Can Social Robots Enhance Customer Satisfaction with Hotels? An Emotional Perspective

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Full research paper

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Abstract

Recently, social robots have been employed in hotels to deliver services to customers. However, there is a lack of knowledge on whether robotic services could enhance customer satisfaction with hotels. Incorporating 4053 online hotel reviews from TripAdvisor, this study investigates the relationships between six different emotions (joy, surprise, anger, disgust, fear, and sadness) in using social robots in hotels and customer satisfaction with hotels. The positive emotion of surprise and the negative emotions of anger and disgust are found to affect customer satisfaction negatively, and the other emotions demonstrate no impact. This study enriches customer emotion literature by discovering the insignificant impacts of the positive and negative emotions (joy, fear, and sadness) and the negative impact of the positive emotion of surprise on customer satisfaction, in contrast to the findings in the literature about the positive impacts of positive emotions and the negative impacts of negative emotions on customer satisfaction.

Keywords: Social robots, customer satisfaction, emotions, human-robot interaction.

1 Introduction

Artificial intelligence (AI) developments have made it possible to apply social robots to provide service to customers. For instance, there is a growing trend in the hospitality sector of combining human and social robots in services, especially during and after the Covid-19 pandemic. Hotels worldwide are eager to see the evidence of the benefits of implementing social robots in hotels and are preparing to employ social robots in hotel services (Tung and Au 2018). Some scholars argued that implementing social robots in hotel services could potentially enhance service delivery, customer experience, and customer satisfaction (Luo et al. 2021; Wu and Huo 2023).

Social robots have also attracted the attention of researchers. Recent studies on social robots have examined the anthropomorphic designs of social robots and user perceptions in hotel services to explain how social robots use in hotels could affect customer satisfaction with hotels (Luo et al. 2021; Orea-Giner et al. 2022; Tung and Au 2018). Customer emotions have been suggested to be important factors in determining customer satisfaction. Emotions could be exhibited and transmitted during human-robot interaction (HRI) when social robots deliver hotel services to customers (Borghi and Mariani 2022). However, there is a lack of knowledge on how social robots could trigger customers' different emotions and how these emotions are associated with customer satisfaction with hotels.

Emotional valence refers to the perception of a certain emotion as either positive or negative (Bradley and Lang 2000; Russell 2003). Further, emotional valence has been widely applied in the prior literature to understand the effect of customer emotions on their satisfaction with services (orghi and Mariani 2022; Lai et al. 2020; Lo and Wu 2014). Previous research has explored the impacts of positive and negative emotions on customer satisfaction in different service scenarios (Lai et al. 2020; Lo and Wu 2014). However, few studies have attempted to examine how negative and positive emotions in customers' use of social robots in hotel services affect their satisfaction with hotels.

To address the above research gap, drawing on customer satisfaction and the valence of emotions, the current study investigates the relationships between six different emotions (joy, surprise, anger, disgust, fear, and sadness) in social robots use in hotels and customer satisfaction with hotels based on online hotel reviews from TripAdvisor. We found that the positive emotion of surprise and the negative emotions of anger and disgust negatively affect customer satisfaction with hotels and the positive emotion of joy and the negative emotions of fear and sadness have no impact on customer satisfaction. This study enriches the customer emotions and satisfaction literature by discovering the insignificant impacts of both joy as a positive emotion and fear and sadness as negative emotions on hotel customer satisfaction and the negative impact of the positive emotion of surprise on customer satisfaction. The findings are in contrast to the findings in literature about the positive impact of positive emotions and the negative impacts of negative emotions on customer satisfaction. The findings also guide hotel managers on how the use of social robots in hotel services is related to customer satisfaction from the perspective of customer emotions.

The rest of the paper proceeds as follows. After presenting the theoretical background relevant to the current study, the research hypotheses in this study are proposed. The next section explains the research method of the study. Afterward, we report the research findings and elaborate on them. Finally, the contributions of this study are discussed, followed by an acknowledgment of the limitations of this study and future research directions.

2 Theoretical Background

2.1 Satisfaction of Hotel Customers

Customer satisfaction is a critical and complex concept that aims to fulfill users' needs and desires (Li et al. 2013). The definitions for customer satisfaction have emerged from different disciplines. For example, Oh and Parks (1997) claim that satisfaction involves both cognitive and affective procedures along with psychological influences. A disconfirmation approach suggested by Engel et al. (1990) has been widely used to define customer satisfaction in the literature, asserting that satisfaction results from the interaction between a customer's expectations before purchase and their judgment after purchasing. According to Hunt (1975), customer satisfaction is an assessment or judgment made by customers on a service encounter that meets or exceeds their expectations. However, a commonly accepted definition is that customer satisfaction is an emotional response to the utilization of a service or product (Oliver 1981). When customers compare their pre-purchase expectations of what they expect to get from a service or product to their subjective judgments of the actual performance they have experienced, they

construct an attitude or assessment of the service or the product that they have experienced (Li et al. 2013).

Some studies have focused on service quality, hotel attributes, and user judgments in explaining customer satisfaction with hotels (Gunasekar and Sudhakar 2019; Khurana and Sharma 2021; Li et al. 2013). Some scholars stated that service quality of hotel attributes is important in understanding customer satisfaction in relation to 'hotel product,' which consists of the conditions of the hotel room, interactions with service providers, perception of necessary conditions such as front desks, and access to other value-added services. According to Qu et al. (2000) and Xiang et al. (2015), other hotel attributes such as location, price, value, image, food and beverage, and security also affect customer satisfaction with hotels.

Due to their ability to provide services with a noticeable level of efficiency and precision, service robots in the hospitality industry have a significant promise for the future (Luo et al. 2021). Human-oriented functions of hotel services such as delivery, reception, check-in, and check-out are assigned to social robots, aiming at cost reduction, effectiveness, entertainment, and enhancing customer experience (Choi et al. 2021; Li et al. 2013). Robotic service is an effective way to support social distancing and reduce the dangers of disease transmission in the hotel environment (Luo et al. 2021). Successful HRIs are critical in performing human-assistance tasks to satisfy customers despite the autonomous nature of the robot (Borghi and Mariani 2022; Choi et al. 2021). Social robot implementation in hotels brings some novel service attributes to hotel services (Li et al. 2013). It is important to establish user trust in robots when introducing social robots in services to ensure that customers will feel comfortable and secure (Chen and Girish 2023). In addition, robotic services in reception and luggage handling have been identified as an attribute affecting customer satisfaction with hotels (Huang et al. 2021). Wu and Huo (2023) also revealed that the introduction of robots to hotel services increases the overall satisfaction levels of hotel customers. Some scholars have attempted to understand the effect of social robot implementation in hotels on customer satisfaction from a customer cognition point of view (Luo et al. 2021; Orea-Giner et al. 2022; Tung and Au 2018). For instance, Luo et al. (2021) found that service traits of robots, such as speed, technology, and design, influence customer satisfaction with hotels. Moreover, studies uncover that customer sentiments on robotic services are also associated with customer satisfaction with hotels (Borghi and Mariani 2021; Orea-Giner et al. 2022; Tung and Au 2018; Xiang et al. 2015). These studies have mainly focused on the general sentiments among customers, such as positive or negative sentiments. Though recent studies have identified services provided by social robots in hotels as another value addition to hotel services deviating from the traditional service encounters, little research has examined how specific customer emotions in using social robots in hotels are linked with their satisfaction with hotels (Borghi and Mariani 2022; You and Robert 2018).

2.2 Valence of Emotions

Deriving from the pleasure-displeasure dimension in the three-factor theory of emotions (Russell and Mehrabian 1977) and extended in the circumplex model of affect (Russell 1980), emotional valence refers to the perception of a certain emotion, indicating whether the particular emotion is either positive, "good" or negative "bad" (Bradley and Lang 2000; Russell 2003). Although emotional valence is rooted in psychology, it has been constantly researched in various fields, such as product research (Jaeger et al. 2022; Ren and Nickerson 2019; Ullah et al. 2016), hospitality (Borghi and Mariani 2021; Lee et al. 2017; Qahri-Saremi and Montazemi 2022), information systems (IS) (Briggs et al. 2008; Ho et al. 2019), and HRI (Saxena et al. 2022). For service providers, it is essential to understand the underlying positive or negative emotions in their service use experience to get a deep understanding of customers' attitudes and behaviors.

As emotions are identified as causes, effects, or mediators of other psychological processes, similar to memory, perception, and attention, researchers altered their direct focus on emotions and began to identify effects with other variables (Lai et al. 2020). Valence is considered a fundamental feature of emotional stimuli. The overall valence of emotions is frequently studied in relation to online reviews. For example, past research has investigated the impacts of positive or negative emotions on customers' preference tendencies (Kauschke et al. 2019).

Previous studies have drawn on the valence of emotions to understand aspects of user intentions, experiences, and satisfaction. Lo and Wu (2014) investigated the effect of positive and negative emotions on customers' intention to revisit a resort and the mediating impact of positive emotions on the relationship between service quality and value perceptions. Similarly, Lai et al. (2020) provided insights into how the valence of emotions influences customer satisfaction or dissatisfaction with resorts with games such as casinos and found that the negative emotions formed during gaming/casino experiences do not lead to dissatisfaction. In a broader context, Huang et al. (2021) offered an overview of HRIs in

the hospitality context and proposed that enjoyment, novelty, satisfaction, and negative emotions form affective experiences. Highlighting the negative online reviews, Qahri-Saremi and Montazemi (2022) mentioned that negative reviews often contribute to negative emotions such as anger and stress in the diagnosis of negativity bias. In addition, it is necessary to understand the nuances within emotions of the same valence. As Machleit and Eroglu (2000) uncovered, emotions of the same valence, such as anger and sadness, though both are perceived negatively, might influence customer satisfaction in distinct ways. This emphasizes the complexity and multifaceted nature of emotional responses.

According to previous literature, the valence of emotions is an important dimension in understanding customer satisfaction. Drawing on prior research on the valence of emotions and customer satisfaction, this study attempts to examine the relationships between discrete emotions in social robots use in hotels and customer satisfaction with hotels, specifically the effect of positive and negative emotions on customer satisfaction with hotels, which could provide an understanding of the effect of social robots use in hotel service on customer satisfaction with hotels from a discrete emotion view.

3 Hypotheses

Six discrete emotions (joy, surprise, anger, disgust, fear, and sadness) suggested by Ekman (1992) were applied in this study to explain customer satisfaction with hotels. These emotions are often described as basic emotions (Shaver et al. 1987). Previous research has shown the validity of using such emotions in understanding customer responses to services, such as customer satisfaction (Oliver 1993). Additionally, these six emotions have been widely applied in research to understand customer emotions as well as their consequences (Borghi and Mariani 2022; Li and Chignell 2011; Wang et al. 2019). Emotions of joy and surprise are commonly classified as positive emotions, whereas anger, disgust, fear, and sadness are characterized as negative emotions (Borghi and Mariani 2022).

Positive emotions are commonly identified as drivers of customer satisfaction. For example, Borghi and Mariani (2022) identified joy as a strong positive emotion that might even overcome the negative emotions perceived during HRI. A similar reason is associated with the surprise experience in HRI experiences. The studies of Borghi and Mariani (2022) and Fuentes-Moraleda et al. (2020) confirm that surprise is associated with excitement. Tung and Au (2018) state that elements of surprise during HRI can be described as "novel" and "wow." Previous research states that positive emotions could enhance customer satisfaction (Mano and Oliver 1993; Oliver 1993). When social robots are utilized in service delivery, they can elicit positive emotions by creating hedonic perceptions through the excitement and fun of using such robots (Choi et al. 2021). These positive emotions could lead to customers' positive hotel experiences, thereby enhancing customer satisfaction. Based on the above reasoning, we propose the following hypotheses:

H1a. Customers' feeling of joy in interacting with social robots in hotel services is positively associated with their satisfaction with hotels.

H1b. Customers' feeling of surprise in interacting with social robots in hotel services is positively associated with their satisfaction with hotels.

Negative emotions have often been viewed as detrimental to customer satisfaction (Mano and Oliver 1993). Studies have shown that negative emotions have greater lasting effects on customer experiences, thereby adversely impacting overall customer satisfaction. For example, anger creates a series of negative reactions, such as resulting in customer dissatisfaction (Huang et al. 2021). When users are disappointed during HRI due to reasons such as communication failures, they could feel anger and even disgust, which could lead to dissatisfaction (Tung and Au 2018). Lai et al. (2020) argued that customers' feelings of fear could result in lower evaluations of overall service encounters. Additionally, when social robots provide inaccurate information, customers will have lower excitement and sadness, which could even lead to a negative experience during HRI, thus leading to customer dissatisfaction (Wang et al. 2019). As a result, the negative emotions elicited during HRI may have a negative impact on customer satisfaction. Therefore, we hypothesized the following:

H2a. Customers' feeling of anger in interacting with social robots in hotel services is negatively associated with their satisfaction with hotels.

H2b. Customers' feeling of disgust in interacting with social robots in hotel services is negatively associated with their satisfaction with hotels.

H2c. Customers' feeling of fear in interacting with social robots in hotel services is negatively associated with their satisfaction with hotels.

H2d. Customers' feeling of sadness in interacting with social robots in hotel services is negatively associated with their satisfaction with hotels.

4 Data and Methodology

4.1 Data collection

Data for this study were collected from one of the biggest online review platforms in the world, TripAdvisor, which provides travelers with a channel to share their travel experiences socially via generating online reviews (Egresi and Prakash 2019; Li et al. 2013). Researchers have extensively utilized online travel reviews from the TripAdvisor platform to detect customer emotions in the hospitality context (D'Acunto et al. 2023; Fuentes-Moraleda et al. 2020; Orea-Giner et al. 2022; Xiang et al. 2015). The authors first identified hotels that have implemented robots in their services from the website TripAdvisor by using robots as a keyword in searching online hotel reviews. Then, the authors further checked the hotels' websites and online reviews about the selected hotels to confirm their usage of robots in hotel services. Finally, 94 hotels were confirmed for data collection.

The extraction of data about the selected hotels from TripAdvisor was carried out using a Python script developed by the authors. The selenium package was used for the data crawling. Only reviews in English were scrapped. For each online review, we collected review texts, hotel name, overall hotel rating, review title, location, overall score, location score, cleanliness score, service score, value score, review date, and hotel star. In addition, the NumPy package was used for data storage and basic formatting of the initial data set. The initial data set included 150,384 hotel reviews of 94 hotels. The selected reviews ranged from April 2004 to September 2022.

The data set included reviews that explained the experiences of robotic services as well as the overall hotel stay experience. The majority of the reviews explained only the overall hotel stay experience and some service attributes of hotels. Thus, the collected online reviews were filtered by using the following keywords (Orea-Giner et al. 2022) of 'robot,' 'robots,' and 'robot names' (e.g., Yobot, Titan, Jeno, Jenna, Milton, Leo, and Cleo) to retrieve online reviews that mentioned social robots or services provided by social robots in hotels.

Afterward, a manual check was performed on these filtered online review texts, and we excluded some online reviews that were not really associated with robots use, such as '*hostess should have common sense and sense of taste but not being just robot*,' '*…and the old staff who was just like a robot*', and '*…the only criticism I can muster is that the staff are maybe too serious and robotic*'. The filtered reviews include review texts about robots as well as texts related to other hotel attributes and services. Therefore, we further extracted the specific review text related to social robots in each selected review and set the review texts as a new data feature in the same dataset. These selected review texts were further processed by removing non-alphabetic characters, stop-words, and extra white spaces. All sentences were then made into lowercase text. Additionally, the text was tokenized, and lemmatization was carried. After organizing the data, the dataset included 4,053 online reviews. The online reviews were still spread throughout the initial 94 hotels. The final dataset included reviews from 3.5-star hotels (8.5%), 4-star hotels (42.6%), 4.5-star hotels (43.6%), and 5-star hotels (5.3%). The star rating is presented according to TripAdvisor.

4.2 Computation of Data Variables

The six emotions of the filtered sentences explaining the robot or robotic services were extracted from the selected online review text related to social robots by deploying the National Research Council Canada (NRC) Word–Emotion Association Lexicon (EmoLex) developed by Mohammad and Turney (2013). EmoLex contains over 14,000 words to detect different emotions (Taecharungroj and Stoica 2023) and has been widely applied to examine customer emotions in different service contexts such as finance (Mittal and Agrawal 2022), customer services (Tian et al. 2022), and hospitality (Borghi and Mariani 2022; Wang et al. 2019). Instead of providing a sentiment with positive and negative polarity, EmoLex can capture a range of different emotions, allowing to capture detailed and comprehensive emotional sentiment of a review that contains emotional elements (Orea-Giner et al. 2022).

Six discrete emotions (joy, surprise, anger, disgust, fear, and sadness) were calculated by tallying the frequency of words associated with each emotion appear in the review text related to social robots. When all the words in a review are processed, counts of words for each emotion from the EmoLex were recorded. Afterward, the word counts were normalized by dividing the count of words associated with each emotion by the total number of words in the review. For example, variable anger is the ratio of the anger-related terms or words to the review length.

Hotel review ratings account for the overall hotel experience of the customers and strongly convey customer satisfaction (Xiang et al. 2015). A popular proxy for customer satisfaction is the review rating, which has been widely used in research on online hotel reviews (Li et al. 2013). Therefore, hotel review rating ranging from 1-5 (terrible to excellent) included in each online review was applied in this study to measure customer satisfaction.

The six different emotions (joy, surprise, anger, sadness, disgust, and fear) were set as the independent variables, and customer satisfaction with hotels is the dependent variable in the research model. The sentiment of the review title, the sentiment of the review text about robot services (sentiment of the robot experience), hotel star, and location score were included as control variables since prior literature has mentioned how such variables influence customer satisfaction. For example, the review sentiments reflect the experience and may also affect satisfaction (Gunasekar and Sudhakar 2019). The location of a hotel can affect customer satisfaction with hotels (D'Acunto et al. 2023). Also, hotel ratings are frequently used to indicate service level and the overall quality of hotels (Ku et al. 2019). The descriptive statistics of variables are listed in Table 1.

Sentiments of the review title and of the review text about robot services (sentiment of the robot experience) were computed by using a sentiment analysis, which identifies as a novel natural language processing (NLP) research branch (Orea-Giner et al. 2022). We utilized the Valence Aware Dictionary for Sentiment Reasoning (VADER) (Hutto and Gilbert 2014) approach in the study to detect the polarity score, which spanned from -1 to +1 (extremely negative to extremely positive). VADER has been a popular approach to analyze sentiments of social media data (Borghi and Mariani 2022). Therefore, by utilizing VADER, the polarity scores (sentiment values) of the review title and the review sentences containing robotic service were computed.

Variable	Mean	Std. deviation	Minimum	Maximum
Customer satisfaction	4.400	0.921	1.000	5.000
Joy	0.080	0.095	0.000	0.667
Surprise	0.029	0.057	0.000	0.500
Anger	0.010	0.032	0.000	0.333
Disgust	0.005	0.021	0.000	0.200
Fear	0.012	0.036	0.000	0.375
Sadness	0.012	0.033	0.000	0.250
Hotel star	4.191	0.305	3.500	5.000
Sentiment of the review title	0.386	0.333	-0.823	0.949
Sentiment of the robot experience	0.508	0.371	-0.971	0.994
Location score	4.566	0.263	3.000	5.000

Table 1. Descriptive Statistics

5   Data Analysis and Results

In this study, we utilized a stepwise ordinal logistic regression (OLR) analysis to test the research model since the dependent variable, customer satisfaction is an ordinal variable and the independent and control variables were continuous or ordinal variables. To perform the OLR, the variables of the six emotions were transformed to address the multicollinearity issues using a power transformation method called Yeo-Johnson transformation (Yeo and Johnson 2000). The variables were standardized to align them to comparable scales, which enhances their interpretability. The variance inflation factors (VIF) of the variables were all below 1.440 (ranging from 1.039 to 1.440), indicating no multicollinearity issues (Hair et al. 2010). The odds ratios between the levels of customer satisfaction had to be consistent

across all levels. Therefore, the existence of proportional odds was checked using the test of parallel lines (parallel regression lines) (Alrumaidhi and Rakha 2022). Model 1 consisted only of the control variables, whereas Model 2 included the independent variables of negative emotions. The final model (Model 3) included all control variables, and the independent variables of negative and positive emotions. The test results are presented in Table 2.

Measure	Model 1			Model 2			Model 3		
	Estimate (se)	Z value	Odds ratio	Estimate (se)	Z value	Odds ratio	Estimate (se)	Z value	Odds ratio
Sentiment of the review title	0.648*** (0.035)	18.389	1.912	0.634*** (0.035)	17.981	1.885	0.634*** (0.035)	17.951	1.885
Sentiment of the robot experience	0.457 *** (0.034)	13.513	1.579	0.447*** (0.034)	13.246	1.564	0.453*** (0.038)	11.792	1.573
Hotel star	0.510*** (0.040)	12.772	1.665	0.506*** (0.040)	12.648	1.659	0.502*** (0.040)	12.518	1.652
Location score	0.094* (0.039)	2.409	1.099	0.083* (0.039)	2.121	1.087	0.086* (0.039)	2.176	1.090
Anger_trans				-0.087* (0.039)	-2.255	0.917	-0.086* (0.039)	-2.217	0.918
Disgust_trans				-0.155*** (0.036)	-4.325	0.856	-0.153*** (0.036)	-4.267	0.858
Fear_trans				-0.040 (0.037)	-1.082	0.961	-0.032 (0.037)	-0.868	0.969
Sadness_trans				-0.034 (0.038)	-0.090	0.967	-0.024 (0.038)	-0.640	0.976
Joy_trans							0.023 (0.039)	0.596	1.023
Surprise_trans							-0.075* (0.036)	-2.079	0.928
AIC	7606			7556			7552		
BIC	7656			7631			7627		
Log-Likelihood	-3794.8			-3765.8			-3763.7		
Number of observations	4053			4053			4053		

Notes: * p<0.05, ** p<0.01, *** p<0.001, trans (transformed variable), se (standard error)

Table 2. Test Results

The AIC, BIC, and Log-Likelihood values indicate that model 3 is best fitting to the data. All models were significant, while the final model exhibited a χ^2 (df = 10, N = 4053) = 952.7, p<0.001. The test results showed no significant relationship between joy and customer satisfaction. Thus, H1a was not supported. We found a significant negative impact of positive emotion of surprise on customer satisfaction. The finding reveals that higher surprise is likely to lead to lower customer satisfaction with hotels with an odds ratio (OR) of 0.928. Hence, H1b was not supported. Moreover, the model estimates show that higher negative emotions of anger and disgust are likely to lead to lower customer satisfaction with hotels with ORs of 0.918 and 0.858, respectively. Therefore, both H2a and H2b were supported. Negative emotions of fear and sadness exhibited no significant effects on customer satisfaction with hotels. Hence, H2c and H2d were not supported. The results also showed that the control variables, such as the sentiment of the review title the sentiment of the robot experience, hotel star, and location score are positively associated with customer satisfaction with hotels.

6   Discussion

The current study investigates the impacts of six basic emotions (e.g., joy, surprise, anger, disgust, fear, and sadness) in social robots use in hotel services on customer satisfaction with hotels. Out of our expectation, the positive emotion of joy shows no significant positive impact, whereas the positive emotion of surprise exerts a significant negative impact on customer satisfaction with hotels. Our findings on positive emotions are not consistent with the findings in previous literature that positive emotions have a positive effect on customer satisfaction (Chen and Girish 2023; Chinelato et al. 2023). The insignificant effect of joy might be due to customers' expectation of robotic services being more utilitarian-oriented. Though social robots in services could bring joy to hotel customers, hotel customers may not consider that joy in using social robots is a critical factor when judging their satisfaction with hotels. The significant negative impact of surprise on customer satisfaction could be due to several reasons. Surprise from social robots could spark negative senses of uncertainty and discomfort while disrupting customers' service encounters, which might deviate from the desired service experiences. In addition, the negative impact of surprise on customer satisfaction could be linked to a possible misalignment between customers' anticipated beliefs of the service interaction and their actual experience with social robots. When the surprise emotion is critically deviating from expectations, it can drive cognitive dissonance, which affects satisfaction adversely (Wang and Li 2022).

The impact of anger on customer satisfaction was found to be significant and negative. Anger is an emotion that expresses hostility or annoyance (Borghi and Mariani 2022). Anger is also considered an intense negative emotion that occurs when customers experience an extreme violation of their expectations during service encounters (Kim and So 2023; Lee et al. 2017). This finding is similar to the findings of Chinelato et al. (2023) that negative emotions are found to affect satisfaction negatively. According to Huang et al. (2021), anger provokes a chain of negative perceptions, which often result in even more realizations of negative emotions, creating customer dissatisfaction with hotel products.

Disgust was discovered to affect customer satisfaction negatively. Strong feelings of dislike or disapproval are portrayed in the emotion of disgust (Borghi and Mariani 2022). Also, this outcome aligns with the findings of Orea-Giner et al. (2022) that disgust is negatively associated with customer dissatisfaction with the concierge robots and room service robots in hotels.

Interestingly, negative emotions of fear and sadness have no significant negative impacts on customer satisfaction with hotels. These findings deviate from the existing findings about customer satisfaction from the perspective of emotional valence that positive emotions positively affect customer satisfaction, and negative emotions negatively influence customer satisfaction (Chen and Girish 2023; Huang et al. 2021). Fear is often felt when faced with danger or a threat (Borghi and Mariani 2022). Customers might feel fear when interacting with social robots in hotels due to the high anthropomorphism of social robots (Song and Kim 2022) as the anthropomorphic features of social robots are unique features of robots. When hotel customers interact with robots in hotel service delivery, though they might feel fear when they perceive the anthropomorphism of robots, they will not feel dissatisfied with the robotic service and hotel service. In other words, they will not feel dissatisfied with hotel services due to their fear of using robots in hotel services. Similarly, sadness is an emotion that is expressed during disappointment (Borghi and Mariani 2022). Customers might feel disappointed during HRI when they encounter service failure of social robots or if they have high expectations with robotic service in hotels. However, they might not feel dissatisfied after realizing that social robots applied in hotel services are merely an innovative technology and the same as other technologies robots could fail in service delivery due to different technical reasons.

7   Contributions

7.1   Theoretical Contributions

Prior literature has examined customer satisfaction with hotels based on online reviews from different lenses, such as customer attributes, hotel attributes, and online users' popularity based on the availability of review data of customers (Zhao et al. 2019). This study examines the relationships between six different emotions (joy, surprise, anger, disgust, fear, and sadness) in using social robots in hotel services and customer satisfaction with hotels from an emotional perspective. The findings of this study make theoretical advances to the literature on customer emotions and customer satisfaction in the social robot context.

The current study enriches the literature about customer emotions and satisfaction by discovering that positive emotions could have negative effects on customer satisfaction and that negative emotions could

have no negative impacts on customer satisfaction in the specific context of robotic services in hotels from the emotion valence view. These findings are not consistent with the prior research findings on the positive impact of positive emotions and the negative impact of negative emotions on customer satisfaction in the prior literature (Chen and Girish 2023; Chinelato et al. 2023; Huang et al. 2021). Thus, this study extends the understanding of the impacts of both positive and negative emotions on customer satisfaction.

In addition, the findings in this study indicate that the research context should be considered when examining customer satisfaction from a discrete emotion view since the research context could make the impacts of negative and positive emotions on customer satisfaction change. Specifically, in this study, positive emotions such as surprise showed a negative impact, and joy showed no positive impact on customer satisfaction with hotels, whereas negative emotions such as sadness and fear exhibited no negative impact on customer satisfaction. These findings implied that the specific context of robots makes the positive emotions (e.g., surprise) have even negative impacts on customer satisfaction due to the disruptive feature of robots. Thus, this study suggests the necessity to reconsider both the positive role of positive emotions and the negative role of negative emotions when examining robots' use on customer satisfaction in different service scenarios.

7.2 Practical Contributions

This study offers several practical contributions specifically to hotel managers. In this study, different emotions (e.g., surprise, anger, and disgust) in using social robots in hotels are found to have significant impacts on customer satisfaction with hotels. The findings indicate that hotel managers need to understand that social robots' implementation in hotels is associated with customers' overall satisfaction with hotels and the importance of managing customer emotions to enhance customer satisfaction with hotels. Moreover, the findings on the negative impacts of negative emotions such as anger and disgust on customer satisfaction with hotels indicate that hotel managers could develop strategies to avoid the negative emotions of anger and disgust in customers' use of social robots in hotels. In order to address potential feelings of anger and disgust toward social robots, hotel managers could use online reviews and collect customer feedback to identify the specific reasons for customers' anger and disgust in social robot use in hotels. Hotel managers could also provide additional attention and assistance to customers when they use social robots, which could diminish the levels of anger and disgust, thereby increasing customer satisfaction.

In addition, hotel managers should understand the novelty of social robots in hotel services and customers' emotional responses to such innovative robotic services. Since our study uncovers that surprise is negatively associated with customer satisfaction, it demands hotels to communicate the functionalities, capabilities, and even limitations of social robots employed in their services. Thereby, customers could have an understanding of robotic services and generate realistic expectations of social robots, which could reduce the likelihood of negative surprises and will not lead to customer dissatisfaction.

8 Limitations

The limitation of this study should be acknowledged. First, this study only examines social robots use in the hotel context, and caution should be taken when generalizing the findings in other contexts. Thus, future research could consider replicating this study in different service scenarios to generalize the findings in the service sector. Second, this study only examines the relationships between the six different emotions and customer satisfaction with hotels. Future research could consider further investigation of the reasons for these discrete emotions through text mining of online hotel reviews. Third, this study has not considered moderators such as hotel customers' demographic background gender, country, and age. These factors might be closely linked with their emotions and attitudes toward robotic services in hotels; thus, further research could examine their moderating effect on the relationships between discrete emotions and customer satisfaction in the context of robots use in different service scenarios.

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