining CX hinder the wide-scale generalizability of the conclusions drawn in this study. The scope of the paper is further limited by contextual inhibitors such as the focus on hotels and only one dimension of the USUS framework, i.e., user experience. Therefore, considering multiple factors would be optimal for researchers and practitioners alike when examining SR integration and subsequent HRI. Future research could also examine the variations in CX across different sectors within the hospitality and tourism industry. The thematic review is subjective to the authors' judgment and could benefit from complementary quantitative and quantitative analysis techniques (Chakraborty et al., 2022; Chatterjee et al., 2022).

Additionally, the proposed framework provides a preliminary overview of CX pertaining to SR integration with no empirical support. Future research can effectively enhance and update the research framework as the literature develops (Al-Muftah et al., 2018; Hughes et al., 2022; Rana & Dwivedi, 2016; Rana et al., 2011, 2012). The study uses the USUS framework to guide its findings. However, alternative frameworks, scales, and theoretical models could be used to provide a comparative assessment of CX. This paper contributes to hospitality research by assessing the implications of SR integration on customer experiences. Overall, the subject of this paper is timely and informative for researchers and practitioners who seek to understand the future of SR and customer interaction in hotels.

Conclusions

This study examined customer experiences with service robots in hotels. Thematically assessed across the five dimensions of evaluating user experiences with HRI, namely, embodiment, emotions, human-oriented perceptions, feelings of security, and co-experience, the study provides a holistic understanding of customer experiences with SR-integrated hotels. The systematic review findings are further mapped out to provide a micro-level view of the aspects impacting the various dimensions of customer experiences. As one of the initial studies in this emerging field of literature, the research lays the groundwork to holistically capture the current state of HRI from a customer perspective. The evolution of the service landscape with the integration of SR further provides several

implications for customer experiences in hotels from both academic and practical perspectives. As the hospitality and tourism industry continues to progress toward technological advancements such as SR, future research would be pertinent to assess CX developments and evolving nature. Overall, this study comprehensively evaluates current customer experiences with SR in Hotels, provoking several future research directions and offering valuable and actionable insights for practitioners. This research further opens new avenues for future research to examine customers' experiences while contributing to the growing HRI literature on hospitality and tourism management.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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