Consumers' Brand Experiences With Robotic Service Failures: Modeling Appraisal, Attribution, and Psychological Reactance

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Highlights

- Designed experiments in concierge and front desk robotic service failure contexts
- Connected appraisal, attribution, and psychological reactance theories
- Interaction effect of service failure and attribution on hotel brand experience
- Involuntary service robot adoption can lead to consumers' negative evaluations

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Abstract

Due to the stretched capacities of human staff, consumers are increasingly placed in situations where they are 'required' to use technology amidst their travel experiences, despite potential service failures in robotic technologies. Yet, research into how robotic service failures could potentially spill over to consumers' brand experiences, robot experiences, and adoption intention remain unexplored. Drawing on appraisal, attribution, and psychological reactance theories, an interconnected research model of service failure, attribution, and (in)voluntary robot adoption was tested via two experiments. A mixed-design quasi-experiment (Study 1) found a significant interaction effect of service failure and attribution on brand experience in hotel concierge context. Study 2 provided further evidence for the causal effects in Study 1 by employing a between-subject quasi-experiment in front desk context with additional measures. Collectively, this research contributes to the literature by highlighting how temporal, situational, and contextual factors in HRI may impact evaluations of brand and robot experiences.

Keywords: Service Robots; Service Failure; Attribution, (In)Voluntary Robot Adoption; Brand Experience; Robot Experience;

1. Introduction

The implementation of service robots in the hospitality and tourism industry has accelerated in recent years (Fan et al., 2023; Hu et al., 2021; Lin et al., 2023). This massive shift has led to profound debates on the balance between 'high tech' and 'high touch', particularly in hospitality (Wu et al., 2022). Proponents of 'high touch' suggest that consumers would choose face-to-face service to experience a personal touch that is the essence of hospitality (Arici et al., 2023). In contrast, supporters of 'high tech' argue that contemporary consumers would prefer automated services for convenience and efficiency.

From a conceptual perspective, previous research on this debate adhered to several underlying assumptions. The first assumption is that consumers can easily 'choose' hotels that are high tech or high touch. This assumption implies a dichotomy between touch and tech in terms of consumer choice. The second assumption is that hotels could define and position themselves as primarily high tech or high touch, although in reality, they are not mutually exclusive. Previous studies have investigated – predominantly in marketing and consumer experience perspectives – the deployment of service robots in high tech properties such as Henn-na hotel in Japan, or more recently, Alibaba's FlyZoo hotel in China. The third assumption is that the debate between high tech and high touch are framed in positive terms. For instance, studies have shown that consumers will positively benefit from stronger intellectual experiences while those who choose a high touch hotel will have more emotional experiences (Davari et al., 2022).

Despite insights from previous studies, the present research suggests that the prevailing environment in tourism and hospitality has changed significantly, which warrants a critical investigation into these assumptions. For instance, consumers' desires for health and safety due

to the COVID-19 pandemic has shifted the discussion towards a balance between high tech and high touch, rather than a dichotomous view, as hotels across all levels (e.g., budget, mid, or luxury) adopt contactless services and robotic technologies to a certain extent. The move towards robotic adoption is further compounded by the recurring labor shortage in the hospitality industry across many destinations worldwide. The result is that consumers are ever more likely to be placed in a situation where they are 'required' to use rather than 'choose' to use technology in their hospitality experiences (e.g., the default use of concierge and front desk robots as priority given the stretched capacities of human staff across many properties). When consumers 'must' use service robots, it moves the assumption from consumer choice (i.e., voluntariness; consumers' context-dependent freedom in adopting technologies) (Tsai et al., 2017; Wu & Lederer, 2009) towards the effects of *involuntary* adoption of service robots (i.e., involuntariness; consumers' lack of freedom in adopting technologies) on experiences, which is relatively less examined in the current literature.

Based on these premises, the subsequent question that arises is: "how would involuntary adoption of service robots impact consumer experiences in hospitality?" Previous studies examined the constructive side to consumer experiences when consumers choose to use service robots; however, the present research challenges this assumption with an alternative perspective by investigating the *negative* effects on experiences when consumers must *involuntarily* adopt service robots. In doing so, the present research investigates the shifts towards involuntary adoption, coupled with an alternative – albeit critical – view on the negative impacts toward experiences.

The above perspectives are contingent on a crucial factor: a service robot can effectively carry out its assigned task. When consumers 'choose' to try a robot (e.g., for fun), they are more

likely to understand when the robot fails to execute its task (Feng et al., 2019). However, how would consumers react when they must (i.e., involuntarily) use a robot and the robot fails? Service failures are common, yet the question of how involuntary adoption, in connection with robotic service failures, could affect consumer perceptions of their onsite experiences and potentially spillover to their overall evaluations of a hotel's brand experience remains unexplored.

By applying the appraisal theory (Lazarus, 1991), attribution theory (Weiner, 1985), and psychological reactance theory (Brehm, 1966), the present research seeks to address these aforementioned research gaps through two related studies. The objective of Study 1 is to identify the causal effects of robotic service failures, attribution of service failures, and involuntary adoption of service failures using a mixed-design quasi-experiment. The goal is to evaluate the extent to which consumers' brand experiences could be negatively affected if a robotic service failure was involuntary in the context of hotel concierge service.

A limitation of Study 1 is that it is narrow in its application: consumers do not necessarily use concierge services; hence, the objective of Study 2 is to strengthen the generalizability of Study 1 by investigating the involuntary adoption of service robots and attribution of service failures via a between-subject quasi-experiment in the front desk context. Furthermore, Study 2 examined these causal effects on additional outcomes, including consumers' experience with the robot itself, and their intention to adopt service robots in the future. In doing so, Study 2 reinforces the robustness of the findings in Study 1 in a different context and with additional dependent constructs.

Overall, this research offers a number of contributions to the literature. From a conceptual perspective, this research connects insights from the appraisal theory, attribution

theory, and psychological reactance theory, providing an alternative angle to the literature on human-robot interactions by connecting *involuntary* adoption of robots with the *negative* impacts on consumer experiences. Methodologically, this research offers realistic and experimentally-tested scenarios (i.e., concierge and front desk) that are rigorous and applicable for future studies on human-robot interactions. From a practical point of view, this research provides forewarning to management on how seemingly small, specific onsite experiences of service failures during consumers' involuntary adoption of robotic service may, in fact, spillover to a cause a larger detriment to a hotel's overall brand experience.

2. Literature Review

2.1. Brand Experience, Robot Experience, and Adoption Intention

Service robots have been used in various functional areas in the hotel industry to enhance consumer experience with the hotel brand (Lu et al., 2019). Accordingly, it is critical for hotels to understand consumers' brand experience after their interactions with service robots. Brand experience indicates consumers' perceptions and responses from their interactions with a hotel brand (Teng et al., 2023; Tung & Tse, 2023). Brand experience is created by various consumer touchpoints and significantly affected by perceived quality of services (Hwang et al., 2021). Brand experience has been acknowledged for its importance as it not only positively affects consumer satisfaction and loyalty (Zarantonello & Schmitt, 2010), but also plays a critical role in developing business strategies (Kahn & Rahman, 2017).

Cost reduction and operational efficiency are another key drivers of hotels' implementation of service robots (Belanche et al., 2021; Huang et al., 2021). While studies showed that the implementation of service robots can increase the value of service experiences

with increased functional benefits, such as availability and efficiency (Huang et al., 2021), service robots are not free from errors and service failures are likely to occur not only by the service robots but also by the consumers. Furthermore, the service failures would cause negative evaluations of robot experiences from consumers, which will lead unfavorable attitudes and reluctance to adopt service robots in the future. If consumers are not favorable to service robots and not willing to use them in the future, the implementation of service robot could not replace human staff, generating sunk costs for hotels. In other words, understanding consumers' experience with service robots is critical as they are key antecedents of consumers' intentions to adopt service robots in the future.

2.2. Robotic Service Failures in Hotels

Fueled by the exponential development of technology, robotic technology, which used to be valued in the manufacturing industries (Stevens, 2021), has been introduced in the service industry, such as healthcare, construction, agriculture, medical industries (International Federation of Robotics, 2021). Among various service industries, service robots have been continuously growing in the hospitality industry (Tuomi et al., 2021). The reasons behind the increasing popularity of service robots in the hospitality industry include the efficient utilization of resources, precise prediction of demand, reduction of employees' mistakes, and, most importantly, handling labor shortages (Bowen & Morosan, 2018; Tuomi et al., 2021). Furthermore, the emergence of COVID-19 has even accelerated the growing popularity of service robots in the hospitality industry to help enforce social distancing (Romero & Lado, 2021).

However, unlike the industry practitioners' anticipation of reducing labor costs and increasing operational efficiency (Shin & Jeong, 2020), many service failure cases regarding service robots have been reported, and the number of service failures has continuously increased (Airici et al., 2023). In other words, the performance of service robots did not seem to reach consumers' expectations, as shown in the case of Henn-na hotel in Japan. Robotic service failures in hotels vary, from simple technical glitches to incompetent human-robot interactions (e.g., socially inappropriate communications and behaviors). Major complaints include service robots' malfunction and their inability to address consumers' requests (Hadded, 2020). For example, some guests have complained that service robots were not able to understand questions that were not pre-programmed and unfamiliar terms, and to communicate with guests with different accents (Alfonso, 2023). Additionally, consumers' unfamiliarity with service robots were not able to request special services (Alamdari, 2017).

2.3. Appraisal Theory Perspective of Robot Failures

Service failures indicate situations in which a company's promise was broken (Choi & La, 2013). According to the appraisal theory (Lazarus, 1991), when an event occurs, consumers tend to evaluate whether there is a congruency between the outcome of the event and their goal (Moors, 2020; Xu et al., 2019). When a service failure occurs, the consumers would cognitively evaluate the consequences of the service failure. Therefore, much research has been conducted to investigate the negative impact of service failures on consumers' post-evaluation of the service, such as satisfaction (Migacz et al., 2018). In terms of consumer-robot interaction, when a service failure occurs, consumers' expected service is not delivered, leading to a negative evaluation of

their robot experiences as well as decreasing their intention to adopt hotel service robots in the future.

However, the impact of service failures on consumers' relationships with the company has been under-examined. For example, whether a service failure damages brand experience was not fully explored. As consumers' perceived utility would be decreased as a result of service failures (Xu *et al.*, 2019), their evaluation of the hotel brand, which was supposed to add value (Sajtos et al., 2010), would be negatively affected by service failures. Furthermore, after a service failure, if a consumer thinks the hotel brand introduced service robots that are not able to provide services promised by the hotel brand, it might negatively affect his/her experience with the hotel brand (Belanche et al., 2021).

H1: Robotic service failures negatively affect hotel guests' brand experience.

2.4. Attribution Theory Perspective of Service Failures

As service robots became more prevalent and various service failures happened, researchers have paid much attention to robot service failure, including attribution of service failure (e.g., Ryoo et al., 2024). For example, Belenche et al. (2020) investigated if consumers feel different levels of attribution of responsibility depending on service providers (e.g., robot, human). Similarly, Leo and Huh (2020) also examined consumers' attribution process of blaming on service provider for service failures. However, previous studies mostly focused on service failure itself and service providers, rather than considering who was responsible the cause of service failures. Furthermore, it was also neglected that hotel consumers could be responsible

for service failure. Thus, it was imperative to investigate the attribution of service failures by considering hotel consumers.

Robotic service failures can be categorized into physical failures and human failures (Ponnappan, 2018). Physical failures indicate service failures resulted from the technological aspects of the service robots, whereas human failures refer to the service failures that occur due to the interaction between robots and consumers (Ponnappan, 2018). Physical failures include technical problems and glitches (e.g., sudden malfunctions, power issues, and downtime). Consumers' misunderstanding of the situation, requesting services in implicit ways, and/or entering the wrong command can be seen as human failures. Given that service robots are still in the developing stage and are in the early stages of diffusion, there would be various service failures related to hotel service robots with different attributions.

According to the attribution theory (Weiner, 1985), consumers tend to identify who was responsible for the service failure and blame the service provider for causing the failure (Arici et al., 2023; Baker & Kim, 2018; Xu et al., 2019). Previous studies (e.g., Dabholkar & Spaid, 2012) found that consumers' satisfaction is when a failure occurred due to technology, such as malfunction. Given that consumers would consider service robots as the hotel's property and responsibility (Belanche et al., 2020), service failures caused by service robots would have a more negative impact on consumers' brand experience with a hotel than when consumers were responsible for the service failure (Dabholkar & Spaid, 2012). On the other hand, when consumers were responsible for service failures (e.g., lack of attention to the instruction, not following the instructions, providing incorrect information), they might not blame the hotel brand since the service failures were beyond the control of the service robots and the hotel (Choi & Mattila, 2008). In a similar vein, consumers' robot experience might not be negatively

affected when they caused the service failure, whereas it might have a significantly negative impact on robot experience when the service robots were the cause of service failures. When service robots cause service failures, consumers would think that service robots are incapable of delivering expected services, thereby negatively affecting their intention to adopt hotel service robots in the future. On the other hand, consumers might continue their adoption of service robots if they were responsible for the failure.

H2: The attribution of robotic service failure affects hotel guests' (a) brand experience, (b) robot experience, and (c) robot intention.

2.5. Psychological Reactance Theory Perspective of (In)Voluntary Adoption of Service Robots

Consumers' voluntariness has been much studied in the context of technology adoption behavior (Tsai et al., 2017), and it has been well known that consumers' personal characteristics and perceptions, such as technology readiness, are significant predictors of voluntary technology adoption behavior (Tsai et al., 2017). Voluntary adoption can be categorized into cognitive/perceived and actual voluntariness of adoption (Tsai et al., 2017). On one hand, cognitive/perceived voluntariness refers to the extent to which a consumer perceives using a technology as being voluntary (Tsai et al., 2017). On the other hand, actual voluntariness is defined as consumers' freedom in adopting technologies that are dependent on the environment (e.g., context). This research applied the concept of actual voluntariness. The rationale behind using actual voluntariness is that more and more consumers are adopting technologies

involuntarily due to the context-specific environment. For example, some hotels are fully automated, depriving guests of the choice of choosing their service agent and forcing guests to use hotel services without human interactions (Hu, 2022).

As an attribute of the environment, voluntary adoption of technology indicates whether an individual's adoption of technology is perceived as his/her decision of their free will (Moore & Benbaset, 1991; Tsai et al., 2017). The psychological reactance theory (Brehm, 1966) suggests that consumers feel enslaved and their perceived control decreases when they are required to do certain behaviors, as their attitudinal or behavioral freedom was threated. As consumers perceive the loss of freedom, they build more negative attitudes/perceptions when they are required to act in a certain way. Studies (Johnson et al., 2008; Liu, 2012) demonstrated that consumers develop negative attitudes/perceptions when they were required to use self-service technology (Feng et al., 2019; Liu, 2012) and positive attitudes/perceptions are developed when consumers have freedom to choose self-service technology (Johnson et al., 2008).

However, even though the availability of human staff is decreasing with the implementation of technologies (Mathews, 2021), not much has been investigated about if consumers' voluntary/involuntary adoption of technology would affect their evaluation of tourism and hospitality services. Accordingly, it remains unclear how consumers' experience with brands/robots would be affected when service failures occur. When consumers used a technology voluntarily, the consumers' perceptions would be reflected in their actual usage of the technology (Blut & Wang, 2020), suggesting consumers' evaluation of their experience would be affected. Past studies showed that consumers' willingness to participate in services affects their subsequent evaluations (Dong et al., 2015). Zolfagharian et al. (2018) found that when consumers' preference for a service provider matches with the actual service provider, the

negative effect of service failure was mitigated. Thus, when consumers voluntarily adopt service robots in a hotel, their subsequent evaluation of service failures would not be substantially affected. Furthermore, the modesty bias, consumers' tendency to take a certain degree of blame for the service failure (Zolfagharian et al., 2018), might arise when service failures occur due to the voluntary adoption of service robots. Whereas, when consumers are 'required to use service robots, their preferred service provider (i.e., human staff) and actual service provider (i.e., service robots) are different. Thus, their subsequent evaluation of their experiences would not be mitigated when service failures occurred.

H3: Hotel guests' (in)voluntary adoption of service robots affects hotel guests' (a) brand experience, (b) robot experience, and (c) robot intention.

2.6. Interconnected Model of Appraisal, Attribution, and (In)Voluntary Adoption

When a service failure occurs, consumers tend to assess whether the outcome is consistent with their goals (Moors, 2020), and their subsequent evaluation of their experience with the service and the service provider is negatively affected. Although the negative effects of service failure on hotel consumers' subsequent evaluation and behavioral outcomes were much demonstrated (Luo & Mattila, 2020), consumers' brand experience might not be negatively affected when the hotel brand was not the cause of the service failure or the adoption of the service robot was entirely voluntary. Specifically, when a consumer voluntarily adopted a service robot as his/her service agent, and he/she caused a service failure, his/her experience with the brand would not be affected since the brand is not related to the service failure. On the other hand, if a consumer was required to use a service robot and the robot caused a service failure,

his/her experience with the brand would be negatively affected since the brand required him/her to use the robot, which caused the service failure. Since the consumer was the victim of the service failure, he/she would blame the brand for the service failure, weakening brand experience.

On the other hand, consumers' experience with service robots and intention to adopt hotel service robots in the future might be negatively affected regardless of the attribution of service failure and (in)voluntary adoption of service robots. However, the degree of the negative impact would be divergent. Particularly, the negative impact on consumers' robot experience and adoption intention would not be substantial when consumers voluntarily adopted service robots. They were responsible for the service failures because it was their choice to adopt the service robot, and they caused the service failures. However, consumers' robot experience and intention to adopt hotel service robots in the future might be largely decreased when they were required to use service robots, and the robots failed in providing expected services.

H4: There are interaction effects of service failure, attribution of service failure, and (in)voluntary adoption of service robots on hotel guests' (a) brand experience, (b) robot experience, and (c) robot intention.

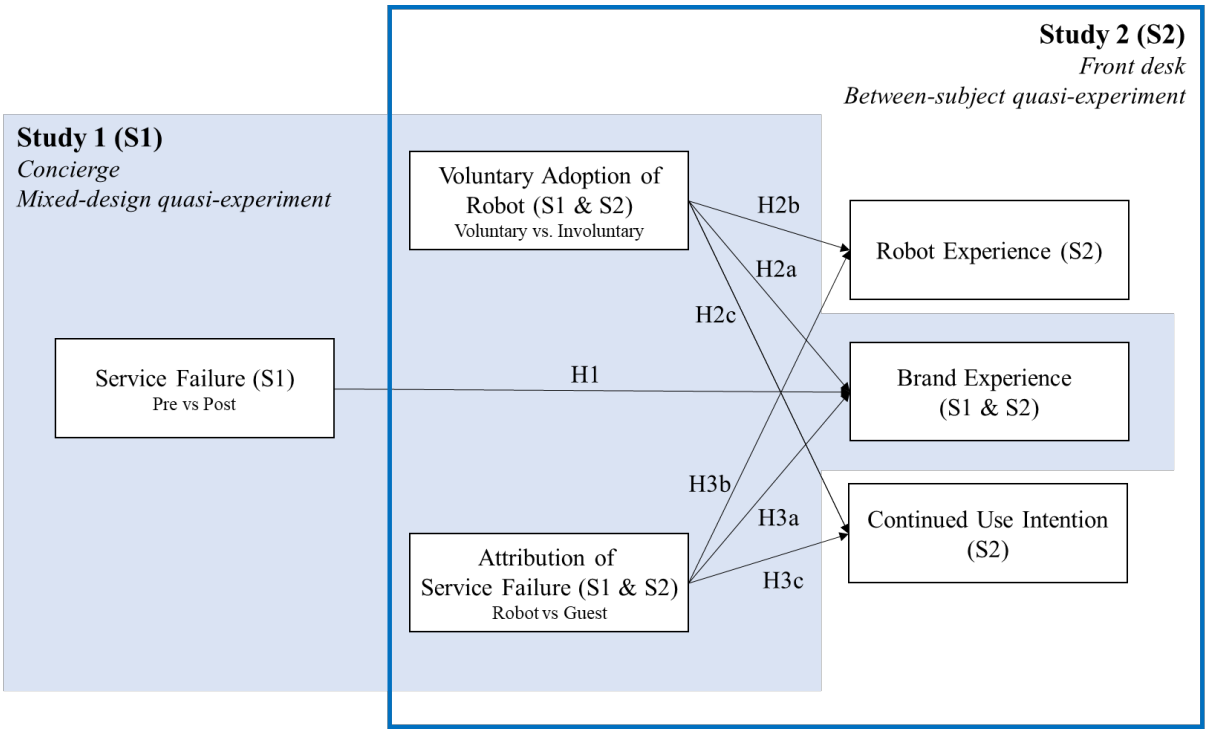
3. Methodology and Results

This research aims to investigate the effects of robotic service failures, attribution of service failures, and hotel consumers' (in)voluntary adoption of service robots on their brand experience, robot experience, and intention to adopt service robots in the future. The research framework is presented in Figure 1. Specifically, Study 1 employs a 2 (Within: pre/post service

failure) X 2 (Between: voluntary vs. involuntary adoption of service robots) X 2 (Between: consumer-attributed vs. robot-attributed service failure) mixed-design quasi-experiment to examine the extent to which consumers' brand experiences could be negatively affected if a robot service failure was involuntary in the context of hotel concierge service.

Study 2 seeks to strengthen the robustness and generalizability of the findings in Study 1 through the addition of different dependent constructs (i.e., robot experience, and intention to adopt service robots in the future) in a different context (i.e., front desk by employing a 2 (Between: voluntary vs. involuntary adoption of service robots) X 2 (Between: consumer-attributed vs. robot-attributed service failure) between-subject quasi-experiment.

Figure 1. Research Framework



3.1. Preliminary experiment: Development of manipulation scenarios

A preliminary experiment was conducted to develop two sets of service failure scenarios for the different contexts in Studies 1 and 2: concierge and front desk, respectively. The reasons for selecting concierge and front desk of a hotel as the study setting were two-fold: (1) hotels have introduced service robots to these areas (e.g., Hilton's concierge robot Connie and Henn-na hotel's front desk robots, and (2) hotel consumers can interact more with concierge and front desk robots compared to robots in other areas, such as housekeeping. Although concierge and front desk might be considered similar contexts, they are different in their purposes and functions. Particularly, concierge services are not necessary as the purpose of a concierge is to enhance consumer experience. Whereas, interactions with front desk are necessary for consumers to check-in/out. Therefore, developing two sets of scenarios in two different areas would increase the generalizability of the findings.

While previous studies were used as the starting point of scenario development (Chen et al., 2021; Ho et al., 2020; Kim & Jang, 2021; Shin & Jeong, 2020). However, as the context of this research was different from the previous studies, the scenarios were developed in two different contexts (i.e., concierge and front desk). Furthermore, to accurately reflect the real-world service failures in human-robot interactions, the scenarios were further revised by using actual service failure examples in human-robot interactions in hotels based on news articles about hotel robotic service failures. In addition, a short survey was conducted with 758 Amazon Mechanical Turk (MTurk) panels who had used service robots in hotels. About 86% (n = 632) respondents indicated that they had experienced robotic service failures, and the frequent service failure incidents were consistent with the incidents in the developed scenarios. Specifically, the respondents answered that they had experienced service failures resulted from (1) environment

or human interactions (e.g., communication problems) (84%), operation and user requirements (e.g., complicated interface) (83%), (3) technical glitches (e.g., system freeze) (42%), and (4) incomplete service ranges (e.g., unavailability of certain services) (28%).

To verify the developed scenarios (Appendix A), an online survey was developed. The survey included the developed scenarios, manipulation check items, constructs of interests, and control variables. All respondents were randomly assigned to one of the scenarios, and asked questions about their perceptions after the given scenario. The manipulation of (in)voluntary adoption of service robots was measured with four items from Shin (2021), and the attribution of service failure was measured with two items adopted from Kim, So, and Mihalik (2022). Furthermore, three items for service failure magnitude (Obeidat et al., 2017) and six items for negative emotion (Harrison-Walker, 2019) were adopted as control variables and to evaluate the comparability of the developed scenarios in the two different contexts (i.e., concierge and front desk). A total of 403 respondents were recruited via MTurk: 202 respondents for concierge scenarios and 201 respondents for front desk scenarios. About a half of the respondents were female (51%), and Millennials (50%). Approximately four-fifths (79%) of the respondents worked full-time, and about 73% were Caucasian. Except for 33 respondents (8%), the purpose of the respondents' hotel stays involved leisure. Among 222 respondents who previously used service robots, 130 respondents (59%) experienced robot service failures. Two-thirds (41%) of the respondents indicated that their preference of service agent would depend on the situation/task. Front desk (60%) was the area where the respondents expected to see service robots the most.

The manipulation of (in)voluntary adoption of service failure was successful in both scenarios ($p<.001$). The attribution of service failure was manipulated as intended ($p<.001$).

Furthermore, to ensure the two contexts were comparable, the measurement invariance test was conducted. The results indicated that configural, metric, and scalar invariance were supported (p<0.05). Lastly, the difference between the two contexts in participants' service failure magnitude and negative emotion was assessed. The results indicated that there was no significant difference between the two contexts in service failure magnitude (p<.05, $M_{FrontDesk}$=5.51, $M_{Concierge}$=5.69, CI[-.368,.015]) and negative emotion (p<.05, $M_{FrontDesk}$=4.11, $M_{Concierge}$=4.36, CI[-.517,.024]). Furthermore, there was no significant difference between front desk and concierge contexts in terms of scenario realism (p>.05, CI[-.206,0.169]), and the realism was high for both contexts ($M_{FrontDesk}$=5.99, $M_{Concierge}$=5.98), indicating the scenarios in both contexts well reflected the real-life situations.

3.2. Study 1: Effects of robot failure on consumers' brand experiences at concierge service

3.2.1. Research Design and Participants

A 2 (Within: pre/post service failure) X 2 (Between: voluntary vs. involuntary adoption of service robots) X 2 (Between: consumer-attributed vs. robot-attributed service failure) mixed-design quasi-experiment was conducted. The sample size was determined by conducting a power analysis using *R* and *easypower* package. For small-medium effect size (Cohen's f^2 = .04) for the three-way interaction effect, the minimum sample size was 197 to obtain 80% power and the significance level of .05. Thus, the target sample size per cell was decided at 25. The online survey was developed on Qualtrics, and participants were recruited from MTurk panels. The concierge scenario as well as validity and reliability of measurement items were adopted and tested from the preliminary experiment.

The participants were asked a series of questions to ensure their representativeness of the population of interest. As the study design included within-subject component (i.e., pre-service failure and post-service failure), participants' prior brand experience was required to measure before and after respondents were given a random scenario. Accordingly, using fictitious hotel brand in the scenarios was not appropriate since the respondents would have never experienced the fictitious hotel, indicating they cannot develop brand experience. Furthermore, using chain hotel brands would increase the realism of the scenarios. Therefore, participants were asked to choose the level of service of hotels they typically stay, provided a list of hotels based on their selected service level (STR, 2021), and requested to choose one brand they knew. Pre-service failure measures were given before assigning the participants to one of the scenarios. Then, the participants were asked to imagine a situation and choose their preferred staff (i.e., human concierge, robot concierge) (Appendix A). Then, the participants were provided with a situation description and asked to choose their preferred service agent between a human concierge and a robot concierge. Those who chose a human concierge were assigned to one of the random scenarios in involuntary adoption, whereas those who selected a robot concierge agent were randomly assigned to one of the voluntary adoption scenarios. A series of manipulation check items and realism check questions were asked (Appendix C). Then, the participants were asked to indicate their brand experience (Kim et al., 2018), before and after they were given the scenarios. Lastly, the participants were asked to provide their sociodemographic information. To control the quality of data, a quality assurance item was asked at the beginning of the survey, and different types of attention and quality check items were asked (Lu et al., 2022).

A total of 225 complete responses were collected, meeting the minimum sample size of 197. About 60% of the participants were born between 1980 and 1994 (Appendix D).

Approximately 62% of the participants answered that their primary purpose of staying at a hotel was bleisure. Two-fifths (40%) of the participants answered that they typically stay at upper midscale hotels, such as Courtyard and Holiday Inn. About 40% of the participants answered that their preferred service agent depended on the situation/tasks. Specifically, the participants preferred human staff when the situation was critical or complicated, whereas service robots were preferred for standardized and simple services, such as room delivery. Among various areas of a hotel, housekeeping (55%), front desk (54%), room service (48%), and concierge (41%) were the areas where the participants expected to see service robots.

3.2.2. Results

The assumptions for subsequence data analyses were met. The manipulation check showed that the scenario worked as intended (Table 1). The standardized factor loading for brand experience was greater than .85, and the average variance explained (AVE) was .77, supporting convergent validity (Fornell & Larcker, 1981; Gefen et al., 2000). Cronbach's alpha was equal to or greater than .93, showing sufficient internal consistency (Nunnally & Bernstein, 1978) (Appendix B).

The three-way analysis of variance (ANOVA) revealed there was no three-way interaction effect of service failures, attribution of service failures, and (in)voluntary adoption of service robots on brand experience (F=.66, p>.05). However, there was a significant two-way interaction of service failures (pre/post) and attribution of service failures on brand experience (F=6.81, p<.05). Thus, H4a was partially supported. As there was a significant interaction effect, simple main effect of service failures was assessed. The simple main effect of service failures showed that hotel consumers' brand experience (F=.19, adjusted-p>.05) was not significantly

affected by service failure caused by consumers, whereas robot-attributed service failure had a significantly negative impact on their brand experience (F=11.46, adjusted-p<.01). More specifically, the simple main effects results indicated that hotel consumers who experienced robot-attributed failure had a significantly lower brand experience, compared to pre-failure brand experience ($diff_{\text{Pre-Post}}$=.34, adjusted-p<.05, CI[.003,.670]). As the two-way ANOVA showed that there was a significant simple main effect of service failures on brand experience (F=8.80, p<.01), a post-hoc analysis was conducted. Service failures had a negative impact on brand experience ($diff_{\text{Pre-Post}}$=.19, t=3.14, adjusted-p<.05, CI[.005,.373]), supporting H1. Hotel consumers' brand experience (F=4.51, adjusted-p<.05) was significantly affected by consumers' (in)voluntary adoption of service robots, supporting H3. Thus, the main effect of (in)voluntary adoption of service robots was investigated. Brand experience ($diff_{\text{Involuntary-Voluntary}}$=-.23, t=-2.48, adjusted-p<.05, CI[-.418,-.048]) was significantly lower for those participants who were required to use service robots (i.e., involuntary). The main effect of attribution and interaction effect of (in)voluntary adoption and attribution was insignificant possibly because 'time (i.e., pre- and post- service failures)' was not considered. More specifically, attribution itself was closely associated with the occurrence of service failures. Thus, without service failure, the main effect of attribution of service failure and interaction with voluntariness should be insignificant, as supported by the results. Interestingly, the main effect of voluntariness on brand experience was significant without considering the occurrence of service failure, supporting H3. Specifically, consumers who have a freedom of choosing service robots more favorably evaluated their brand experience, which might be attributed to perceived control. The interaction between (in)voluntary adoption and time (i.e., pre- and post- service failure) was insignificant as consumers' brand experience decreased as service failure occurred regardless of voluntary

adoption, showing parallel lines. In other words, service failure itself negatively influenced brand experience regardless of (in)voluntary adoption.

Table 1. Study 1 Results

Manipulation (Failure Attribution)	*t*	*p*	M_{Guest}	M_{Robot}
Guest Attribution	12.35	< .001***	5.59	3.75
Robot Attribution	-9.29	< .001***	3.58	5.37
Effect on General Brand Experience	***DFn***	***DFd***	***F***	***p***
Voluntary	1	221	4.51	< .05*
Attribution	1	221	1.83	> .05
Time	1	221	8.80	< .05*
Voluntary:Attribution	1	221	0.57	> .05
Voluntary:Time	1	221	1.38	> .05
Attribution:Time	1	221	6.81	< .05*
Voluntary:Attribution:Time	1	221	0.66	> .05

3.3.3 Brief Discussion

Study 1 evaluated the causal effects of service failures, attribution of service failures, and involuntary adoption of service on consumers' brand experiences in the context of hotel concierge service. The negative impacts of service failures on brand experience were much stronger when consumers were required to adopt service robots. In other words, there was a spillover effect on consumers' overall evaluations of a hotel's brand experience with failures when they were required (i.e., involuntary adoption) to adopt robot services.

Study 2 seeks to strengthen the generalizability of these results as the context of Study 1 could be construed as rather restricted: consumers do not necessarily use concierge services. To address this gap, Study 2 investigates these causal effects (i.e., robot service failure and involuntary adoption) in the context of front desk, while including additional dependent

constructs (i.e., consumers' experience with the robot itself, and their intention to adopt hotel service robots in the future). In this regard, Study 2 reinforces the findings of Study 1 in a new context and with different measures, thereby strengthening the robustness of the causal effects.

3.3. Study 2: Extended casual effects of robot service failure at the front desk context

3.3.1. Research Design and Participants

In contrast to Study 1, which employed a mixed-design quasi-experiment, Study 2 used a 2 (voluntary vs. involuntary adoption of service robots) X 2 (consumer-attributed vs. robot-attributed service failure) between-subject quasi-experiment. To achieve 80% power at .05 significance level, the minimum sample size was 193 with a small-medium effect size (Cohen's $f^2 = .04$) for the two-way interaction effect. Thus, the minimum sample size was set at 200. The survey was developed on Qualtrics, and MTurk panels were invited to participate in the survey. The preliminary experiment provided support that the front desk context was consistent (i.e., in terms of service failure magnitude) with the concierge context in Study 1.

At the beginning of the survey, a series of screening questions were asked to ensure the representativeness of the sample. As in Study 1, STR hotel scales were given to the participants to choose the level of service of their usual hotel stays, followed by items asking them to select a hotel brand they were aware of. The manipulation for (in)voluntary adoption was assigned based on the participants' selection. However, the participants were randomly assigned to one of the two service failure attribution scenarios. After the participants were asked to answer manipulation check items (Appendix C), the measurement items for the construct of interests were provided. Consumers' robot experience was measured with three items from Kim and Choi (2016). The measurement items were adopted from previous studies: brand experience (Kim et

al., 2018), robot experience (Kim & Choi, 2016), robot adoption intention (Lee, 2018) (Appendix B). The survey ended with items asking about the participants' sociodemographic information. To ensure the data quality, a variety of attention and quality check items were included (Lu et al., 2022).

After screening out the participants who had participated in Study 1, a total of 203 complete questionnaires were collected (Appendix D). Thus, the minimum sample size was met. About half of the participants were female (51%) and the Millennials (52%). More than half (59%) of the participants' primary purpose of hotel stays was bleisure. About 35% of the respondents typically stayed at upper-midscale hotels. Consistent with Study 1, approximately two-fifths of the participants answered that their preference of service agent would depend on the situation/tasks. The participants anticipated seeing service robots at the front desk (64%), room service (47%), housekeeping (37%), and concierge (34%).

3.3.2. Results

First of all, the assumptions were tested, and the results were satisfactory. The manipulation check showed that the scenario worked as intended ($p<.001$) (Table 2). The distribution of the data was normal. The standardized factor loading was equal to or greater than .84. The AVE ranged from .85 to .97. Thus, convergent validity was established (Fornell & Larcker, 1981; Gefen *et al*., 2000) (Appendix B). The square root of AVE for a construct was greater than the bivariate correlation with any other constructs, supporting discriminant validity. Cronbach's alpha was equal to or greater than .94, supporting internal consistency (Nunnally & Bernstein, 1978).

The two-way ANOVA results indicated that there was no significant interaction effect between the attribution of service failures and (in)voluntary adoption of service robots on brand experience (F=.49, p>.05), robot experience (F=.03, p>.05), and intention to adopt service robots (F=1.03, p>.05). Furthermore, the insignificant main effects of the attribution of service failures on brand experience (F=.26, p>.05), robot experience (F=.80, p>.05), and intention to adopt service robots (F=2.01, p>.05) were found, thus H2 was not supported. The ANCOVA results (controlling service failure magnitude) were consistent, but the effects of service failure magnitude were significant. The insignificant results might be attributed to the significant impacts of service failure itself, suggesting the critical impacts of service failure on consumers' evaluation of their experiences with brands, robots, and future intentions.

(In)voluntary adoption of service robot significantly affected brand experience (F=4.52, p<.001), robot experience (F=19.33, p<.001), and intention to adopt service robots (F=53.71, p<.001), supporting H3. Those who voluntarily adopted service robots had a more positive brand experience ($diff_{\text{Involuntary-Voluntary}}$=-.36, t=-2.13, adjusted-p<.05, CI[-.698,-.027]), robot experience ($diff_{\text{Involuntary-Voluntary}}$=-1.10, t=-4.36, adjusted-p<.001, CI[-1.601,-.604])), and adoption intention ($diff_{\text{Involuntary-Voluntary}}$=-1.68, t=-7.44, adjusted-p<.001, CI[-2.121,-1.233]) than those who adopted service robots involuntarily. In other words, the significant impacts of (in)voluntary adoption of service robots on brand experience, robot experience, and intention to adopt service robots were consistent across Study 1 and Study 2, supporting H3.

Table 2. Study 2 Results

Manipulation (Failure Attibution)	*t*	*p*	M_{Guest}	M_{Robot}
Guest Attribution	11.43	< .001***	5.87	3.18
Robot Attribution	-10.10	< .001***	2.81	5.33
Manipulation (Voluntary Adoption)	*t*	*p*	$M_{Voluntary}$	$M_{Involuntary}$
Voluntary Adoption	-9.17	< .001	5.92	3.93
Effect on Brand Experience	*DFn*	*DFd*	*F*	*p*
Voluntary	1	199	4.52	< .05*
Attribution	1	199	0.26	> .05
Voluntary:Attribution	1	199	0.45	> .05
Effect on Robot Experience	*DFn*	*DFd*	*F*	*p*
Voluntary	1	199	19.33	< .001***
Attribution	1	199	0.80	> .05
Voluntary:Attribution	1	199	0.03	> .05
Effect on Robot Intention	*DFn*	*DFd*	*F*	*p*
Voluntary	1	199	53.71	< .001***
Attribution	1	199	2.01	> .05
Voluntary:Attribution	1	199	1.03	> .05

3.3.3. Brief Discussion

The findings indicated that the attribution of service failures was not a significant factor affecting consumers' robot experience, and adoption intention. On the other hand, it was found that consumers' (in)voluntary adoption of service robots was a significant determinant of robot experience, and intention to adopt hotel service robots in the future. Specifically, the negative effect of required (i.e., involuntary) adoption of service robots was the strongest on consumers' intention to adopt hotel service robots in the future, followed by robot experience and brand experience. Interestingly, when comparing robot experiences with the neutral point (i.e., 4), those who were required to adopt service robots (i.e., involuntary) had significantly negative robot experience (t=-6.00, p<.001), whereas robot experiences of those who voluntarily adopted service robots was not significantly different from the neutral point (t=.47, p>.05).

4. General Discussion

The goal of this research was to examine robot service failures, in the event of involuntary adoption, could affect consumer's brand experiences, robot experiences, and intentions to adopt service robots in the future. The research was premised on the notion that the dichotomous debate between high tech and high touch has evolved into a more 'balanced' view as hotels across all levels increasingly adopt robot technology as a result of consumers' consciousness for health and safety from the pandemic. Furthermore, the significant labor shortage in the hospitality sector worldwide has placed consumers into a newfound situation where they are 'required' (i.e., involuntary adoption) to use self-serve, robot technology as part of their hospitality experiences. Nevertheless, robot service failures are inevitable; yet, how such service failures negatively spillover to consumers' overall evaluations of a hotel's brand experience across different contexts (e.g., front desk and concierge) remain unexplored.

In addressing this gap, Study 1 of this research found a two-way interaction effect of service failure and attribution of service failure on brand experience. Specifically, the results revealed that hotel consumers' brand experience was not negatively affected by service failures attributed to themselves. As proposed by the attribution theory (Weiner, 1992), hotel consumers investigated who caused the service failure. If service failures were caused by hotel consumers themselves, their brand experience was not negatively affected by service failures because they were responsible for the failures and could have been avoided if they had paid attention (Iglesias, 2009). Whereas, if a service failure occurred because of the robot's systematic error, consumers' brand experience was negatively affected, similar to the study of Leo and Huh (2020). The finding proposed that hotel consumers might have perceived service robots as a part of the hotel brand and wanted to blame the hotel brand for the service failures. In other words, hotel

consumers might want to punish and/or criticize the hotel brand as it implemented the service robots in operation despite the possibility of malfunctions.

According to the balance theory (Heider, 1946) and the cognitive dissonance theory (Festinger, 1957), when consumers perceive a dissonance, they try to reduce the discomfort resulted from their cognitive dissonance by changing their attitude. Thus, when service failures occurred (negative factor), hotel consumers changed their perception of the hotel brand (i.e., brand experience) to maintain consistency in their minds. Furthermore, the results of Study 1 indicated that consumers unfavorably evaluated their brand experience when they experienced service failures. Thus, this finding further supports previous studies (Kim et al., 2022; Sengupta et al., 2015) that consumers tend to have an unfavorable perception and/or attitude when their expectations are not met.

Study 2 showed that consumers' (in)voluntary adoption of service robots significantly influenced brand experience, robot experience, and intention to adopt service robots. Particularly, the results revealed that hotel consumers who voluntarily adopted service robots had significantly higher brand experience, robot experience, and intention to adopt hotel service robots than those who did not want to adopt service robots. It might be explained by cognitive bias (Heider, 2013). Consumers tend to change their perceptions to protect themselves (Yen et al., 2004). Accordingly, when hotel consumers voluntarily adopt service robots, and a service failure occurs, they might not want to make an internal attribution since it would negatively affect their self-esteem or ego (Jackson, 2019). Thus, they might have tried to minimize their responsibility and protect their ego by maintaining favorable attitudes. When consumers were required to use service robots despite their reluctance, consumers' self-serving bias appeared by claiming more responsibility for service failures (Bendapudi & Leone, 2003). Even though

consumers were involved in the human-robot interactions, they tend to evaluate the service providers (i.e., hotel brands, service robots) in unfavorable ways. The negative impact of involuntary adoption of service robots on brand experience might be caused by consumers' punishment of hotel brands for forcing them to use service robots. Furthermore, the significant effects of (in)voluntary adoption of service failure on consumers' brand experience, robot experience, and adoption intention might be further explained by the psychological reactance theory (Brehm, 1966). More specifically, as they were 'required' to use the service robots regardless of their preference, they perceived loss of their freedom to choose their own service agent, which in turn developed negative attitudes/perceptions of their experiences with the brand and the robot, as well as their adoption intentions.

4.1. Theoretical Implications

This research contributes to the literature by adding a temporal perspective to the concept of brand experiences in the hospitality industry. Previous studies typically considered brand experiences as a static outcome via cross-sectional studies or one-shot experimental designs (Chan & Tung, 2019). This research adds to the literature by showing that brand experience is a dynamic concept that could vary depending on consumers' evaluations of their onsite service experiences at a hotel. Specifically, consumers' views of brand experiences could change as a result of their experiences with robot-attributed service failures. As Study 1 (mixed-design experiment) showed, service failures during human-robot interactions in hotels could damage consumers' subsequent brand experiences compared to their prior evaluations no matter who caused the service failure. Therefore, the findings of this research, particularly Study 1, provide further evidence that brand experience includes pre-consumption and during-consumption

experiences (Ding & Tseng, 2015), and consumers' brand experience with hotels is significantly affected by the hotel's brand-related stimuli, including staff competence (Imran & Zillur, 2017).

Second, this research deepens the understanding of consumers' evaluations following service failures in conjunction with (in)voluntary adoption of service robots. Despite the increasing number of service failures occurring when consumers were interacting with service robots, studies about service failures associated with service robots have been primarily conducted to understand how internal aspects of service failures (e.g., service robots' morphology) affect consumers' reactions and subsequent evaluations (e.g., Choi et al., 2021; Lv et al., 2021). Accordingly, the current understanding of how the situational factors affect consumers' response to service failures, such as (in)voluntary adoption of service failure, has been limited. To address the gap in the literature, drawing upon appraisal theory (Lazarus, 1991), attribution theory (Weiner, 1985), and psychological reactance theory (Brehm, 1966), this research examined the effects of situational factors (e.g., attribution of service failure, (in)voluntary adoption of service robots) on consumers' evaluation of their experiences with hotel brands and robots, and adoption intention. Therefore, this research provides a more comprehensive understanding of consumers' subsequent evaluation of service failures.

This research also offers a methodological contribution by developing two sets of experimental scenarios in two different areas of a hotel (i.e., concierge and front desk) through a preliminary experiment. The findings indicated that two contexts were not statistically different in respondents' perceptions (i.e., service failure magnitude, negative emotion, realism), highly realistic, and invariant in terms of the measurement items for constructs of interest. Furthermore, this research employed multi-study approach with the two sets of robotic service failures scenarios in different contexts within a hotel, thereby extending the boundary of service failures

associated with service robots by testing and comparing the proposed relationships in different contexts. Furthermore, the findings of Study 1 and Study 2 were consistent, indicating the generalizability of the proposed research model.

4.2. Practical Implications

The present research also offers practical implications. From a practical perspective, over the past few years, more and more hotels have tried to capitalize on their customers' experiences with robots. The results of this research showed, however, that hotels need to be cognizant of the risks of experimenting with service robots, as robot-attributed service failures may negatively impact customers' perceptions of brand experience. Furthermore, hotels may desire to automate touch-points at the front desk and concierge to address labor shortages in the hospitality industry and change consumers' psychology for health and hygiene as travel recovers (Cheung et al., 2021). In doing so, hotels are recommended to maintain a certain number of human staff and make it clear to customers that alternatives are available (i.e., human staff) so that customers do not feel compelled to use service robots if they are reluctant, as involuntary adoption of service robots might harm their subsequent evaluations of the hotel's brand experience.

Second, this research reminds the hotel industry that service failures can damage not only consumers' consumption experience (e.g., robot experience) but also brand experience. In other words, the negative impacts of service failure are not limited to consumers' experience with the specific service encounter. Rather service failures can deteriorate the relationship between consumers and hotel brands. Specifically, the results indicated that consumers' brand experience was severely affected by robot-attributed service failures (e.g., system errors), whereas their brand experience was not affected when they were responsible for the service failures. Therefore,

when implementing service robots in its operation, the hotel industry is recommended to consider potential risks of service failures, especially for failures caused by the service robots. For example, hotels utilizing service robots in consumer-facing areas (e.g., front desk, concierge) may consider regular upgrades of their robots to reduce technical glitches and unexpected errors.

Third, the results showed that consumers' brand experience was significantly lower when consumers were required to adopt service robots (i.e., involuntary adoption), and service failures occurred, compared to when they voluntarily used service robots. Accordingly, the hotel industry should provide consumers with options of human staff and service robots, rather than substituting human staff with service robots. Considering the results of this research, consumers' negative brand experiences with fully robot-staffed hotels might be attributed to the fact that there were no other options but to use service robots regardless of their willingness/reluctance.

4.3. Limitations and Future Research

This research has several limitations. First, given the difficulty of conducting a field study for service failures (Choi et al., 2021), this research solely relied on scenario-based experiments. Although preliminary studies were conducted to verify the developed scenarios and their realism, the findings of this research might not accurately reflect and predict hotel consumers' behaviors (Kim & Jang, 2014). Second, this research only focused on concierge and front desk areas of a hotel. Thus, the findings might not be generalized to other areas of a hotel, such as room service delivery and housekeeping where service robots are commonly implemented. Thus, future studies are recommended to apply the research framework of this study to other areas of a hotel to increase the external validity. Another limitation of this research is the data collection period. This research was conducted in early 2022 when the COVID-19

pandemic echoed around the world. Accordingly, the findings might be divergent in the post-pandemic era. Therefore, it is advised to replicate the present research when the pandemic ends to increase the ecological external validity. In addition, since this research was conducted only with participants residing in the U.S., future studies may conduct a cross-cultural study to enhance the external validity of the population. Last, this research examined the interaction effects of (in)voluntary adoption of service robots and attribution of service failures. Future studies may include potential moderators, such as time pressure and failure types, to investigate conditioning effects, thereby providing a deeper understanding of consumers' perceptions of robotic service failures.

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Appendix

Appendix A. Sample Scenarios

Voluntary Adoption of Service Robot & Robot Attributed Service Failure in Concierge Context

Assume that you were staying at [Hotel Brand] for your three-day vacation.
In order to enjoy your dinner, you already booked a table for dinner at the restaurant, Bistro 1979 at 6 pm. Since your phone is out of battery, you cannot get the direction to Bistro 1979. So, you wanted to ask a concierge at [Hotel Brand] about how to get to the restaurant, Bistro 1979. At the concierge desk, there were one robot concierge and one human concierge. Among them, you voluntarily chose the robot concierge to ask the direction to the restaurant, Bistro 1979. When you approached the robot concierge, the robot greeted you and asked how it can help you with. So, you asked the robot concierge about how to get to Bistro 1979. However, in the middle of the conversation, it froze for a while. Then, it said that a system error occurred, and asked you to wait a few minutes and try again. So, you waited a minute and tried again with the robot concierge. However, the same problem happened.

Involuntary Adoption of Service Robot & Guest Attributed Service Failure in Front Desk Context

Assume that you were staying at [Hotel Brand] for your three-day vacation.
As your flight arrived at midnight, we wanted to check-in as quickly as possible.
At the front desk, there were one robot front desk agent and one human front desk agent. However, the human front desk agent was helping other customers. So, there was no option other than the robot front desk agent. Thus, you had to complete the check-in process with the robot front desk agent. In order to check-in with the robot, you had to provide your reservation number and a few information. The robot said you would be given a PIN number to access your room, after successfully check-in. When you were about halfway done with the check-in process, you got an important phone call. So, you were not attentive to the instructions. Because you were inattentive to the instruction, you answered your last name when you were asked your first name, and answered your first name when you needed to provide your last name. So, the robot said, “The information is not found in our reservation information. Please try it again with the correct information.” So, you had to terminate the process and try it again with the robot. Then, you mistakenly provided a wrong reservation number. Eventually, the entire check-in process took much longer than you expected.

Appendix B. Key Measures

Constructs/Items	Study 1						Study 2					
	Mean	SD	FL	α	CR	AVE	Mean	SD	FL	α	CR	AVE
Brand Experience (Kim, Shin, & Koo, 2018)				0.93	0.93	0.77				0.94	0.94	0.80
I feel good when I experience [Hotel Brand].	5.47	1.13	0.87				5.22	1.27	0.92			
[Hotel Brand] gives me pleasure.	5.43	1.20	0.86				5.06	1.34	0.85			
It is fun to experience [Hotel Brand].	5.44	1.23	0.87				5.19	1.35	0.89			
Experiencing [Hotel Brand] is enjoyable.	5.54	1.23	0.90				5.31	1.33	0.92			
Robot Experience (Kim & Choi, 2016)				NA	NA	NA				0.97	0.97	0.91
I would say that the experience with the robot was excellent.	NA	NA	NA	NA	NA	NA	3.50	1.89	0.96			
I believe that I got a great experience with the robot.	NA	NA	NA	NA	NA	NA	3.44	1.90	0.93			
I think that my experience with the robot was excellent.	NA	NA	NA	NA	NA	NA	3.49	2.00	0.97			
Robot Intention (Lee, 2018)				0.96	0.96	0.89				0.95	0.95	0.76
I intend to use the robot for the next time.	4.70	1.66	0.94				4.22	1.91	0.84			
I expect to use the robot in the future.	4.98	1.72	0.93				4.52	1.88	0.85			
I plan to use the robot in the future.	4.89	1.76	0.96				4.37	1.94	0.93			

Appendix C. Sample Manipulation Check Items and Control Variables

Realism (Shin & Jeong, 2020)

- Very unclear to understand … very clear to understand
- Very difficult to imaging … very easy to imaging
- Very unrealistic … very realistic
- Unlikely to occur in a real life … likely to occur in a real life

Voluntary Adoption Manipulation (Shin, 2021)
Using the robot in the hotel was …

- Involuntary … voluntary
- Compulsory … noncompulsory
- Required … optional
- My choice … recommended by the hotel

Attribution of Service Failure (Kim, So, & Mihalik, 2022)

- I was responsible for the problem.
- The robot was responsible for the problem

Service Failure Magnitude (Control Variable: Obeidat, Xiao, Iyer, & Nicholson, 2017)
Please select the option that best describes your opinion about the given scenario.

- What happened in the given scenario caused me inconvenience.
- What happened in the given scenario caused me aggravation.
- What happened in the given scenario caused me problems.

Negative Emotion (Control Variable: Harrison-Walker, 2019)
To what extent did you feel as a consequence of the service failure in the given scenario?

- Anger
- Frustration
- Irritation
- Disappointment
- Regret
- Uncertainty

Appendix D. Participants' socio-demographic information

Sociodemographic (N = 428)	Total		Study 1 (n = 225)		Study 2 (n = 203)	
	N	%	n	%	n	%
Gender						
Male	204	47.7%	107	47.6%	97	53.0%
Female	217	50.7%	113	50.2%	104	56.8%
Prefer not to disclose	7	1.6%	5	2.2%	2	1.1%
Age Generation						
Generation Z (1995 or later)	38	8.9%	20	8.9%	18	9.8%
Late Millennials (1987 - 1994)	129	30.1%	72	32.0%	57	31.1%
Early Millennials (1980 - 1986)	111	25.9%	62	27.6%	49	26.8%
Generation X (1965 - 1979)	105	24.5%	47	20.9%	58	31.7%
Baby Boomers (1946 - 1964)	42	9.8%	23	10.2%	19	10.4%
The Silient (1945 or before)	3	0.7%	1	0.4%	2	1.1%
Education Level		0.0%				
Less than high school degree	1	0.2%	0	0.0%	1	0.5%
High school graduate	43	10.0%	24	10.7%	19	10.4%
Associate degree	46	10.7%	20	8.9%	26	14.2%
Bachelor's degree	259	60.5%	137	60.9%	122	66.7%
Postgraduate Degree	77	18.0%	43	19.1%	34	18.6%
Others	2	0.5%	1	0.4%	1	0.5%
Employment Status		0.0%		0.0%		
Employed full time	348	81.3%	185	82.2%	163	89.1%
Employed part time	19	4.4%	8	3.6%	11	6.0%
Self-employed or business owner	32	7.5%	12	5.3%	20	10.9%
Unemployed or students	16	3.7%	11	4.9%	5	2.7%
Retired	7	1.6%	5	2.2%	2	1.1%
Others	6	1.4%	4	1.8%	2	1.1%
Household Income Level				0.0%		
$30,000 or less	54	12.6%	30	13.3%	24	13.1%
$30,001 to $50,000	88	20.6%	50	22.2%	38	20.8%
$50,001 to $70,000	106	24.8%	54	24.0%	52	28.4%
$70,001 to $90,000	82	19.2%	40	17.8%	42	23.0%
$90,001 to $110,000	44	10.3%	21	9.3%	23	12.6%
More than $110,000	53	12.4%	29	12.9%	24	13.1%
Prefer not to disclose	1	0.2%	1	0.4%	0	0.0%
Ethinicity						
Caucasian	357	83.4%	187	83.1%	170	92.9%
Black or African American	32	7.5%	13	5.8%	19	10.4%
Asian	13	3.0%	6	2.7%	7	3.8%
Hispanic	15	3.5%	13	5.8%	2	1.1%
Others	11	2.6%	6	2.7%	5	2.7%
Stay Purpose		0.0%				0.0%

Exclusively business	41	9.6%	30	13.3%	11	6.0%
Bleisure	259	60.5%	139	61.8%	120	65.6%
Exclusively leisure	128	29.9%	56	24.9%	72	39.3%
Typical Hotel Level of Service						
Economy	60	14.0%	32	14.2%	28	15.3%
Midscale	85	19.9%	39	17.3%	46	25.1%
Upper Midscale	160	37.4%	90	40.0%	70	38.3%
Upscale	59	13.8%	32	14.2%	27	14.8%
Upper Upscale	37	8.6%	22	9.8%	15	8.2%
Luxury	17	4.0%	10	4.4%	7	3.8%
Hotel Loyalty Membership						
Yes	221	51.6%	119	52.9%	102	55.7%
No	178	41.6%	91	40.4%	87	47.5%
Not sure	29	6.8%	15	6.7%	14	7.7%
Previous Robot Experience						
Never	158	36.9%	69	30.7%	89	48.6%
Once or twice	190	44.4%	106	47.1%	84	45.9%
Three to five times	59	13.8%	33	14.7%	26	14.2%
More than five times	21	4.9%	17	7.6%	4	2.2%
Service Robot Failure Experience						
Never	110	40.7%	58	37.2%	52	45.6%
Once or twice	140	51.9%	89	57.1%	51	44.7%
Three to five times	18	6.7%	7	4.5%	11	9.6%
More than five times	2	0.7%	2	1.3%	0	0.0%
Service Agent Preference						
Human	123	28.7%	54	24.0%	69	37.7%
Robot	115	26.9%	73	32.4%	42	23.0%
Depends on the situation/task	173	40.4%	89	39.6%	84	45.9%
No specific preference	17	4.0%	9	4.0%	8	4.4%
Areas of Robot Services						
Front Desk	251	58.6%	122	54.2%	129	70.5%
Concierge	160	37.4%	92	40.9%	68	37.2%
Housekeeping	199	46.5%	124	55.1%	75	41.0%
Reservation	211	49.3%	111	49.3%	100	54.6%
Room Service	202	47.2%	107	47.6%	95	51.9%
Bellman/Doorman	97	22.7%	47	20.9%	50	27.3%
Other Areas (Please specify)	18	4.2%	13	5.8%	5	2.7%
No area is acceptable for a service robot	11	2.6%	8	3.6%	3	1.6%