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Darina Vorobeva^a, Diego Costa Pinto^a, Nuno António^a, Anna S. Mattila^b

^a NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Nova de Lisboa, Portugal

^b School of Hospitality Management, Pennsylvania State University, University Park, PA, USA

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Darina Vorobeva*

NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Portugal

Diego Costa Pinto

NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Portugal

Nuno António

NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Portugal

Anna S. Mattila

School of Hospitality Management, Pennsylvania State University, University Park, Pennsylvania, USA

*Corresponding author

E-mail: dvorobeva@novaims.unl.pt; Phone: +351 915 354 957; +351 920 388 730
NOVA Information Management School (NOVA IMS), Universidade Nova de Lisboa, Campus de Campolide, 1070-312 Lisboa, Portugal

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Although Artificial Intelligence is a big revolution in the tourism and hospitality industry, prior research provides little insight into how customers respond to AI replacement and how providers can mitigate AI aversion. Drawing on the Feeling Economy framework, three studies examine how customers react to a different framing of AI replacement (augmentation vs. substitution) compared to using only human employees, affecting their acceptance of AI-based services. The findings contribute to the tourism and hospitality literature by revealing that framing AI as augmentation (vs. substitution) can increase enjoyment and ease of use and improve AI acceptance. Consistent with the Feeling Economy account, the findings highlight the proposed mechanism of enjoyment and perceived ease of use underlying the AI framing effects. This research provides important theoretical and managerial implications for tourism and hospitality providers, helping them understand how to effectively introduce AI-based services to win customers' acceptance.

Keywords: artificial intelligence, feeling economy, hospitality, tourism, technology acceptance.

1. Introduction

Artificial Intelligence (AI) is becoming a new norm in the tourism and hospitality industry, creating massive opportunities and challenges for researchers and practitioners alike (Ozdemir et al., 2023; Tussyadiah, 2020). Recent studies show that nine in ten leading businesses are investing in AI and that 62% of customers are willing to use AI to enhance their experience, causing significant disruption in the field (Lin, 2020; Makridis & Mishra, 2022). Indeed, the use of advanced technologies has enabled several opportunities for AI-based services in the tourism and hospitality domain: e-concierge services in hotels (Gosjen et al., 2023), airport services (Gursoy et al., 2019; Lv et al., 2022), restaurants (Blöcher & Alt, 2021), and virtual reality tours (Bec et al., 2021). Most notably, the COVID-19 pandemic further increased the inclination for

robotic automation in the hospitality industry (Polemis & Stengos, 2021; Yoganathan et al., 2021), raising awareness of the benefits and drawbacks of AI. AI can be defined as the ability of artificial entities to perform tasks commonly associated with intelligent beings (Stahl, 2021).

Although the disruptive technology presence in the tourism and hospitality domain has significantly increased, research suggests that consumers might be reluctant to accept AI as a service (Holthöwer & van Doorn, 2022; Ozdemir et al., 2023). Consequently, theoretical and empirical investigation is imperative to explore how customers' AI aversion can be mitigated or possibly even avoided. Such research is crucial because demand-side factors might incentivize companies to retain human labour that otherwise would be replaced by technology (Granulo et al., 2021). Nevertheless, AI adoption processes and consequent advantages are still not fully understood (Venkatesh, 2021) since there is scant research investigating customer preferences for automated products (Leung et al., 2019).

Given this paucity in the literature, this research examines customer perceptions of different AI framing types (i.e., augmentation, full substitution) and what drives their acceptance of AI-based services. Augmentation refers to the use of technology to enhance or complement human abilities or performance, pairing AI and humans amplifies productivity and reduces costs (Jabeen et al., 2021). Human-AI collaboration is the key characteristic of service evolution (X. Y. Leung, 2020). In contrast, substitution is a full replacement of human labor or specific tasks with technology such as AI or robots. Substitution is not a straightforward replacement of humans by different technologies. Some tasks are easier to replace by machines than others (Tussyadiah, 2020). By integrating the augmentation/substitution duet with the Feeling Economy (Huang et al., 2019; Rust & Huang, 2021), we contribute to the literature by revealing

that an augmentation (vs. substitution) framing is more acceptable for consumers because it includes the vital characteristics of both worlds: feeling (enjoyment) and thinking (ease of use).

Despite the prevalent use of AI-based technologies in everyday life, the human touch is still invaluable for consumers in the field of tourism and hospitality. According to the Feeling Economy framework (Huang et al., 2019; Rust & Huang, 2021), technological developments should be actively introduced for the prosperity of business while combining key capabilities inherent to human feeling-related features with AI's thinking capabilities (e.g., Vorobeva et al., 2022).

This study aims to address the following research questions: How different types of framing of AI replacement can shape consumers' acceptance of AI? Under which conditions can AI-based services be more acceptable and enjoyable for consumers? To that end, this research: (1) conducts a sentiment analysis about AI in the tourism and hospitality context; (2) examines whether customers' willingness to accept AI-based services depends on whether AI replaces or augments human employees; and (3) identifies the unique factors that underlie customer perceptions (perceived enjoyment and perceived ease of use).

The Feeling Economy framework proposes that the advance of AI will change the balance between AI and human intelligence, prioritizing feeling-based and social tasks for humans (Huang et al., 2019; Rust & Huang, 2021). Indeed, AI has already outperformed humans in mechanical and analytical tasks but in not interpersonal and empathetic tasks (Huang et al., 2019; Rust & Huang, 2021). This suggests that augmenting the capabilities of AI technology with human abilities benefits service providers (Huang & Rust, 2021b) and creates new opportunities (Brynjolfsson, 2022). Resistance to AI is frequently driven by a lack of human communication, ethical issues,

and fear of replacement by AI human workers (Granulo et al., 2021; Huang & Rust, 2021a; Vorobeva et al., 2022). Therefore, this research proposes that framing AI as augmentation (vs. substitution) can benefit from both worlds: apply the strongest AI capabilities – thinking tasks (ease of use), then, most importantly, provide feeling-related advances (enjoyment).

By doing so, the current research makes several key contributions to the literature. First, by conducting a systematic literature review, we demonstrate a lack of empirical research examining different AI framing types (augmentation vs. substitution) in tourism and hospitality settings. Xiao and Kumar (2021) suggest that technology's influence on customer service and how firms should adopt technology remains largely unknown. We tackle these issues by performing qualitative (sentiment analyses) and quantitative (experimental studies) research. Compared to AI substitution, we show that framing AI as augmentation increases customers' willingness to accept AI-based services. Third, merging an AI framing approach with the Feeling Economy, we reveal unique underlying processes– i.e., the combination of feeling (enjoyment) and thinking (ease of use) features and their impact on consumers' willingness to accept AI.

2. Theoretical background

Innovative technologies have become a vital part of customer experiences, and accordingly, AI has gained attention among tourism and hospitality businesses (Choi et al., 2020; Jung et al., 2023; Seyitoğlu & Ivanov, 2020). Prior research suggests that the impact of AI on service encounters depends on employees' and customers' acceptance of the role of technology (Chi et al., 2020). A lack of understanding of AI by users and customers remains the main obstacle to its extensive adoption. A successful introduction of AI and robotics into customer service is a substantial challenge for most companies (Xiao & Kumar, 2021), including tourism and hospitality.

AI is an intelligent machine that can substitute people mainly for technical tasks (Huang et al., 2019). The recently introduced socio-economic paradigm, the Feeling Economy, suggests that the advance of AI will augment human intelligence, making humans focus on feeling intelligence and social tasks (Huang et al., 2019; Rust & Huang, 2021). ‘Feeling tasks are social, emotional, communicative, and interactive’ (Huang et al., 2019, p. 49), while thinking tasks are complex and rule-based (Huang et al., 2019). Yet, despite the knowledgeable role of AI in the Feeling Economy, little is known whether consumers are still feeling- and relationship-oriented in tourism and hospitality settings, given the exponential ubiquity of technology.

Intelligent machines are often presented with exaggerated optimism or equally exaggerated pessimism. In their meta-research, Davenport et al. (2020) discuss a wide variety of factors why customers perceive AI negatively. For instance, AI (vs. humans) cannot differentiate what makes one customer different from another (Granulo et al., 2021; Longoni et al., 2019). Moreover, AI bots are proven to be seen as less empathetic (Lv et al., 2022). Customers have a lower tendency to accept AI if an activity is crucial to a customer’s unique identity or has symbolic value (Granulo et al., 2021; E. Leung et al., 2019). Moreover, not only customers but service employees as well might also face adverse outcomes, such as fear of being replaced by AI and lower job performance (Vorobeva et al., 2022).

On the other hand, recent research accentuates the progressive impact of AI on society in general and on customers in particular: AI-driven economic growth and increased well-being (Makridis & Mishra, 2022), overwhelmingly positive customer experiences with service robots (Filiari et al., 2022), and positive influence on service quality by anthropomorphizing service robots (Yoganathan et al., 2021).

2.1. Augmentation vs. Substitution in tourism and hospitality

While AI is a real threat to employment, it is also a significant source of innovation. To tackle this double-edged sword, Huang and Rust (2018) identified four categories of intelligence applied to service: mechanical, analytical, intuitive, and empathetic.

According to their theorizing, AI first substitutes some tasks. The next phase is known as augmentation, followed by the replacement of human employees. Larivière et al. (2017) highlight substitution and augmentation as two key facets of service automation. McLeay et al. (2021) investigate customers' responses to service robots substituting (vs. augmenting) service employees and urge practitioners to consider substitution with caution. To further investigate AI framing perspectives (augmentation vs. substitution), we conducted a systematic literature review focusing on the tourism and hospitality domain (see Table 1). For the methodological procedure based on PRISMA, see Appendix A.

[Table 1 near here]

We applied the following search query ((tourism OR travel OR hospitality) AND (artificial intelligence OR AI OR robot OR technology OR virtual assistant OR voice assistant OR virtual reality OR chatbot)) AND (augmentation OR substitution OR automation)). We further examine if the authors of the respective papers also cognized the Feeling economy paradigm and employed an experimental design or sentiment analysis. In short, many studies are conceptual, emphasizing the importance of further investigation of AI-based technology in the tourism and hospitality industry (Buhalis et al., 2019; Ivanov, 2019; X. Y. Leung, 2020; Tussyadiah, 2020; Webster & Ivanov, 2020). In addition, only two papers included mediation analyses (Seo & Lee, 2021; Tong et al., 2022), and only Kim et al. (2022) adopted sentiment analysis. None of the articles combined a data mining approach and an experimental design.

Although the papers theoretically discuss augmentation and/or substitution framing, raising the issue of job replacement by technologies (Buhalis et al., 2019; R. Leung, 2019; Tong et al., 2022; Webster & Ivanov, 2020) and presenting augmentation as a possible solution of such problem (Buhalis et al., 2019; Jabeen et al., 2021; Tussyadiah, 2020), none of them empirically contrasted the two strategies. This further enhances our potential contribution to this important body of literature.

Concerning the Feeling Economy, only two papers discuss the older versions of this paradigm in their theoretical development (Blöcher & Alt, 2021; Gupta et al., 2022). However, our research adds to earlier work on AI replacement in services ((Huang & Rust, 2018) identified in several papers in our systematic review (Kim et al., 2022; Tong et al., 2022; Webster & Ivanov, 2020) by contributing to more recent views on the Feeling Economy (Huang et al., 2019; Rust & Huang, 2021) and adding the empirical comparison of AI framing (augmentation vs. substitution). The most recent version of the Felling Economy framework proposes that AI implementation might already replace analytical and thinking tasks, with human employees actively moving toward performing more social, interpersonal, and empathetic tasks (i.e., feeling tasks) (Huang et al., 2019; Rust & Huang, 2021). Forming collaboration between AI and humans will maximize its potential effects by using an augmentation perspective (Huang & Rust, 2021b). Hence, we anticipate that customers tend to be more willing to accept AI when it augments human employees rather than fully replaces them. Accordingly, we put forth the following:

H1: Customers have a higher acceptance of AI-augmented service providers (vs. AI substitution).

2.2. The mediating role of perceived enjoyment and ease of use

This study further examines the underlying mechanisms for customer preferences for augmented human-AI service delivery in the tourism and hospitality context by testing the Feeling Economy – related variables. For instance, enjoyment is indeed a substantial aspect of tourism experiences as well as a crucial factor in technology usage (Loureiro, 2015). Moreover, it can positively influence customer satisfaction and loyalty (Ruan et al., 2021). Overall, scholars indicate that enjoyment positively affects tourists' behaviours and intentions (Ayeh et al., 2013; Loureiro, 2015). As an intrinsic trait, enjoyment is strongly linked with using a particular technology (Ayeh et al., 2013). Some studies place enjoyment as a crucial domain representing user experience (Bressler & Bodzin, 2013), particularly when the primary purpose of technology has a hedonic function (Van Der Heijden, 2004), such as in tourism (Pomfret, 2021). Therefore, we include enjoyment as one of the mediators.

Augmentation combines the strongest qualities of humans and AI, and the latter is known for its impeccable execution of thinking tasks. For example, perceived ease of use is one of the underlying elements of technology acceptance and usage (Kucukusta et al., 2015). Some studies have demonstrated the causal relationship between enjoyment and perceived ease of use (Sun & Zhang, 2006). The extent to which an individual recognizes that using a certain technology would require a minimum effort is referred to as perceived ease of use (Davis, 1989). Perceived ease of use affects people's attitude toward intended behaviour (Kucukusta et al., 2015), which in this research is the willingness to accept the service. Hence, by combining an AI framing approach with the Feeling Economy, we explore unique underlying processes that are key to tourism and hospitality – i.e., the combination of feeling (enjoyment) and thinking (ease of use) features and their potential impact on consumers' willingness to accept AI. We thus

propose that augmentation (compared to AI substitution framing) results in a higher acceptance of AI-based services mediated by perceived enjoyment and ease of use.

Therefore, we predict that:

H2: Enjoyment and perceived ease of use mediate the AI framing effect on customers' willingness to accept AI services.

3. Overview of the studies

To better understand how customers react to AI-based services, we conducted sentiment analysis (study 1) and two online experiments in different tourism and hospitality contexts (studies 2 and 3). To probe our initial suggestion that substitution is less favourable (vs. augmentation), we conducted Study 1 ($N = 350,348$). This study examines the general sentiment about AI and other disruptive technologies by analysing Twitter posts with text mining techniques. Based on real-life comments, we discovered a different sentiment toward AI augmentation vs. substitution. We further replicate these findings in an online experiment (study 2, $N = 231$) and explore consumers' willingness to accept AI-based services framed as augmentation, substitution, or human work. Finally, study 3 ($N = 253$) provides corroborating evidence for the influence of AI framing (augmentation vs. substitution) vs. human service employees on consumers' willingness to accept AI-based service. Further, this research investigates the mediating role of enjoyment and ease of use. The experimental studies (studies 2 and 3) were pre-registered (AsPredicted #58580, #102378).

3.1. Study 1. AI framing in tourism and hospitality

Study 1 aims to offer initial evidence of customer sentiment towards AI and innovative technology in the tourism and hospitality context. Most importantly, we demonstrate

that tweets related to augmentation carry a more positive sentiment than those about the substitution.

Social media content related to tourism and hospitality has become a very powerful source of information (Alaei et al., 2019). Twitter is a prevalent platform where people share their opinions and experiences, making it an ideal data source for sentiment analysis. Sentiment analysis is crucial to understand the population's perceptions and defining the credibility of content (Ribeiro et al., 2016). Sentiment analysis quantifies opinions according to their polarity (negative, positive, neutral) (Liu & Zhang, 2012). By allocating polarity value to each review, we can detect and compare users' posts' sentiments (Phillips et al., 2020).

Design and Procedures. We collected public opinions via Twitter API and analysed data in Python. The tweets were collected from January 2019 until the mid of January 2022, amounting to 506,812 tweets. The following search query was applied: (tourism OR travel OR tour OR restaurant OR hotel OR museum OR 'tourist office' OR airport OR booking) ('artificial intelligence' OR AI OR robot OR automation OR technology OR 'intelligent machine' OR 'virtual assistant' OR 'voice assistant' OR 'virtual reality' OR chatbot OR bot). The query represents the combination of two research topics: tourism and hospitality domain and AI-based technology. First, the keywords were extracted from the WTO webpage about tourism and travel-related services (*WTO / Services: Tourism and Travel-Related Services*, n.d.). Then, the set of the most common AI-related terms.

Next step, we eliminated repetitive tweets (retweets) and obtained 350,348 unique tweets. A fundamental step in sentiment analysis for further text mining is the pre-processing phase (such as deleting URLs, punctuation marks, etc.) Hence, the dataset was pre-processed and lemmatized (to gain a word's base or dictionary form).

We applied the VADER sentiment analyses package, which has demonstrated good accuracy in tweets' sentiment classification (Elbagir & Yang, 2019). The following compound was used: most extreme negative (-1), most extreme positive (1). The following threshold values were applied to convert a quantitative to a qualitative value: positive tweets with a compound score ≥ 0.05 and neutral tweets with a compound score between -0.05 and 0.05. Negative tweets have a compound score of ≤ -0.05 (Hutto & Gilbert, 2014).

Next, tweets related to technological augmentation (e.g., 'augment', 'complement', 'supplement') and substitution ('replace', 'eliminate', 'substitute') were extracted and analysed. This analysis resulted in the creation of two additional datasets with the sentiment of each tweet. Table 2 summarizes the findings.

[Table 2 near here]

Then, we explored word associations. We applied N-grams analysis, which is often used to investigate which words frequently show up together (Yang, 2020). We explored the combination of two words, i.e., Bigrams. Such analysis provides an opportunity to extract the most discussed topics.

Results. Through the sentiment analysis, we discovered that 60.44% ($N = 211,738$) of the tweets were positive, 16.14% ($N = 56,540$) of the tweets were negative, and 23.42% ($N = 82,069$) had a neutral connotation. The compound score was 0.27. Furthermore, the tweets related to augmentation had a similar sentiment: 68.15% positive, 26.10% neutral, and only 5.76% negative. Conversely, when we examined tweets linked to substitution, the pattern shifted - 21.98% of such tweets were negative, and the amount of neutral and positive tweets dropped to 23.13% and 54.89%, respectively. A Kruskal-Wallis test confirmed that the difference in sentiment between substitution-related ($M = 0.19$, $SD = 0.45$) and augmentation-related ($M = 0.36$, $SD =$

0.36) tweets is statistically significant ($KW \chi^2 = 131.04, p < 0.001$), indicating tweets related to augmentation carry a more positive sentiment than those connected to substitution.

After identifying the top bigrams (Figure 1), the most frequently occurring combination of the words' collocation, the following results were obtained, specifically: 'time travel' comes as the most frequent combination, which most probably relates to the phrase 'time to travel', but we deleted stop words during the pre-processing phase. Although, the following two phrases are of most significant interest to us, namely, 'virtual reality' and 'restaurant bots', implying such terms have the utmost interest in public opinion on a topic covering AI and other disruptive technologies in the field of tourism and hospitality services. Latter findings provide a fruitful area for further investigation.

[Fig. 1 near here]

Discussion. The findings indicate that the sentiment towards different tourism-related technologies is mainly positive. Nevertheless, when we split the pool of tweets based on substitution and augmentation, the sentiments differed in valence. Tweets related to technology substitution have a higher percentage of negative connotations, while tweets about augmentation were more positive. These results provide initial evidence for H1. Although Twitter's content is beneficial for grasping the general sentiment of real public opinions, statistical inference is limited. Thus, we conducted studies 2 and 3 to gather more evidence regarding customers' acceptance of AI framing in tourism and hospitality settings.

3.2. Study 2. AI framing experiment

Study 2 aims to provide corroborating evidence for the influence of AI framing (augmentation vs. substitution) vs. human employees on customers' willingness to

accept AI services. Using snowball sampling, Master students from a major European university shared the Qualtrics link to a study on social media. Respondents were randomly assigned to one of the three scenarios: service performed by substitution (only AI), augmentation (AI and human together), and only human. Next, they were presented with a set of questions capturing the dependent variable (willingness to accept the service agent) and manipulation checks.

Design and Procedures. An online experiment with a between-subjects design was conducted, and AI framing was manipulated by augmentation, substitution, and control (human) (see McLeay et al. (2021)). An AI-infused service robot was introduced as either fully replacing gate agents (substitution) or assisting human gate agents with boarding procedures (augmentation). Only human staff was present in the control scenario. Scenarios can be found in Appendix B.

Respondents were asked to answer a set of questions measuring their willingness to accept the service agent (measurements can be found in Appendix C). A 9-point Likert scale was used where 1 - strongly disagree and 9 - strongly agree. After the screening process, 231 (56.3% women, 79.2% with a university degree) valid responses were obtained. We coded data using orthogonal linear contrasts (substitution = -1, control = 0, augmentation = 1) (Thompson & Malaviya, 2013). As a manipulation check, participants were asked to indicate if they 1 - strongly disagree or 9 - strongly agree whether the scenario was performed by Mario, the airline employee ($M = 4.49$, $SD = 2.92$), Mario, the airline robot ($M = 6.67$, $SD = 2.50$), or both the airline employee and the robot ($M = 5.30$, $SD = 2.83$) ($F_{(2;458)} = 36.920$, $p < 0.001$).

Results. A One-way ANOVA with SIDAK post hoc test was used to compare the three conditions – total substitution, augmentation, and human service delivery on willingness to accept the service agent ($M_{\text{aug}} = 7.10$, $M_{\text{sub}} = 6.30$, $M_{\text{cont}} = 7.33$, $F_{(2;228)} =$

7.078, $p < 0.001$, $\eta_p^2 = 0.058$). Moreover, post hoc tests using the SIDAK comparison showed that there is a significant difference in willingness to accept between substitution and control (a human employee) ($p < 0.001$), substitution and augmentation ($p = 0.019$) but no significant differences between augmentation and control (a human employee) ($p = 0.812$).

Discussion. There was a significant difference in the substitution vs. augmentation condition (supporting H1), as well as in the substitution and control condition. In other words, full substitution by AI (vs. a human employee or augmented service provider) results in a lower willingness to accept the service agent. Yet, there was no difference between human and augmented service delivery. These findings suggest that the service provided by a human agent is not different from the augmented service combining both humans and AI. This effect could be explained by the fact that augmented service can offer an AI-based approach and involves human touch, which has been proven a critical factor in the tourism and hospitality domain (Ivanov et al., 2023). In the subsequent study, we investigate how human-related and AI-related service characteristics from the Feeling Economy can affect consumers' willingness to accept such services.

3.3. Study 3. *The underlying mechanism of AI framing*

Study 3 aims to provide additional evidence for customers' willingness to accept different service delivery modes (augmented service vs. AI substitution vs. human employee) in the hospitality context. We also examine whether perceived enjoyment and ease of use mediate the AI framing on customers' willingness to accept the service.

Study 3 employed the same experimental design approach as in study 2 while being heedful of the underlying mechanism of the proposed phenomena by testing different sets of mediators (perceived enjoyment and ease of use) as well as the

existence of alternative mediation (empathy, warmth, and productivity). Respondents were asked to answer a set of questions measuring their willingness to accept the service (the dependent variable), mediators, and manipulation check questions.

Design and Procedures. An online experiment was conducted, and AI framing was manipulated by augmentation, substitution, and control (human) (see Appendix B). An AI-infused hotel robot was introduced as either fully replacing a receptionist (substitution) or assisting a human receptionist by showing the room and explaining the hotel's rules (augmentation). Only human staff was present in the control scenario.

Respondents were asked to answer a set of questions measuring their willingness to accept the service agent, perceived ease of use, and enjoyment (variables and items can be found in Appendix C). A 9-point Likert scale was used where 1 - strongly disagree and 9 - strongly agree. The data was collected on Prolific. 253 (39.5% women, $M_{\text{age}}=26.18$, 68.4% with a university degree) valid responses were obtained. We coded data using orthogonal linear contrasts (substitution = -1, control = 0, augmentation = 1) (Thompson & Malaviya, 2013). As a manipulation check, participants were asked to choose if the service was delivered by a human hotel employee ($N = 86$), an AI-based service robot ($N = 82$), or both ($N = 85$) ($\chi^2(4) = 172.455, p < 0.001$).

In study 3, we also tested several alternative mediators (feeling-related: empathy, and warmth; thinking-related: productivity). Empathy (three items, $\alpha = 0.829$, de Kervenoael et al., 2020), warmth (three items, $\alpha = 0.749$, Peng et al., 2022), and productivity (four items, $\alpha = 0.836$, Green et al., 2005) were measured on a 9-point Likert scale. Appendix C lists the scales.

Results. A One-way ANOVA with SIDAK post hoc test was used to compare the three conditions – total substitution, augmentation, and human service delivery on willingness to accept the service agent ($M_{\text{aug}} = 6.91, SD = 1.51; M_{\text{sub}} = 6.30, SD = 1.89;$

$M_{\text{cont}} = 7.07$, $SD = 1.70$; $F_{(2;250)} = 4.676$, $p < 0.01$, $\eta_p^2 = 0.036$). Moreover, post hoc tests using the SIDAK comparison showed that there is a significant difference in willingness to accept between substitution and control (a human employee) ($p < 0.05$) marginal difference between substitution and augmentation ($p = 0.066$) but no significant differences between augmentation and control (a human employee) ($p = 0.903$).

Next, we analyse if enjoyment and ease of use influence consumers' willingness to use AI-based service agents. The sequential mediation effect was analysed by PROCESS 3.1 for SPSS, model 6 (Hayes, 2013). The model predicts that willingness to accept is serially mediated through enjoyment and perceived ease of use (Figure 2). The mediation model is based on 5,000 bootstrap samples.

[Fig. 2 near here]

To analyse the serial-mediation model (Figure 2), a bootstrap test of serial mediation verified the predicted mechanism via enjoyment (mediator 1) and perceived ease of use (mediator 2). First, the results demonstrate that service provider type [augmentation (coded 1) vs. human (coded 0) vs. substitution (coded -1)] significantly affected perceived enjoyment ($b = 0.32$, $SE = 0.13$; $p < 0.05$; 95% CI (0.07; 0.57)). Second, perceived enjoyment influenced perceived ease of use ($b = 0.58$, $SE = 0.04$; $p < 0.01$; 95% CI (0.50; 0.66)), and perceived ease of use had a positive effect on willingness to accept the service ($b = 0.14$, $SE = 0.05$; $p < 0.01$; 95% CI (0.04; 0.24)). The total effect was also significant ($b = 0.30$, $SE = 0.13$; $p < 0.05$; 95% CI (0.04; 0.56)).

Alternative mediators. We also examined potential mediators (feeling-related empathy and warmth; thinking-related productivity) for the proposed interaction between the type of AI framing (independent variable) on willingness to accept a service agent using PROCESS Model 4 with 5,000 bootstrapped samples (Hayes, 2013). The index of mediation analyses showed no significant effect of any potential

mediators on willingness to accept (empathy: $b = 0.001$; 95% CI : -0.01 to 0.01; warmth: $b = 0.02$; 95% CI : -0.005 to 0.06; productivity: $b = 0.005$; 95% CI : -0.04 to 0.05).

Therefore, the proposed alternative mediators did not have a significant effect of AI framing on willingness to accept a service agent.

Discussion. There was a significant difference in the substitution vs. augmentation condition (supporting H1), as well as in the substitution and control condition (human employee). In other words, full substitution by AI (vs. a human employee or augmented service provider) results in a lower willingness to accept the service. Yet, there was no difference between human delivery and AI-augmented service delivery. Most importantly, we show that AI substitution evokes lower enjoyment and lower perceived ease of use, which in turn reduces customers' willingness to accept such services (supporting H2). We demonstrate that an alternative solution, augmentation, enhances perceived enjoyment and ease of use, thus leading to a higher willingness to accept the service delivery mode. Congruent with the Feeling Economy framework (Huang et al., 2019; Rust & Huang, 2021), we show that augmentation (vs. substitution) framing is more acceptable because it embraces the vital characteristics of both humans and AI: feeling (enjoyment) and thinking (ease of use). Thus, this study indicates that tourism and hospitality companies must carefully consider the most suitable forms of AI integration. Such companies might want to focus on human employees and smartly augment human work with AI, i.e., maintaining a balance between feeling (human-related) vs. thinking (AI-related) services. The full substitution of human work with AI might backfire since it incites lower customer acceptance.

4. General discussion

We conducted three studies (text mining and two online experiments) to test our predictions. Study 1 demonstrates that the public sentiment collected from Twitter is more negative towards substitution than augmented services. Study 2 shows that AI framing (augmentation vs. substitution) vs. human employee significantly influences consumers' willingness to accept AI-based services. Study 3 suggests that customers prefer augmented service providers to AI substitution. Further, we identified perceived enjoyment and perceived ease of use as the underlying mechanisms explaining the AI framing effect in the context of tourism and hospitality services.

4.1. Theoretical implications

This research offers several contributions to tourism and hospitality literature by integrating the Feeling Economy perspective of augmentation (vs. substitution) framing on customers' willingness to accept AI-based services. Innovative technologies like AI can add value to tourism and hospitality customers. McLeay et al. (2021) underscore the importance of customers understanding the positive and negative consequences of technology-driven service delivery. Our findings indicate that augmentation is a more appropriate solution for AI integration in the tourism and hospitality context since AI substitution negatively affects customers' willingness to accept AI-based services. Our findings are consistent with three dominant books on AI (Brynjolfsson & McAfee, 2014; Daugherty & Wilson, 2018; Davenport & Kirby, 2016) by revealing unique augmentation effects, combining feeling and thinking features. Overall, the augmentative approach is one of the possible solutions at the current stage of technology development, combining alternative skills of humans and AI's power to induce customer acceptance of AI-based services. Moreover, we contribute to recent theoretical work on augmentation (Davenport & Miller, 2022), underlining the

leveraging effect of combing the best of people and machines to work effectively together.

Indeed, our studies add empirical evidence to conceptual research (see Table 1 for a systematic literature review) suggesting that customers prefer augmentation framing to AI substitution. Such resistance to AI is commonly explained by a lack of human communication, ethical issues, and a high potential for unemployment (Granulo et al., 2021; Huang & Rust, 2021a; Vorobeva et al., 2022). These findings build upon the theory of the Feeling Economy (e.g., Huang et al., 2019) and emphasize the importance of customers' orientation towards feeling- and relationship traits (i.e., enjoyment) because AI can partially or fully perform many analytical and thinking dimensions of work. In particular, our findings add to the Feeling Economy by showing that the detrimental effects of AI presence alone decrease customers' willingness to accept the service due to a lack of feeling-related characteristics.

Most importantly, the prioritization of AI-augmented services is explained by two sequential processes: perceived enjoyment and ease of use. AI only (substitution framing) is perceived more negatively because it is considered less enjoyable and harder to use. These findings can be explained by the fact that enjoyment can be defined as the satisfaction of customers' unique needs (Tamborini et al., 2010), and AI is less capable of grasping what makes each customer different (Granulo et al., 2021; Longoni et al., 2019). Adding to recent research on the Feeling Economy (Rust & Huang, 2021), we advance the current knowledge of technological development in tourism and hospitality, shifting toward the balance between AI and humans.

Nevertheless, we do not propose to neglect technological substitution, but it should be cautiously applied. Augmenting or substituting service employees for technology is a managerial decision (Marinova et al., 2017). A recent study suggests

that AI might be more acceptable for functional services, while using AI devices for hedonic services such as hospitality & tourism might backfire

4.2. *Practical implications*

This research provides critical insights for tourism and hospitality firms in introducing AI-based services. First, tourism and hospitality managers must introduce technological substitution very carefully. Full substitution is perceived negatively not only by employees (Vorobeva et al., 2022) but also by customers. Our findings show that customers prefer human service providers to service delivery powered by AI. The next best thing is to partially replace human employees – i.e., augmentation. Therefore, the allocation of investment in AI and adoption strategies should be cautiously designed based on customer acceptance.

Developing and providing tourism experiences involves orchestrating various components based on a detailed understanding of customer requirements (Tussyadiah, 2020). Consequently, disruptive technologies should be introduced carefully. For instance, AI is still perceived as less enjoyable and harder to use. The human presence is needed to enhance enjoyment and ease of use, thus influencing consumers' willingness to accept AI-based services. . Tourism and hospitality businesses should consider the demand-side factors and retain human labour that AI could otherwise substitute to satisfy their customers' needs.

Finally, the effective introduction of technology into customer service is a crucial challenge for most companies (Xiao & Kumar, 2021). Tourism and hospitality managers must have strategic flexibility and respond readily to constantly changing technology innovations. For instance, AI can assist hotels in minimizing their fixed costs and support liquidity (Polemis & Stengos, 2021). More recently, tourism and hospitality providers can use new generative AI tools like ChatGPT to interact with

customers (Whitmore, 2023). However, according to our findings, tourism and hospitality managers must carefully consider such tools because although they might be *easy to use*, they will not cover the *enjoyment* that AI-augmented travel services offer. It can also potentially create physical and emotional distance between customers and service providers (Seyitoğlu & Ivanov, 2020).

4.3. *Limitations and future research*

This paper provides promising opportunities for future research. We focused on AI framing (augmentation vs. substitution) vs. human service employees with perceived enjoyment and ease of use as the underlying processes to examine customers' acceptance of AI-based services. Future research should examine other potential mediators, such as trust, emotions (feeling-related), other thinking-related mediators, or measure alternative downstream consequences (i.e., repurchase or revisit intention). Future research should also observe customer acceptance of restaurant bots and virtual reality in the tourism and hospitality context.

Further, empirical research is needed to investigate the AI framing (augmentation vs. substitution) across hedonic and utilitarian services. For instance, certain attributes might be more relevant for hedonic services due to differential relations to customers' identities (Davenport et al., 2020). More recently, Longoni and Cian (2022) highlight the importance of utilitarian attributes regulating the inclination of AI recommenders (vs. humans).

Several limitations of this study also provide directions for future research. First, our data were collected during the pandemic. COVID-19 has drastically affected human communication, given the lack of social interactions (Calbi et al., 2021; de Figueiredo et al., 2021), which could provoke higher resilience toward AI integration using a

substitution framing. Future research should analyse the post-pandemic situation with AI.

To conclude, constant innovations in AI development and integration in the tourism and hospitality industry indicate that AI-based services are here to stay. Therefore, understanding the interplay between human touch and technology is crucial.

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The authors report there are no competing interests to declare.

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References:

- Alaei, A. R., Becken, S., & Stantic, B. (2019). Sentiment Analysis in Tourism: Capitalizing on Big Data. *Journal of Travel Research*, 58(2), 175–191.
<https://doi.org/10.1177/0047287517747753>
- Ayeh, J. K., Au, N., & Law, R. (2013). Predicting the intention to use consumer-generated media for travel planning. *Tourism Management*, 35, 132–143.
<https://doi.org/10.1016/J.TOURMAN.2012.06.010>
- Bec, A., Moyle, B., Schaffer, V., & Timms, K. (2021). Virtual reality and mixed reality for second chance tourism. *Tourism Management*, 83, 104256.
<https://doi.org/10.1016/J.TOURMAN.2020.104256>
- Blöcher, K., & Alt, R. (2021). AI and robotics in the European restaurant sector: Assessing potentials for process innovation in a high-contact service industry. *Electronic Markets*, 31, 529–551. <https://doi.org/10.1007/s12525-020-00443-2/Published>
- Bressler, D. M., & Bodzin, A. M. (2013). A mixed methods assessment of students' flow experiences during a mobile augmented reality science game. *Journal of Computer Assisted Learning*, 29(6), 505–517.
<https://doi.org/10.1111/JCAL.12008/SUPPINFO>
- Brynjolfsson, E. (2022). The Turing Trap: The Promise & Peril of Human-Like Artificial Intelligence. *Stanford Digital Economy Lab*. <http://brynjolfsson.com>
- Brynjolfsson, E., & McAfee, A. (2014). *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*. New York: Norton.
- Buhalis, D., Harwood, T., Bogicevic, V., Viglia, G., Beldona, S., & Hofacker, C. (2019). Technological disruptions in services: lessons from tourism and hospitality. *Journal of Service Management*, 30(4), 484–506. <https://doi.org/10.1108/JOSM-12-2018-0398/FULL/PDF>

- Calbi, M., Langiulli, N., Ferroni, F., Montalti, M., Kolesnikov, A., Gallese, V., & Umiltà, M. A. (2021). The consequences of COVID-19 on social interactions: an online study on face covering. *Scientific Reports*, *11*(1), 2601. <https://doi.org/10.1038/s41598-021-81780-w>
- Chi, O. H., Denton, G., & Gursoy, D. (2020). Artificially intelligent device use in service delivery: a systematic review, synthesis, and research agenda. *Journal of Hospitality Marketing and Management*. <https://doi.org/10.1080/19368623.2020.1721394>
- Chi, O. H., Gursoy, D., & Chi, C. G. (2020). Tourists' Attitudes toward the Use of Artificially Intelligent (AI) Devices in Tourism Service Delivery: Moderating Role of Service Value Seeking: <https://doi.org/10.1177/0047287520971054>, *61*(1), 170–185. <https://doi.org/10.1177/0047287520971054>
- Choi, Y., Oh, M., Choi, M., & Kim, S. (2020). Exploring the influence of culture on tourist experiences with robots in service delivery environment. *Current Issues in Tourism*, *24*(5), 717–733. <https://doi.org/10.1080/13683500.2020.1735318>
- Daugherty, P. R., & Wilson, H. J. (2018). *Human+ machine: Reimagining work in the age of AI*. Harvard Business Review Press.
- Davenport, T. H., Guha, A., Grewal, D., & Bressgott, T. (2020). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, *48*(1), 24–42. <https://doi.org/10.1007/s11747-019-00696-0>
- Davenport, T. H., & Miller, S. M. (2022). *Working with AI: Real Stories of Human-Machine Collaboration*. The MIT Press. <https://books.google.pt/books?hl=en&lr=&id=f79WEAAAQBAJ&oi=fnd&pg=PR9&dq=Working+With+AI:+Real+Stories+of+Human-Machine+Collaboration&ots=WBhSY5n5sV&sig=XuThNUExUOOxKw5tQ0uR>

LYoUyQ&redir_esc=y#v=onepage&q=Working%20With%20AI%3A%20Real%20Stories%20of%20Human-Machine%20Collaboration&f=false

Davenport, T., & Kirby, J. (2016). *Only humans need apply: Winners and losers in the age of smart machines*. HarperCollins.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly: Management Information Systems*, 13(3), 319–339. <https://doi.org/10.2307/249008>

de Figueiredo, C. S., Sandre, P. C., Portugal, L. C. L., Mázala-de-Oliveira, T., da Silva Chagas, L., Raony, Í., Ferreira, E. S., Giestal-de-Araujo, E., dos Santos, A. A., & Bomfim, P. O. S. (2021). COVID-19 pandemic impact on children and adolescents' mental health: Biological, environmental, and social factors. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 106, 110171. <https://doi.org/10.1016/J.PNPBP.2020.110171>

de Kervenoael, R., Hasan, R., Schwob, A., & Goh, E. (2020). Leveraging human-robot interaction in hospitality services: Incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots. *Tourism Management*, 78, 104042. <https://doi.org/10.1016/J.TOURMAN.2019.104042>

Elbagir, S., & Yang, J. (2019). Twitter sentiment analysis using natural language toolkit and Vader sentiment. *Lecture Notes in Engineering and Computer Science*, 2239, 12–16.

Filieri, R., Lin, Z., Li, Y., Lu, X., & Yang, X. (2022). Customer Emotions in Service Robot Encounters: A Hybrid Machine-Human Intelligence Approach. *Journal of Service Research*, 2022(4), 614–629. <https://doi.org/10.1177/10946705221103937>

- Gosjen, D. I., Haryadi, K. H., Nicholas, Gunawan, A. A. S., Djuwita, C. M., & Adiati, M. P. (2023). Implementation e-concierge in hotel. *Procedia Computer Science*, 216, 485–498. <https://doi.org/10.1016/J.PROCS.2022.12.161>
- Granulo, A., Fuchs, C., & Puntoni, S. (2021). Preference for human (vs. robotic) labor is stronger in symbolic consumption contexts. *Journal of Consumer Psychology*. <https://doi.org/10.1002/jcpy.1181>
- Green, G. C., Hevner, A. R., & Collins, R. W. (2005). The impacts of quality and productivity perceptions on the use of software process improvement innovations. *Information and Software Technology*, 47(8), 543–553. <https://doi.org/10.1016/J.INFSOF.2004.10.004>
- Gupta, S., Modgil, S., Lee, C. K., Cho, M., & Park, Y. (2022). Artificial intelligence enabled robots for stay experience in the hospitality industry in a smart city. *Industrial Management and Data Systems*, 122(10), 2331–2350. <https://doi.org/10.1108/IMDS-10-2021-0621/FULL/PDF>
- Gursoy, D., Chi, O. H., Lu, L., & Nunkoo, R. (2019). Consumers acceptance of artificially intelligent (AI) device use in service delivery. *International Journal of Information Management*. <https://doi.org/10.1016/j.ijinfomgt.2019.03.008>
- Hayes, A. F. (2013). Introduction to Mediation, Moderation, and Conditional Process Analysis: A ... - Andrew F. Hayes - Google Books. In *The Guilford Press*.
- Holthöwer, J., & van Doorn, J. (2022). Robots do not judge: service robots can alleviate embarrassment in service encounters. *Journal of the Academy of Marketing Science*, 1–18. <https://doi.org/10.1007/S11747-022-00862-X/TABLES/2>
- Huang, M. H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172. <https://doi.org/10.1177/1094670517752459>

- Huang, M. H., & Rust, R. T. (2021a). Engaged to a Robot? The Role of AI in Service. *Journal of Service Research*, 24(1), 30–41.
<https://doi.org/10.1177/1094670520902266>
- Huang, M. H., & Rust, R. T. (2021b). A Framework for Collaborative Artificial Intelligence in Marketing. *Journal of Retailing*.
<https://doi.org/10.1016/J.JRETAI.2021.03.001>
- Huang, M.-H., Rust, R., & Maksimovic, V. (2019). The Feeling Economy: Managing in the Next Generation of Artificial Intelligence (AI). *California Management Review*, 61(4), 43–65. <https://doi.org/10.1177/0008125619863436>
- Huang, M.-H., & Rust, R. T. (2018). Artificial Intelligence in Service. *Journal of Service Research*, 21(2), 155–172. <https://doi.org/10.1177/1094670517752459>
- Hutto, C. J., & Gilbert, E. (2014). VADER: A Parsimonious Rule-based Model for Sentiment Analysis of Social Media Text. In *Proceedings of the International AAAI Conference on Web and Social Media* (Vol. 8, Issue 1). <http://sentic.net/>
- Ivanov, S. (2019). Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries? *Zeitschrift Für Tourismuswissenschaft*, 11(1), 25–43. <https://doi.org/10.1515/TW-2019-0003>
- Ivanov, S., Webster, C., & Seyitoğlu, F. (2023). Humans and/or robots? Tourists' preferences towards the humans–robots mix in the service delivery system. *Service Business*, 17(1), 195–231. <https://doi.org/10.1007/S11628-022-00517-5/TABLES/7>
- Jabeen, F., Al Zaidi, S., & Al Dhaheri, M. H. (2021). Automation and artificial intelligence in hospitality and tourism. *Tourism Review*, 77(4), 1043–1061.
<https://doi.org/10.1108/TR-09-2019-0360/FULL/PDF>

- Jung, I., Quan, W., Yu, J., & Han, H. (2023). Are you ready for robot services? Exploring robot-service adoption behaviors of hotel-goers. *International Journal of Hospitality Management*, 109, 103404.
<https://doi.org/10.1016/J.IJHM.2022.103404>
- Kim, T., Jo, H., Yhee, Y., & Koo, C. (2022). Robots, artificial intelligence, and service automation (RAISA) in hospitality: sentiment analysis of YouTube streaming data. *Electronic Markets*, 32, 259–275. <https://doi.org/10.1007/s12525-021-00514-y>
- Kucukusta, D., Law, R., Besbes, A., & Legohérel, P. (2015). Re-examining perceived usefulness and ease of use in online booking the case of Hong Kong online users. *International Journal of Contemporary Hospitality Management*, 27(2), 185–198.
<https://doi.org/10.1108/IJCHM-09-2013-0413/FULL/PDF>
- Larivière, B., Bowen, D., Andreassen, T. W., Kunz, W., Sirianni, N. J., Voss, C., Wunderlich, N. V., & De Keyser, A. (2017). ‘Service Encounter 2.0’: An investigation into the roles of technology, employees and customers. *Journal of Business Research*, 79, 238–246. <https://doi.org/10.1016/j.jbusres.2017.03.008>
- Leung, E., Paolacci, G., & Puntoni, S. (2019). Man Versus Machine: Resisting Automation in Identity-Based Consumer Behavior. *Journal of Marketing Research*. <https://doi.org/10.1177/0022243718818423>
- Leung, R. (2019). Smart hospitality: Taiwan hotel stakeholder perspectives. *Tourism Review*, 74(1), 50–62. <https://doi.org/10.1108/TR-09-2017-0149/FULL/PDF>
- Leung, X. Y. (2020). Technology-enabled service evolution in tourism: a perspective article. *Tourism Review*, 75(1), 279–282. <https://doi.org/10.1108/TR-06-2019-0229/FULL/PDF>
- Lin, Y. (2020). *10 Artificial Intelligence Statistics You Need to Know in 2021*. Oberlo. <https://www.oberlo.com/blog/artificial-intelligence-statistics>

- Liu, B., & Zhang, L. (2012). A survey of opinion mining and sentiment analysis. *Mining Text Data*, 9781461432234, 415–463. https://doi.org/10.1007/978-1-4614-3223-4_13/COVER
- Longoni, C., Bonezzi, A., & Morewedge, C. K. (2019). Resistance to Medical Artificial Intelligence. *Journal of Consumer Research*. <https://doi.org/10.1093/jcr/ucz013>
- Longoni, C., & Cian, L. (2022). Artificial Intelligence in Utilitarian vs. Hedonic Contexts: The ‘Word-of-Machine’ Effect. *Journal of Marketing*, 86(1), 91–108. <https://doi.org/10.1177/0022242920957347>
- Loureiro, S. M. C. (2015). The Role of Website Quality on PAD, Attitude and Intentions to Visit and Recommend Island Destination. *International Journal of Tourism Research*, 17(6), 545–554. <https://doi.org/10.1002/JTR.2022>
- Lu, V. N., Wirtz, J., Kunz, W. H., Paluch, S., Gruber, T., Martins, A., & Patterson, P. G. (2020). Service robots, customers and service employees: what can we learn from the academic literature and where are the gaps? In *Journal of Service Theory and Practice*. <https://doi.org/10.1108/JSTP-04-2019-0088>
- Lv, X., Yang, Y., Qin, D., Cao, X., & Xu, H. (2022). Artificial intelligence service recovery: The role of empathic response in hospitality customers’ continuous usage intention. *Computers in Human Behavior*, 126, 106993. <https://doi.org/10.1016/J.CHB.2021.106993>
- Makridis, C. A., & Mishra, S. (2022). Artificial Intelligence as a Service, Economic Growth, and Well-Being. *Journal of Service Research*, 2022(4), 505–520. https://doi.org/10.1177/10946705221120218/ASSET/IMAGES/LARGE/10.1177_10946705221120218-FIG2.JPEG
- Marinova, D., de Ruyter, K., Huang, M.-H., Meuter, M. L., & Challagalla, G. (2017). Getting Smart: Learning From Technology-Empowered Frontline Interactions.

Journal of Service Research, 20(1), 29–42.

<https://doi.org/10.1177/1094670516679273>

McLeay, F., Osburg, V. S., Yoganathan, V., & Patterson, A. (2021). Replaced by a

Robot: Service Implications in the Age of the Machine: *Journal of Service Research*, 24(1), 104–121. <https://doi.org/10.1177/1094670520933354>

Ozdemir, O., Dogru, T., Kizildag, M., & Erkmen, E. (2023). A critical reflection on

digitalization for the hospitality and tourism industry: value implications for stakeholders. *International Journal of Contemporary Hospitality Management*, ahead-of-print(ahead-of-print). [https://doi.org/10.1108/IJCHM-04-2022-](https://doi.org/10.1108/IJCHM-04-2022-0535/FULL/PDF)

0535/FULL/PDF

Peng, C., van Doorn, J., Eggers, F., & Wieringa, J. E. (2022). The effect of required

warmth on consumer acceptance of artificial intelligence in service: The moderating role of AI-human collaboration. *International Journal of Information Management*, 66, 102533. <https://doi.org/10.1016/J.IJINFOMGT.2022.102533>

Phillips, P., Antonio, N., de Almeida, A., & Nunes, L. (2020). The influence of

geographic and psychic distance on online hotel ratings. *Journal of Travel Research*, 59(4), 722–741. <https://doi.org/10.1177/0047287519858400>

Polemis, M. L., & Stengos, T. (2021). Threshold effects during the COVID-19

pandemic crisis: evidence from international tourist destinations. *Current Issues in Tourism*, 25(3), 387–393. <https://doi.org/10.1080/13683500.2021.1960286>

Pomfret, G. (2021). Family adventure tourism: Towards hedonic and eudaimonic well-

being. *Tourism Management Perspectives*, 39, 100852.

<https://doi.org/10.1016/J.TMP.2021.100852>

Ribeiro, F. N., Araújo, M., Gonçalves, P., Gonçalves, M. A., & Benevenuto, F. (2016).

SentiBench - a benchmark comparison of state-of-the-practice sentiment analysis

methods. *EPJ Data Science*, 5, 1–29. <https://doi.org/10.1140/epjds/s13688-016-0085-1>

Ruan, W. Q., Yang, T. T., Zhang, S. N., Liu, C. H., & Li, Y. Q. (2021). How to create tourists' enjoyment? critical factors and strategic configurations for cultural and creative tourists' enjoyment. <https://doi.org/10.1080/10548408.2021.1969318>, 38(6), 554–567. <https://doi.org/10.1080/10548408.2021.1969318>

Rust, R. T., & Huang, M.-H. (2021). The Feeling Economy. How Artificial Intelligence Is Creating the Era of Empathy. In *Palgrave Macmillan*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-52977-2>

Seo, K. H., & Lee, J. H. (2021). The Emergence of Service Robots at Restaurants: Integrating Trust, Perceived Risk, and Satisfaction. *Sustainability*, 13(8), 4431. <https://doi.org/10.3390/SU13084431>

Seyitoğlu, F., & Ivanov, S. (2020). Service robots as a tool for physical distancing in tourism. *Current Issues in Tourism*, 24(12), 1631–1634. <https://doi.org/10.1080/13683500.2020.1774518>

Stahl, A. (2021). *How AI Will Impact The Future Of Work And Life*. Forbes. <https://www.forbes.com/sites/ashleystahl/2021/03/10/how-ai-will-impact-the-future-of-work-and-life/>

Sun, H., & Zhang, P. (2006). Causal relationships between perceived enjoyment and perceived ease of use: An alternative approach. *Journal of the Association for Information Systems*, 7(1)(24), 618–646.

Tamborini, R., Bowman, N. D., Eden, A., Grizzard, M., & Organ, A. (2010). Defining Media Enjoyment as the Satisfaction of Intrinsic Needs. *Journal of Communication*, 60(4), 758–777. <https://doi.org/10.1111/J.1460-2466.2010.01513.X>

- Thompson, D. V., & Malaviya, P. (2013). Consumer-generated ads: Does awareness of advertising co-creation help or hurt persuasion? *Journal of Marketing*, 77(3), 33–47. <https://doi.org/10.1509/jm.11.0403>
- Tong, L., Yan, W., & Manta, O. (2022). Artificial Intelligence Influences Intelligent Automation in Tourism: A Mediating Role of Internet of Things and Environmental, Social, and Governance Investment. *Frontiers in Environmental Science*, 135. <https://doi.org/10.3389/fenvs.2022.853302>
- Tussyadiah, I. (2020). A review of research into automation in tourism: Launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. *Annals of Tourism Research*, 81, 102883. <https://doi.org/10.1016/J.ANNALS.2020.102883>
- Van Der Heijden, H. (2004). User acceptance of hedonic information systems. *MIS Quarterly: Management Information Systems*, 28(4), 695–704. <https://doi.org/10.2307/25148660>
- Venkatesh, V. (2021). Adoption and use of AI tools: a research agenda grounded in UTAUT. *Annals of Operations Research*, 1–12. <https://doi.org/10.1007/s10479-020-03918-9>
- Vorobeva, D., Fassi, Y. El, Pinto, D. C., Hildebrand, D., Herter, M. M., & Mattila, A. S. (2022). Thinking Skills Don't Protect Service Workers from Replacement by Artificial Intelligence. *Journal of Service Research*, 25(4), 601–613. <https://doi.org/10.1177/10946705221104312>
- Webster, C., & Ivanov, S. (2020). Future tourism in a robot-based economy: a perspective article. *Tourism Review*, 75(1), 329–332. <https://doi.org/10.1108/TR-05-2019-0172/FULL/PDF>

- Whitmore, G. (2023, February 7). *Will ChatGPT Replace Travel Agents?* Forbes.
<https://www.forbes.com/sites/geoffwhitmore/2023/02/07/will-chatgpt-replace-travel-agents/>
- Wöber, K., & Gretzel, U. (2000). Tourism Managers' Adoption of Marketing Decision Support Systems. *Journal of Travel Research*, 39(2), 172–181.
<https://doi.org/10.1177/004728750003900207>
- WTO | Services: Tourism and travel-related services. (n.d.). Retrieved February 3, 2022, from https://www.wto.org/english/tratop_e/serv_e/tourism_e/tourism_e.htm
- Xiao, L., & Kumar, V. (2021). Robotics for Customer Service: A Useful Complement or an Ultimate Substitute? *Journal of Service Research*, 24(1), 9–29.
<https://doi.org/10.1177/1094670519878881>
- Yang, S. (2020, October 20). *Text analysis basics in Python. Bigram/trigram, sentiment analysis, and topic modeling*. Towards Data Science.
<https://towardsdatascience.com/text-analysis-basics-in-python-443282942ec5>
- Yoganathan, V., Osburg, V. S., H. Kunz, W., & Toporowski, W. (2021). Check-in at the Robo-desk: Effects of automated social presence on social cognition and service implications. *Tourism Management*, 85, 104309.
<https://doi.org/10.1016/j.tourman.2021.104309>
- Yoo, B., & Donthu, N. (2001). Developing and validating a multidimensional consumer-based brand equity scale. *Journal of Business Research*.
[https://doi.org/10.1016/S0148-2963\(99\)00098-3](https://doi.org/10.1016/S0148-2963(99)00098-3)

Appendix A

Literature Review

Data collection was accomplished by following the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

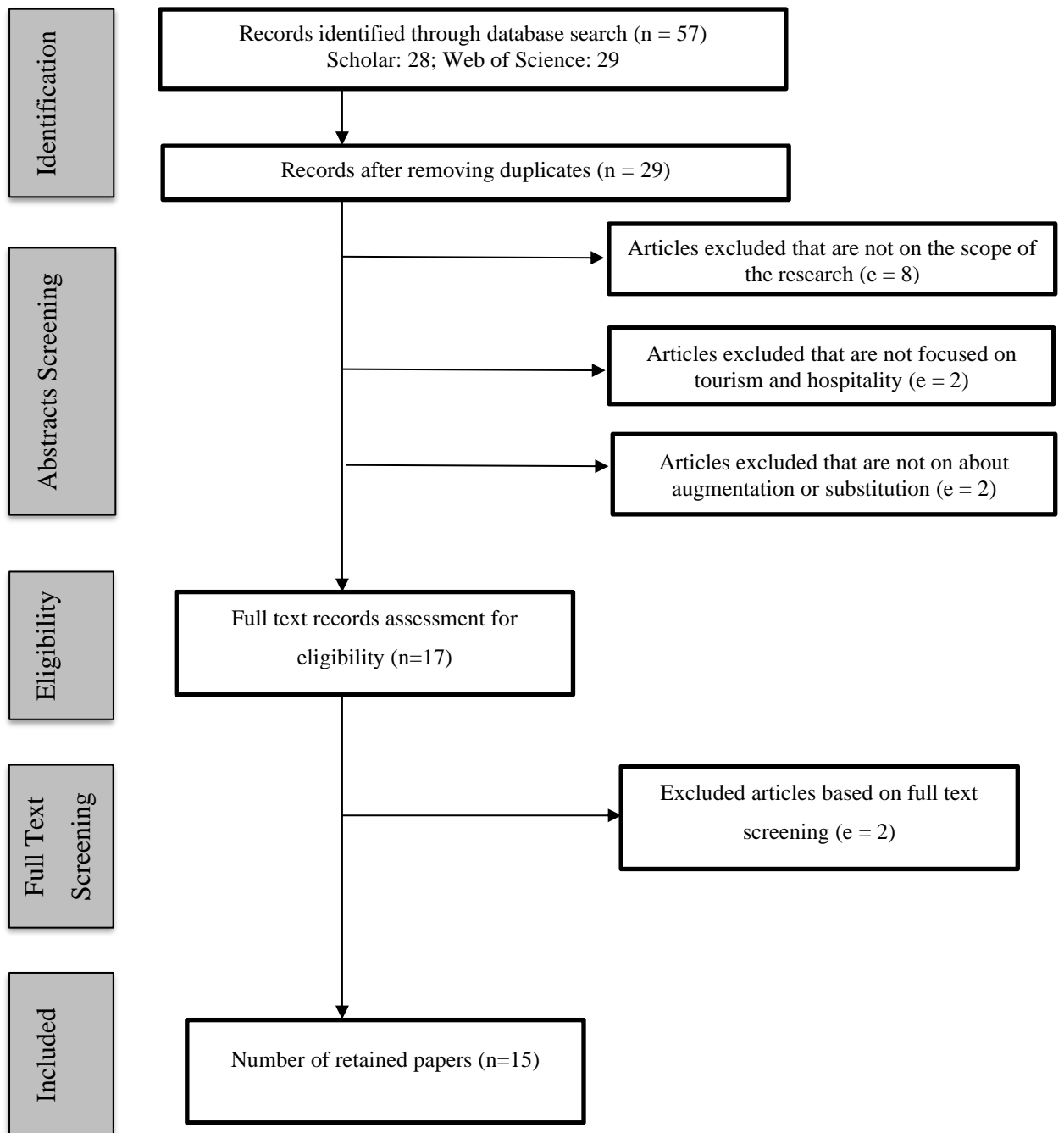


Fig. A. PRISMA Flowchart (n = retained; e = excluded).

Appendix B

Study 2 – scenarios adopted from McLeay et al. (2021)

Augmentation	Imagine you are having a stopover at the airport and you have to proceed to a new departure gate. The airline you are flying with has a new helper, a service robot, Mario. Mario is capable of helping you to find a new gate. After checking your boarding pass, Mario will assist you to your new gate, where the airline employees will manage the boarding procedure further on. In such way, Mario helps you as well as airline staff, who are alternatively often interrupted from their other duties by passengers who cannot find the gate.
AI Substitution	Imagine you are having a stopover at the airport and you have to proceed to a new departure gate. The airline you are flying with has a new helper, a service robot, Mario. Mario is capable of helping you to find a new gate and more. After checking your boarding pass, Mario will assist you to your new gate, where robot will manage the boarding process further on, just as it was previously done by staff of the airline. In such way, Mario helps you but fully substitutes airline employees for the boarding procedure.
Control	Imagine you are having a stopover at the airport and you have to proceed to a new departure gate. The airline you are flying with has a new ground staff, Mario. Mario can help you to find a new gate and more. After checking your boarding pass, Mario will assist you to your new gate, where he will manage the boarding process further on, just as it was previously done by staff of the airline.

Study 3 - scenarios

Augmentation	<p>HOTEL SERVICE (please read carefully)</p> <p>Imagine you are arriving at a hotel and going to a reception. You are greeted by a hotel employee. This employee will do your check-in and deal with your payment. This hotel also has a new helper, an AI-based service robot, Mario. Mario is capable of assisting you to your room and explaining the hotel's rules, breakfast and check-out schedules. After check-in is done by a hotel employee, an AI-based service robot, Mario, will show you the room and explain the available hotel services. In such way, Mario helps you as well as hotel staff, who are alternatively often overbooked with guests and don't have time to show the room and explain the hotel's rules.</p>
AI Substitution	<p>HOTEL SERVICE (please read carefully)</p> <p>Imagine you are arriving at a hotel and going to a reception. You are greeted by a new hotel helper, an AI-based service robot, Mario. Mario will do your check-in and deal with your payment. After check-in is done by Mario, this AI-based service robot will assist you to your room and explain the hotel's rules, breakfast and check-out schedules. In such way, Mario helps you and fully substitutes hotel employees for the check-in procedure.</p>
Control	<p>HOTEL SERVICE (please read carefully)</p> <p>Imagine you are arriving at a hotel and going to a reception. You are greeted by a hotel employee. This employee will do your check-in and deal with your payment. After check-in is done, a new hotel employee Mario will show you the room and explain the available hotel's services. In such way, Mario helps you as well as other hotel staff, who are alternatively often overbooked with guests and don't have time to show the room and explain the hotel's rules.</p>

Appendix C

Constructs and Measures

Variable	Items	Source
Willingness to accept	I am willing to receive this service. I will feel happy to interact with this service. I am likely to interact with assistant service.	(Gursoy et al., 2019)
Enjoyment	You think this is a nice service. You think this service is very attractive. You think this service is very desirable. You think this service is extremely likeable. You would feel relaxed after using this service. You would feel pleased after using this service. You would feel bored after using this service. ® You would feel annoyed after using this service. ®	(Yoo & Donthu, 2001)
Perceived ease of use	You would find it easy to make Julie do what you want to do. Your interaction with Julie would be clear and understandable. You would find Julie to be flexible to interact with. It would be easy for you to become skilful at using assistant service. You would find the assistant's service easy to use.	(Davis, 1989; Wöber & Gretzel, 2000)
Alternative mediators		
Empathy	Service provider in a tourism and hospitality environment usually understands the customers' specific needs. Service provider in a tourism and hospitality environment usually gives customers individual attention. Service provider in a tourism and hospitality environment is available whenever it's convenient for customers.	(de Kervenoael et al., 2020)
Warmth	I feel Mario responsible for the tasks described in the scenario, needs to understand my feelings. I feel Mario responsible for the tasks described in the scenario, needs to be well-intentioned. I feel Mario responsible for the tasks described in the scenario, needs to be friendly.	(Peng et al., 2022)
Productivity	Using the service provided by Mario greatly speeds up the improvement of the hotel's services. Using the service provided by Mario significantly reduces the time I spent on the check-in process. Using the service provided by Mario considerably increases my understanding of the hotels' rules and schedules. Using the service provided by Mario definitely makes me more productive.	(Green et al., 2005).

Notes: ® = Reversed items.

Table 1. Review of literature on augmentation vs. substitution by technology in hospitality and tourism area.

Study	Main Findings	Method	Mediators	Augmentation vs Substitution comparison	Feeling Economy
(Tussyadiah, 2020)	Theoretical research about AI developments in tourism. The author discusses the roles of AI in tourism and how AI systems can augment, substitute, or contribute to the tourists' interactions. Automation is not a straightforward replacement of human by technology, some tasks are easier to replace by machines than others. What should be done to minimize the threat of technological substitution?	Theoretical	no	no	no
(Jabeen et al., 2021)	Research develops a framework for the tourism and hospitality to recognize the key factors in AI's and automation's implementation. The authors briefly discern the threat of AI replacement and the possibility of pairing robots and humans for increased productivity and reduced costs.	Analytic hierarchy process (AHP) model	no	no	no
(D. Huang et al., 2021)	Research develops a framework for hospitality and tourism domain dedicated to customer's experience with service robots. Augmentation and substitution are addressed among different enhancing functions of service robots for service experience. Service robots compliments frontline services with enjoyment.	Qualitative reviews' analysis	no	no	no
(X. Y. Leung, 2020)	An overview of influence of technology on service evolution. Service automation and human-robot collaboration are the key features of the fourth stage of service evolution.	Theoretical	no	no	no
(R. Leung, 2019)	Research is focused on the analyses of the barriers to smart technology and hotel stakeholders' views on smart hotel. Substitution addressed as a source of potential unemployment and decreased job security level. Technology should be presented to employees as tool for better performance.	Qualitative (interviews)	no	no	no
(Webster & Ivanov, 2020)	An impact of robonomic economy on tourism and hospitality. Robonomic economy is presented as substitution of human labour which will provoke a massive transformation of economy and society.	Conceptual	no	no	no
(Buhalis et al., 2019)	An investigation of service innovations in the tourism and hospitality domain. Augmentation in tourism empowers interactive customer experience. Substitution may provoke a dehumanization of experiences and become a disruptive force in the tourism and hospitality industry.	Theoretical	no	no	no

(Zhang et al., 2022)	Hotel guests' preferences for room technologies. AI and robots can perform many hotel-related tasks previously performed by human employee to increase convenience and efficiency. Previous results both confirm and refute the customers' willingness to deal with AI while traveling.	Quantitative and qualitative	no	no	no
(Ivanov, 2019)	This paper is focused on the impact of different technologies in tourism and hospitality settings. Technologies are improving productivity rather than replacing the human employees. Importance of employees' skills set upgrading to avoid technological substitution.	Theoretical	no	no	no
(Tong et al., 2022)	An investigation of AI and intelligent automation in tourism. Augmentation and substitution as an AI's role in designing tourist experiences. Substitution's negative impact on society (loss of job, skills, and knowledge).	Quantitative	IoT; sustainability; adoption; environmental, social, and governance investment	no	no
(Blöcher & Alt, 2021)	The current situation of robotics and AI in the restaurant business. Analysis of the previous research about augmentation and substitution (as a threat to a service jobs). Importance of emotional skills of service employees and how to balance it with technological advantages.	Quantitative, data coding (classification)	no	no	yes
(Mingotto et al., 2021)	Investigation of the humanoid robot Pepper at the hotel's reception. Augmentation and substitution are crucial roles of social robots and AI. Research found out that such technology can operate as an augmentation, and it can evolve primarily into enabler, innovator, and coordinator.	Qualitative and descriptive approach (the action research methodology)	no	no	no
(T. Kim et al., 2022)	Human employees in hospitality are being substituted by RAISA. The findings of the paper demonstrate how online content can suggest a primary reference for potential customers to collaborate with the uncertainty of technological services.	Qualitative (sentiment analysis) and quantitative regression analysis	no	no	no
(Gupta et al., 2022)	Findings demonstrate that deploying AI enabled robots speeds up the automation, personalization, and collection of information in hospitality domain. Robots were not created to substitute humans entirely.	Qualitative (interviews)	no	no	yes
(Seo & Lee, 2021)	Research is focused on the restaurant's robot service and investigates trust, satisfaction, risk, and TAM constructs (perceived usefulness, ease of use, acceptance). Substitution of employees by a service robot in a restaurant could (1) effect significantly customer service experience and behavioural outcomes, and (2) decrease the risk of infection.	Quantative (SEM)	Perceived usefulness, Ease of use	no	no

Table 2. Overview of tweets sentiment.

Tweets	Sentiment	Number of Tweets	Percentage	Mean	SD
ALL	Positive	211,738	60.44%	0.56	0.23
	Negative	56,540	16.14%	-0.44	0.24
	Neutral	82,069	23.42%	0.0002	0.006
	<i>Total</i>	350,348		0.27	0.44
Augmentation	Positive	1,042	68.15%	0.57	0.22
	Negative	88	5.76%	-0.41	0.25
	Neutral	399	26.10%	0.0004	0.004
	<i>Total</i>	1,529		0.36	0.36
Substitution	Positive	1,286	54.89%	0.52	0.23
	Negative	515	21.98%	-0.44	0.24
	Neutral	542	23.13%	-0.0002	0.006
	<i>Total</i>	2,343		0.19	0.45

Figure 1 Caption. AI's most frequent topics in tourism and hospitality.

Figure 1 Alt Text. Bar graph displaying AI's most frequent topics in tourism and hospitality from Twitter analysis.

Figure 2 Caption. Mediation Model of AI framing on willingness to accept.

Figure 2 Alt Text. A graphical model showing the effect of AI framing on willingness to accept through enjoyment and perceived ease of use.



Fig. 1. AI's most frequent topics in tourism and hospitality.

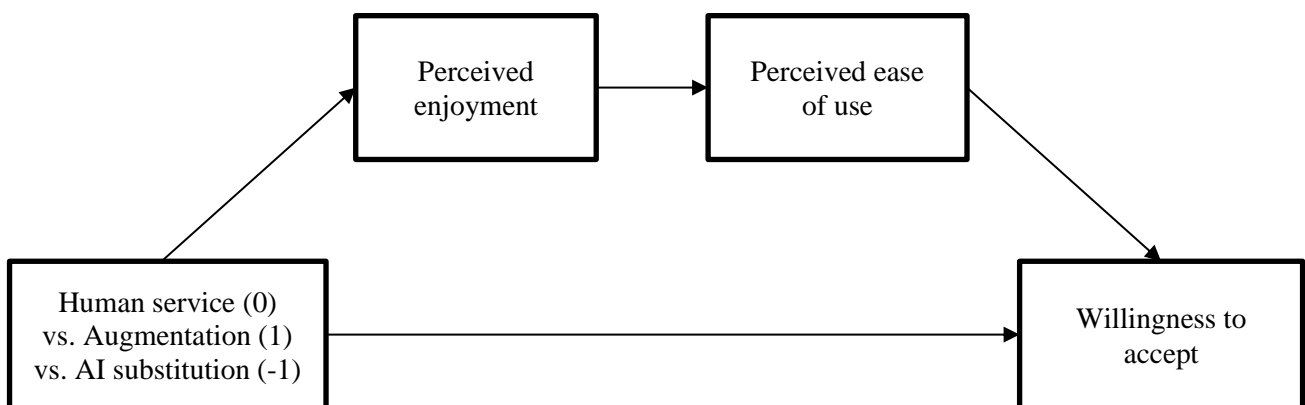


Fig. 2. Mediation Model of AI framing on willingness to accept.