



The Robot Hotel Paradox: Why Guest Satisfaction May Not Translate into Revisit Intention

O Paradoxo dos Hotéis Robotizados: Quando a Satisfação do Hóspede Pode Não se Traduzir em Intenção de Revisita

Daniel Costa Pacheco ¹ 

School of Business and Economics, University of the Azores; Center of Applied Economic Studies of the Atlantic (CEEApIA),
University of the Azores, Rua da Mãe de Deus, 9500-321, Ponta Delgada, Portugal, daniel.c.pacheco@uac.pt

Oswaldo Dias Lopes da Silva 

School of Sciences and Technology, University of the Azores; CICS.UAc/CICS.NOVA.UAc, University of the Azores, Rua da Mãe de Deus, 9500-321, Ponta Delgada, Portugal, osvaldo.dl.silva@uac.pt

Ana Isabel Damião de Serpa Arruda Moniz 

School of Business and Economics, University of the Azores; Center of Applied Economic Studies of the Atlantic (CEEApIA),
University of the Azores, Rua da Mãe de Deus, 9500-321, Ponta Delgada, Portugal, ana.id.moniz@uac.pt

Ling Li 

School of Arts and Humanities, University of Minho; CEHUM, University of Minho, Campus de Gualtar, 4710-057, Braga, Portugal
liling@elach.uminho.pt

Ulrike Gretzel 

Institute Marketing and Wine Business, IMC Krems University of Applied Sciences, Am Campus Krems, Trakt G, 3500 Krems an der Donau, Austria, ulrike.gretzel@imc.ac.at

¹ Corresponding author

Received: 17.06.2026; Revisions required: 15.05.2026; 08.07.2026; Accepted: 20.07.2026

Abstract

Fully automated hotels are a form of smart tourism in which robotic agents organise the service encounter. This study examines whether robot sociality is associated with guest satisfaction and revisit intention. Drawing on the Computers Are Social Actors paradigm and Social Exchange Theory, it distinguishes guests' social responses to robots from their evaluation of exchange value in hospitality. A PLS-SEM analysis of 1,363 post-stay guest surveys from a robot-operated hotel chain in Japan assessed perceived anthropomorphism, emotional closeness, interactive comfort, human-robot interaction quality, satisfaction and intention to revisit. Emotional closeness and interactive comfort were associated with satisfaction and intention to revisit. Perceived anthropomorphism was associated with satisfaction, but not with revisit intention. Human-robot interaction quality partially mediated the associations between social cue responses and satisfaction, but not those with intention to revisit. The findings reveal a robot hotel paradox: robot sociality can strongly support satisfying service encounters, but it does not automatically translate into a robust intention to revisit. The study advances research on service robots and smart tourism by showing when social presence becomes an exchange value and when hotel choice remains shaped by factors beyond the robot encounter.

Keywords: Service Robots; Robot Hotels; Smart Tourism; Human-Robot Interaction; Guest Satisfaction; Revisit Intention.

Resumo

Os hotéis totalmente automatizados constituem uma forma de turismo inteligente em que agentes robóticos organizam o encontro de serviço. Este estudo analisa se a socialidade robótica está associada à satisfação dos hóspedes e à intenção de revisita. Com base no paradigma Computers Are Social Actors (CASA) e na Teoria da Troca Social, distingue as respostas sociais dos hóspedes aos robôs da avaliação do valor da troca no contexto hoteleiro. Uma análise PLS-SEM de 1.363 inquéritos pós-estadia a hóspedes de uma cadeia hoteleira operada por robôs no Japão avaliou o antropomorfismo percebido, a proximidade emocional, o conforto interativo, a qualidade da interação humano-robô, a satisfação e a intenção de revisita. A proximidade emocional e o conforto interativo estiveram associados à satisfação e à intenção de revisita. O antropomorfismo percebido esteve associado à satisfação, mas não à intenção de revisita. A qualidade da interação humano-robô mediou parcialmente as associações entre as respostas a pistas sociais e a satisfação, mas não as associações com a intenção de revisita. Os resultados revelam um paradoxo dos hotéis robotizados: a socialidade robótica pode apoiar fortemente encontros de serviço satisfatórios, mas não se traduz automaticamente numa intenção robusta de revisita. O estudo contribui para a investigação sobre robôs de serviço e turismo inteligente ao mostrar quando a presença social se converte em valor de troca e quando a escolha hoteleira continua a ser moldada por fatores que excedem o encontro com o robô.

Palavras-chave: Robôs de Serviço; Hotéis Robotizados; Turismo Inteligente; Interação Humano-Robô; Satisfação dos Hóspedes; Intenção de Revisita.



1. Introduction

Robotised hospitality has moved from technological display to service substitution. In fully automated hotels, the guest encounter is no longer organised around human staff assisted by machines, but around robotic and digital agents that perform visible service roles traditionally associated with reception, assistance, information provision and room control (Chen et al., 2025; Ivanov et al., 2025; Murphy et al., 2019; Wirtz et al., 2018). The present study uses the term "fully automated" to refer to the hotel's guest-facing interface. It does not imply the disappearance of human labour from hidden organisational functions such as housekeeping, maintenance, security supervision or emergency response. This distinction is necessary because guests evaluate the hotel through the service interface they encounter, while the organisation may still rely on human work outside ordinary guest contact.

This setting changes the theoretical problem. In hybrid hospitality environments, robots can be perceived as novelty, convenience, or entertainment, while human employees remain available for reassurance, empathy, and service recovery (Blut et al., 2021; Tussyadiah et al., 2020). In fully automated hotels, robotic agents become the primary source of welcome, assistance and interactional ease. The question is therefore not whether robots can execute service tasks, but how guests evaluate the social cues through which machines enact hospitality (Kim et al., 2022; Nass et al., 1994;).

Prior research has examined anthropomorphism, social presence, emotional responses, trust and comfort in service robot encounters (Blut et al., 2021; Husain & Prentice, 2025; Liu et al., 2024; Pitardi et al., 2024). Yet much of this evidence comes from experiments, scenarios, or hybrid service contexts, leaving limited field-based knowledge about robot-operated hotels in which artificial agents constitute the visible service interface (Choi et al., 2019; Tussyadiah et al., 2020; Yu et al., 2025). This matters because responses formed after an actual hotel stay may differ from those anticipated for a hypothetical robot encounter.

A second limitation concerns theory. The Computers Are Social Actors paradigm explains why people may apply social rules to machines that display language, responsiveness, embodied presence or polite conduct (Nass et al., 1994). Social Exchange Theory explains how guests evaluate encounters in terms of perceived benefits, costs, reciprocity, and symbolic reward (Blau, 1964; Chen et al., 2025; Cropanzano & Mitchell, 2005). These perspectives are complementary, but they should not be collapsed. A robot may be perceived as humanlike without eliciting emotional affinity; an interaction may feel comfortable without fostering attachment; and a fluent encounter may enhance satisfaction without prompting future patronage.

This distinction is especially relevant for revisit intention. Hospitality choice is episodic and shaped by factors that extend beyond a single service encounter, including destination, trip purpose, price, availability, and variety-seeking (Berezan et al., 2013; Hasan et al., 2017; Seetana et al., 2020). Studies on service robots show that comfort and reduced social discomfort can improve satisfaction and behavioural responses in some contexts (Pitardi et al., 2024; Radia et al., 2022; Spake et al., 2003). However, such effects do not mean that robot-generated relational value will necessarily sustain return decisions in real hotel settings.

This study addresses these issues using survey data from 1,363 guests of a robot-operated hotel chain in Japan. It examines how perceived anthropomorphism, emotional closeness, and interactive comfort are associated with guest satisfaction and intention to revisit, and whether perceived quality of human-robot interaction explains part of these associations. Given the cross-sectional design, the analysis concerns theoretically specified associations, not temporal causation (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

The article contributes to robotic hospitality research in three ways. First, it separates social cue activation from exchange-based evaluation by linking CASA and Social Exchange Theory without treating them as interchangeable. Second, it provides field evidence from a fully automated hospitality setting, extending research beyond laboratory and hybrid service contexts. Third, it shows why affective and interactional evaluations may strengthen satisfaction while offering weaker explanatory power for revisit intention, thereby locating the boundary of relational value creation in robotised hospitality.

2. Theoretical Background: From Social Perception to Relational Evaluation in Robotised Hospitality

2.1 Computers Are Social Actors: Social Response Activation

The Computers Are Social Actors paradigm and media equation theory explain why people respond socially to machines that display modest social cues (Nass et al., 1994; Reeves & Nass, 1996). In service robot encounters, language use, turn-taking, embodied presence, gaze behaviour, response timing and polite scripts may lead guests to attribute agency, warmth or competence to artificial agents, even when they know that the robot has no consciousness or emotion (Blut et al., 2021; Tussyadiah et al., 2020).

CASA therefore accounts for the perceptual onset of robotised hospitality. A robot that greets, listens, pauses, gestures or apologises can be treated as a social actor for the duration of the service episode (Kervenoael et al., 2024; Nass et al., 1994). This helps explain why guests may report anthropomorphism, emotional closeness or interactive comfort in robot-operated hotels. Yet CASA is not sufficient to explain satisfaction or intention to revisit. A humanlike cue may activate a social script without generating affinity, exchange value or future patronage (Blut et al., 2021; Mende et al., 2019; Pitardi et al., 2024).



2.2 Social Exchange Theory and Relational Evaluation

Social Exchange Theory complements CASA by explaining how encounters are evaluated through perceived rewards, costs, reciprocity and symbolic return (Blau, 1964; Chen et al., 2025; Cropanzano & Mitchell, 2005;). Once a robot is treated as a social actor, guests may evaluate politeness as recognition, responsiveness as attentiveness, fluent communication as competence and psychological ease as a reduction in interaction cost (Pitardi et al., 2024; Radia et al., 2022; Spake et al., 2003).

In robotised hospitality, SET shifts the argument from the presence of social cues to their perceived benefits and costs. Social cues matter when guests experience them as reassuring, rewarding or capable of reducing discomfort within the service episode (Blut et al., 2021; Chen et al., 2025; Kim et al., 2022). This logic also separates satisfaction from intention to revisit. Satisfaction evaluates the stay just experienced, whereas intention to revisit concerns anticipated value in a future choice situation shaped by destination, trip purpose, price, availability, risk perception, alternatives and variety seeking (Berezan et al., 2013; Hasan et al., 2017; Seetanah et al., 2020). A robot-mediated exchange may therefore support satisfaction while leaving future patronage only partly explained by relational cues.

2.3 Social Cues in Robot-mediated Service Encounters

The model focuses on perceived anthropomorphism, emotional closeness and interactive comfort. These constructs are related because they concern guest responses to robotic agents, but they describe different psychological processes.

Perceived anthropomorphism concerns the attribution of humanlike appearance, behaviour, agency or mental capacity to a non-human entity (Blut et al., 2021; Epley et al., 2007; Husain & Prentice, 2025). In hospitality settings, anthropomorphic cues may include facial expression, embodied form, voice, greeting behaviour, polite language, gesture or response timing (Tussyadiah et al., 2020). Its theoretical role is perceptual. It makes the robot easier to interpret in terms of social categories, but it does not, by itself, constitute attachment or loyalty (Mende et al., 2019; Pitardi et al., 2024).

Emotional closeness refers to a low-intensity sense of affinity toward the robotic agent. It captures perceived warmth, liking, familiarity and symbolic connection, not deep intimacy (Li et al., 2019; Schramm et al., 2024). This qualification is important because hotel contact with robots is brief and task-bound. Even short encounters can generate warmth when the agent appears responsive, polite and socially attuned, although such closeness remains lighter than enduring human attachment (Choi et al., 2021; Loveys et al., 2022; Tung & Au, 2018).

Interactive comfort refers to psychological ease during contact with the robot. It includes calmness, low embarrassment, low anxiety, perceived safety and freedom from social threat (Radia et al., 2022; Spake et al., 2003). Recent work on uncomfortable service encounters suggests that robots can reduce discomfort because customers attribute them lower agency and engage less in metaperception, meaning they worry less about how the service agent judges them (Pitardi et al., 2024). In robotised hotels, this mechanism is relevant because guests may prefer robotic service in situations where human contact feels awkward, intrusive or socially exposing.

Interactive comfort also has an ethical and psychological dimension. The absence of routine human contact can reduce judgement, embarrassment and social pressure for some guests, but it may also create emotional distance, social deprivation or alienation for others (Liu et al., 2024; Loveys et al., 2022; Odekerken-Schröder et al., 2020). Research on embodied agents shows that closeness and willingness to seek support depend on conversational quality, appropriate responses, empathy, humanlike facial features and the absence of programme errors (Loveys et al., 2022). Comfort in automated hotels should therefore be treated as a condition of psychological acceptability, not merely as a usability issue.

These distinctions reduce conceptual overlap. Anthropomorphism provides social readability, emotional closeness provides relational reward, and interactive comfort lowers emotional cost. This interpretation is consistent with Social Exchange Theory because it separates perceived benefit from cost reduction within the service encounter (Blau, 1964; Blut et al., 2021; Cropanzano & Mitchell, 2005; Spake et al., 2003;).

2.4 Human-Robot Interaction - Quality as an Exchange Mechanism

Human-robot interaction quality refers to guests' judgment of how well the robotic agent performs the service encounter. It includes fluency, responsiveness, intelligibility, social appropriateness and communicative competence (Apostol & Matchimura, 2024; Choi et al., 2019; Ozturk et al., 2023). This construct differs from emotional closeness and interactive comfort because it evaluates the interaction episode itself, not the guest's affective bond or internal ease.

Interaction quality is the exchange mechanism through which social cue responses become service value. Humanlike design may invite social interpretation, emotional closeness may add warmth, and comfort may reduce psychological cost. These responses become valuable when enacted in interactions that feel competent, coherent, and socially suitable (Blut et al., 2021; Kim et al.,



2022; Tussyadiah et al., 2020). If a robot looks humanlike but responds poorly, interrupts the guest, repeats generic scripts or fails to interpret requests, social perception may turn into disappointment (Loveys et al., 2022; Panagou et al., 2024).

In fully automated hotel interfaces, this judgement becomes especially salient because there is no routine human employee available to repair the encounter, provide reassurance or compensate for robot failure (Ivanov et al., 2025; Wirtz et al., 2018). Interaction quality may therefore transmit the value of social cues into satisfaction more readily than into the intention to revisit. SET suggests that a favourable exchange can improve evaluation of the present stay, while return decisions depend on anticipated future value within a wider hotel choice field (Berezan et al., 2013; Hasan et al., 2017). Thus, interaction quality is theorised as a pathway to satisfaction, with a more limited role in explaining future patronage.

2.5 Hypotheses Development

The hypotheses follow the perception-to-evaluation sequence developed above. Social cue responses are expected to shape post-consumption judgements through the quality of human-robot interaction, while guest satisfaction and intention to revisit are treated as distinct outcomes. Satisfaction concerns evaluation of the stay just experienced, whereas intention to revisit concerns a future choice shaped by destination, trip purpose, price, availability and competing accommodation options (Berezan et al., 2013; Hasan et al., 2017; Seetanah et al., 2020). Because the data are cross-sectional, the proposed paths are interpreted as theory-guided associations among perceptions formed during one service episode (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

2.5.1 Perceived Anthropomorphism

Perceived anthropomorphism refers to the attribution of humanlike form, behaviour, agency or mental capacity to a non-human entity (Epley et al., 2007; Husain & Prentice, 2025; Kühne & Peter, 2023). In robotic service encounters, such attribution may arise from facial expressions, gaze, voice, gestures, conversational timing, polite language, and embodied presence (Katsuno, 2011; Tussyadiah et al., 2020). These cues make the robot more socially readable and allow guests to interpret it in terms of familiar interpersonal categories (Blut et al., 2021; Nass et al., 1994).

Anthropomorphism is expected to support satisfaction when humanlike cues reduce technological distance and help guests perceive the robot as an acceptable hospitality actor (Blut et al., 2021; Kim et al., 2022; Moussawi & Koufaris, 2019). This association is not assumed to be uniform. Uncanny valley theory suggests that excessive humanlikeness can evoke unease, while service robot research indicates that positive responses depend on whether humanlike design aligns with task expectations and the service context (Blut et al., 2021; Crollic et al., 2022; Kim et al., 2019). In robot-operated hotels, anthropomorphic cues should therefore contribute to satisfaction when they convey competence, approachability and social suitability without producing dissonance (Tussyadiah et al., 2020; Yu et al., 2025).

H1: Perceived anthropomorphism is positively associated with guest satisfaction.

The association between anthropomorphism and intention to revisit is less secure. Humanlike cues may stimulate curiosity, social presence and initial trust, but future patronage requires anticipated value in a later travel episode (Mende et al., 2019; Tussyadiah et al., 2020; Yu et al., 2025). Hotel choice is also shaped by destination, trip purpose, price, availability and alternatives, which may weaken the role of robot appearance in future selection (Berezan et al., 2013; Hasan et al., 2017). The model, therefore, examines whether anthropomorphism extends beyond evaluation of the stay into intention to revisit.

H2: Perceived anthropomorphism is positively associated with intention to revisit.

2.5.2 Emotional Closeness

Emotional closeness denotes a low-intensity affective affinity toward the robotic agent, including warmth, liking, familiarity, and symbolic connection (Li et al., 2019; Schramm et al., 2024). It does not imply deep intimacy. This qualification is important because hotel encounters are brief, episodic and limited by the service task (Choi et al., 2021; Loveys et al., 2022; Tung & Au, 2018). Even so, guests may experience robotic agents as friendly or pleasant when they communicate politely, respond appropriately and display social attentiveness (Choi et al., 2021; Schramm et al., 2024; Tussyadiah et al., 2020).

From a social exchange perspective, emotional closeness constitutes a relational benefit. It adds affective reward to the encounter and can make robotic service feel less mechanical (Blau, 1964; Chen et al., 2025; Cropanzano & Mitchell, 2005;). Research on embodied agents shows that closeness is shaped by conversational quality, empathy, appropriate responses, humanlike facial features and the absence of programme errors (Loveys et al., 2022). In robotised hospitality, such affinity should therefore enhance satisfaction by making the encounter warmer, more acceptable and more socially rewarding (Choi et al., 2021; Kim et al., 2022; Tung & Au, 2018).

H3: Emotional closeness is positively associated with guest satisfaction.



Emotional closeness offers greater relational potential than anthropomorphism because it concerns affinity rather than mere form. Parasocial interaction research suggests that familiarity and symbolic connection can support loyalty-oriented responses when guests expect future encounters to remain pleasant and socially coherent (Schramm et al., 2024). In robot-operated hotels, this association remains context-sensitive because repeat patronage is still influenced by travel purpose, destination, and accommodation alternatives (Berezan et al., 2013; Liu et al., 2025).

H4: Emotional closeness is positively associated with intention to revisit.

2.5.3 Interactive Comfort

Interactive comfort refers to psychological ease during contact with robotic agents. It includes calmness, low anxiety, low embarrassment, perceived safety and freedom from social threat (Radia et al., 2022; Spake et al., 2003). This construct differs from emotional closeness in that it concerns cost reduction, whereas closeness concerns relational reward (Cropanzano & Mitchell, 2005; Pitardi et al., 2024). A guest may feel comfortable using a robot without feeling close to it.

Interactive comfort is expected to enhance satisfaction by reducing the emotional costs of robot-mediated service. In hospitality encounters, robots may lessen discomfort when guests worry about judgment, awkwardness or social exposure, for example, in late-night requests, complaints or unusual service needs (Holthöwer & Van Doorn, 2023; Liu et al., 2024; Pitardi et al., 2024). Pitardi et al. (2024) show that service robots can reduce metaperception because customers attribute them lower agency and worry less about how the service agent evaluates them. This mechanism should support satisfaction when robotic service feels safe, unobtrusive and free from interpersonal strain (Fang et al., 2024; Radia et al., 2022; Spake et al., 2003).

H5: Interactive comfort is positively associated with guest satisfaction.

Interactive comfort may also support intention to revisit when guests interpret the robotic interface as reliable, private and socially unthreatening (Fang et al., 2024; Pitardi et al., 2024; Radia et al., 2022). Yet the absence of routine human contact can also heighten emotional distance, social deprivation or alienation among guests who value human warmth and interpersonal reassurance (Liu et al., 2024; Loveys et al., 2022; Odekerken-Schröder et al., 2020). For this reason, comfort is expected to be positively associated with the intention to revisit, while the strength of this association remains an empirical question.

H6: Interactive comfort is positively associated with intention to revisit.

2.5.4 Mediating Role of Human-Robot Interaction Quality

CASA and Social Exchange Theory imply a mediating role for interaction quality. CASA explains why anthropomorphism, emotional closeness and comfort can arise when guests encounter robotic agents, while Social Exchange Theory explains why those responses become valuable only when the exchange offers reward or lowers cost (Blau, 1964; Cropanzano & Mitchell, 2005; Nass et al., 1994). Interaction quality is therefore positioned as the evaluative link between social cue response and post-consumption judgement. It captures whether the robot's humanlike signs, affective appeal and psychological ease are enacted through competent service (Choi et al., 2019; Loveys et al., 2022; Ozturk et al., 2023).

This mediating logic applies to satisfaction, as guests evaluate whether the promise implied by social cues is fulfilled during the stay (Blut et al., 2021; Chen et al., 2025; Kim et al., 2022). It may also apply to the intention to revisit if the quality of interaction converts social cue responses into confidence in future robotic service. Nevertheless, this second pathway is expected to be more contingent because revisit decisions depend on a wider choice context beyond the interaction episode (Berezan et al., 2013; Hasan et al., 2017).

H7: Human-robot interaction quality mediates the association between perceived anthropomorphism and guest satisfaction.

H8: Human-robot interaction quality mediates the association between perceived anthropomorphism and intention to revisit.

H9: Human-robot interaction quality mediates the association between emotional closeness and guest satisfaction.

H10: Human-robot interaction quality mediates the association between emotional closeness and intention to revisit.

H11: Human-robot interaction quality mediates the association between interactive comfort and guest satisfaction.

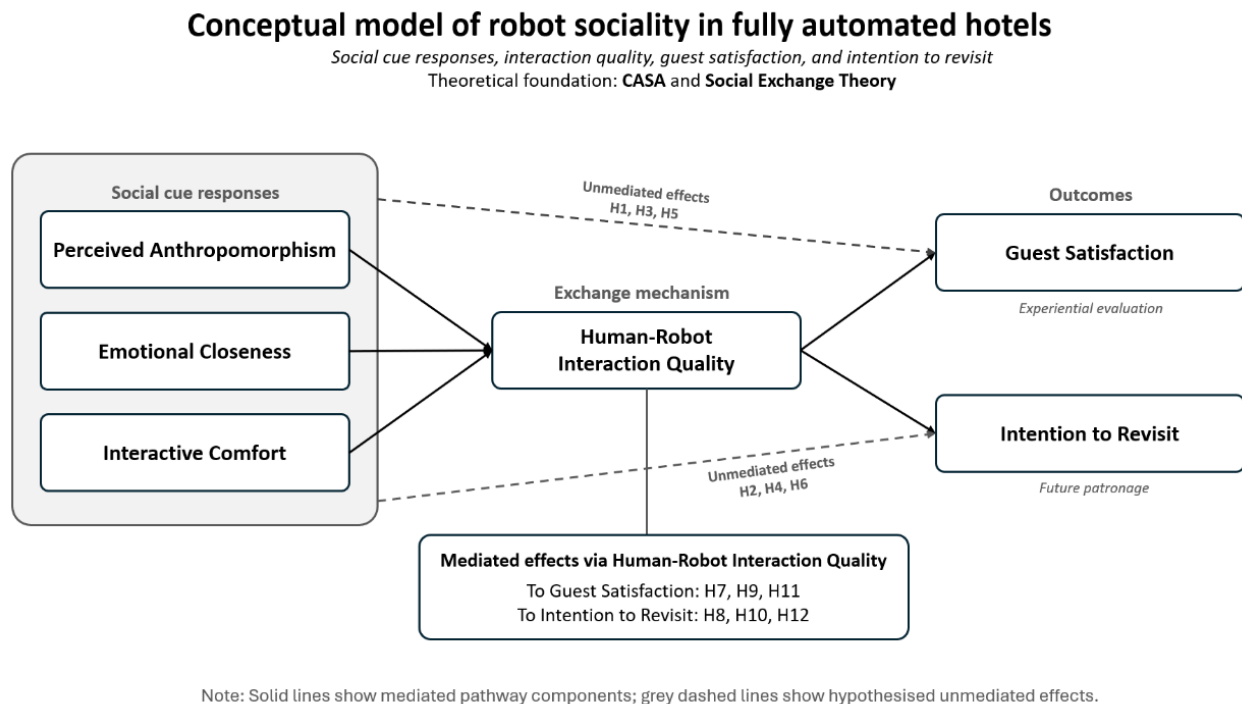
H12: Human-robot interaction quality mediates the association between interactive comfort and intention to revisit.

The proposed model should be read as a perception-to-evaluation framework, not as proof of temporal causation. The cross-sectional design prevents strict causal ordering, and reciprocal relationships between interaction quality and affective responses remain possible (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010). The model nevertheless follows a sequence grounded in CASA, Social Exchange Theory and service robot research: social cues make the robot socially legible, interaction quality evaluates



the service episode, and post-consumption judgements capture satisfaction with the stay and intention to revisit (Choi et al., 2019; Cropanzano & Mitchell, 2005; Nass et al., 1994).

Figure 1. Conceptual model of social exchange dynamics in robotised hospitality



3. Materials and Methods

3.1 Research setting and design

The study used cross-sectional survey data collected from guests of a fully automated hotel chain in Japan. In this article, "fully automated" refers to the visible service interface that guests encounter. Reception, guest assistance, information provision, and room control were handled by robotic or digital agents, whereas back-of-house activities such as housekeeping, maintenance, security supervision, and emergency response could still involve human personnel. This distinction follows prior work on service automation and robotised hospitality, where the guest experience is shaped by the interface through which service is perceived and enacted (Ivanov et al., 2025; Murphy et al., 2019; Wirtz et al., 2018).

A field survey was appropriate because the study examines evaluations formed after an actual hotel stay, not anticipated responses to hypothetical service robots. Field evidence is particularly valuable for service robot research, since laboratory and scenario studies may overstate novelty effects or simplify the interactional demands of hospitality encounters (Blut et al., 2021; Tussyadiah et al., 2020). The cross-sectional design permits estimation of theory-guided associations among perceptual and evaluative constructs, but it does not establish temporal causation (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

3.2 Data collection and participants

Data collection took place between 1 March and 31 May 2025, a period overlapping with Japan's spring tourism season, including the sakura period in several regions. Guests were approached immediately after checkout, away from the service area, and invited to complete an anonymous questionnaire about their stay. This timing was chosen to minimise recall decay and reduce perceived pressure from the service provider, in line with survey design recommendations to reduce evaluation bias in self-report research (Podsakoff et al., 2003; Podsakoff et al., 2024).

Before the main data collection, the questionnaire was pretested with 15 participants. Feedback led to minor wording adjustments to improve comprehension, without altering the conceptual content of the scales. The final questionnaire was administered in paper format and completed by respondents without interviewer assistance. Participants were informed that responses were anonymous, voluntary and used for academic purposes only. No identifying information was collected.

Eligibility requires first-hand contact with at least one robotic service interface during the stay. Guests who interacted only with non-robotic digital interfaces were excluded from the HRI analysis. This criterion ensured that perceptions of anthropomorphism, emotional closeness, interactive comfort and human-robot interaction quality referred to actual robotic service encounters.



3.3 Measurement instrument

The questionnaire included sociodemographic items and six reflective latent constructs: perceived anthropomorphism, emotional closeness, interactive comfort, human-robot interaction quality, guest satisfaction and intention to revisit. All constructs were measured with scales adapted from prior validated instruments. Table A1 presents the measurement items, scale anchors, bibliographic sources, factor loadings and reliability statistics for all constructs.

Guest satisfaction retained the five-point response format used in the original scale. The remaining constructs used seven-point response formats. To reduce scale-length effects, observed indicators were standardised prior to PLS-SEM estimation. A sensitivity analysis using standardised latent variable scores produced substantively equivalent estimates, supporting the comparability of measures across response formats (Hair et al., 2019).

The questionnaire was designed to capture perceptions of the robotic service interface, not of every element of the hotel stay. This delimitation aligns with the study's purpose, which is to examine relational mechanisms in human-robot interaction. Physical room quality, location, price, gastronomy, and destination-related motivations were not modelled as predictors because they fall within the broader hotel choice context rather than the robotic interaction mechanism under examination (Berezan et al., 2013; Hasan et al., 2017).

3.4 Sample size and sample profile

The minimum sample size for PLS-SEM was estimated using the recommendations of Westland (2010) and Soper (2025). The calculation considered six latent variables, twenty-one observed indicators, an anticipated effect size of 0.12, statistical power of 0.80 and $\alpha = 0.05$. This procedure yielded a conservative a priori benchmark of 1,713 cases. The final validated sample comprised 1,363 usable responses. Although the sample did not reach this conservative benchmark, it remains a large field sample for PLS-SEM estimation. The results are therefore interpreted with caution, with emphasis on the size, direction and stability of the estimated associations, and with the sample-size shortfall acknowledged as a limitation of the study. Table 1 reports the respondent profile by sex, age, education, travel companionship and region of origin.

Table 1. Sample profile of participants in the robotised hotel study

	Number	%
Sex		
Male	884	64.9
Female	479	35.1
Total	1,363	100
Age		
34 years or younger	829	60.8
35 years or older	534	39.2
Total	1,363	100
Education		
High school or lower	883	64.8
Higher education	480	35.2
Total	1,363	100
Travel Companionship		
Solo traveller	327	23.9
Couple	181	13.3
Family	358	26.3
Group	497	36.5
Total	1,363	100
Region of origin / nationality group		
East Asia	742	54.4
Southeast Asia	199	14.6
South Asia	49	3.6
Europe	131	9.6
Americas	187	13.7
Australia	55	4.0
Total	1,363	100

3.5 Data analysis strategy

The hypotheses were tested using SmartPLS 4 and PLS-SEM. This approach is suitable for prediction-oriented models involving multiple latent variables, mediated paths and perceptual constructs, and permits assessment of the reflective measurement model



and hypothesised paths within the same analytical framework (Hair et al., 2019; Henseler et al., 2015). Before model estimation, descriptive statistics were inspected for all observed indicators. Table B1 reports item means and standard deviations, indicating adequate dispersion across the observed measures.

The analysis proceeded in two stages. First, the reflective measurement model was assessed through indicator loadings, Cronbach's alpha, composite reliability, average variance extracted, the Fornell-Larcker criterion and the heterotrait monotrait ratio. These procedures assess internal consistency, convergent validity and discriminant validity in reflective PLS-SEM models (Fornell & Larcker, 1981; Hair et al., 2019; Henseler et al., 2015).

Second, the path model was assessed through collinearity diagnostics, explanatory power, predictive relevance, effect sizes and bootstrapped estimates. Collinearity was examined using inner variance inflation factors. Explanatory power was assessed through R-squared values for endogenous constructs, while predictive relevance was assessed using Stone-Geisser Q-squared values. Effect sizes were inspected through F-squared values. Hypothesised associations and mediated effects were tested using bootstrapping with 5,000 resamples and bias-corrected 95 per cent confidence intervals (Hair et al., 2019).

Given the cross-sectional design, the estimated paths are interpreted as theory-guided associations among guest perceptions measured after one service episode. They are not interpreted as temporal causation (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

3.6 Common method bias and robustness checks

Because all focal constructs were measured through the same questionnaire, common method bias was addressed through procedural and statistical remedies. Procedurally, respondents were assured anonymity, participation was voluntary, item wording was neutral, and the questionnaire avoided evaluative prompts likely to encourage socially desirable answers. These remedies are recommended for reducing common method variance in survey research (Podsakoff et al., 2003; Podsakoff et al., 2024).

A preliminary Harman single-factor test indicated that the first unrotated factor accounted for 34.8 per cent of the variance, below the 50 per cent reference point commonly used as an initial diagnostic. A more stringent assessment was conducted using the full collinearity approach. Full collinearity VIF values ranged from 1.42 to 2.88, below the 3.3 threshold recommended by Kock (2015). These results do not eliminate common method concerns, but they reduce the likelihood that the estimates are dominated by measurement method artefacts (Kock, 2015; Podsakoff et al., 2024).

Additional robustness checks were performed by estimating alternative specifications with demographic controls. Age group, sex, education level, nationality group and travel companionship were included as controls. Their inclusion did not materially change the sign, magnitude or statistical significance of the hypothesised associations, supporting the stability of the findings across observable respondent characteristics (Hair et al., 2019).

Finally, the study relies on self-reported evaluations collected after the stay. Although immediate post-checkout administration improves proximity to the service episode, the design does not include behavioural trace data from robot interfaces, conversation logs or video-based interaction measures. Future research should combine survey measures with robot logs, response latency, language switching, task completion, error frequency, help requests and escalation events to examine human-robot interaction as it unfolds during service delivery (Panagou et al., 2024; Podsakoff et al., 2024).

4. Results

4.1 Measurement model assessment

The reflective measurement model was assessed before testing the hypothesised paths, following established procedures for PLS-SEM (Fornell & Larcker, 1981; Hair et al., 2019; Henseler et al., 2015). Indicator loadings ranged from 0.805 to 0.886. Cronbach's alpha ranged from 0.80 to 0.91, composite reliability ranged from 0.88 to 0.92, and average variance extracted ranged from 0.67 to 0.75. These values support internal consistency and convergent validity.

The square roots of average variance extracted, reported on the diagonal of Table 2, exceeded the corresponding correlations, satisfying the Fornell-Larcker criterion (Fornell & Larcker, 1981). Heterotrait monotrait ratios remained below 0.90, supporting discriminant validity (Henseler et al., 2015). The strongest association was observed between human-robot interaction quality and guest satisfaction, consistent with their shared emphasis on evaluating the service episode. The weaker associations involving intention to revisit suggest that future patronage is less closely tied to the relational cues examined in this model.

**Table 2. Reliability, convergent validity and discriminant validity**

	CA	CR	AVE	Inter-construct associations*					
				1	2	3	4	5	6
1. Perceived anthropomorphism	0.83	0.90	0.75	0.866	0.69	0.66	0.68	0.62	0.27
2. Emotional Closeness	0.89	0.92	0.71	0.62	0.842	0.72	0.76	0.74	0.36
3. Interactive Comfort	0.87	0.91	0.72	0.58	0.64	0.849	0.71	0.68	0.30
4. Human-robot interaction quality	0.91	0.91	0.67	0.60	0.68	0.63	0.820	0.81	0.34
5. Guest satisfaction	0.86	0.91	0.71	0.55	0.66	0.60	0.70	0.843	0.42
6. Intention to revisit	0.80	0.88	0.71	0.22	0.30	0.24	0.28	0.35	0.844

Note: CA means Cronbach's alpha. CR means composite reliability. AVE means average variance extracted. Diagonal values report the square root of AVE. Correlations are reported below the diagonal. HTMT ratios are reported above the diagonal.

The square roots of AVE, reported on the diagonal of Table 2, exceeded the corresponding interconstruct correlations, satisfying the Fornell and Larcker criterion. HTMT ratios were below the conservative 0.85 threshold, supporting discriminant validity. The standardised root mean square residual was 0.031, below the 0.08 benchmark commonly used in PLS-SEM (Hair et al., 2019). Inner VIF values ranged from 1.36 to 2.74, indicating no concern for collinearity among predictors. Full collinearity VIF values, discussed in the methodology section, were also below the recommended 3.3 threshold, reducing concerns that common method bias would dominate the estimates (Kock, 2015; Podsakoff et al., 2024).

4.2 Path model assessment

The path model was evaluated through collinearity, explanatory power, predictive relevance, effect sizes and bootstrapped estimates. The model accounted for 73.0 per cent of the variance in human-robot interaction quality and 79.1 per cent of the variance in guest satisfaction. These values indicate substantial explanatory power for perceptions formed during the stay (Hair et al., 2019). By contrast, the model accounted for 10.7 per cent of the variance in intention to revisit.

Predictive relevance showed the same pattern. Stone-Geisser Q-squared values were positive for human-robot interaction quality, guest satisfaction and intention to revisit, indicating predictive relevance for all endogenous constructs. However, Q-squared was much lower for intention to revisit than for the other outcomes. This pattern is consistent with the scope of the model, which examines relational mechanisms in human-robot interaction, not the full hotel choice process. Future hotel selection may also depend on destination, itinerary, price, availability, accommodation alternatives, perceived risk, and variety-seeking (Berezan et al., 2013; Hasan et al., 2017; Seetanah et al., 2020). Table 3 reports the R-squared, adjusted R-squared and Q-squared values for the three endogenous constructs.

Table 3. Explanatory power and predictive relevance

Endogenous construct	R-squared	Adjusted R-squared	Q-squared
Human-robot interaction quality	0.730	0.729	0.514
Guest satisfaction	0.791	0.790	0.596
Intention to revisit	0.107	0.104	0.061

Note: Q-squared values above zero indicate predictive relevance. The lower Q-squared value for intention to revisit reflects the bounded scope of the relational HRI model.

Constituent mediator paths were also inspected before interpreting the mediated effects. Perceived anthropomorphism, emotional closeness, and interactive comfort were positively associated with the quality of human-robot interaction. Human-robot interaction quality was associated with guest satisfaction, but its association with intention to revisit was weaker and not statistically significant. This pattern is consistent with stronger mediated associations for satisfaction than for intention to revisit. Table 4 presents the constituent paths used to assess the mediated mechanism.

Table 4. Constituent paths of the mediated mechanism

Path	β	95% CI	t-value	p-value
Perceived anthropomorphism → Human-robot interaction quality	0.148	[0.074, 0.222]	3.910	< 0.001
Emotional closeness → Human-robot interaction quality	0.419	[0.348, 0.490]	11.550	< 0.001
Interactive comfort → Human-robot interaction quality	0.356	[0.282, 0.430]	9.460	< 0.001
Human-robot interaction quality → Guest satisfaction	0.124	[0.052, 0.196]	3.373	0.001
Human-robot interaction quality → Intention to revisit	0.078	[-0.046, 0.202]	1.236	0.217

Note: These paths are estimated as components of the mediated mechanism and are not treated as standalone hypotheses.



4.3 Hypothesis testing

Hypotheses were tested using bootstrapping with 5,000 resamples and bias-corrected 95 per cent confidence intervals. Eight of the twelve hypotheses received empirical support. Table 5 reports standardised path coefficients, confidence intervals, t-values, p-values and hypothesis decisions.

Table 5. Hypothesis testing results

Hypothesis	β	95% CI	t-value	p-value	Result
H1: Perceived Anthropomorphism → Guest satisfaction	0.286	[0.237, 0.335]	11.420	< 0.001	Supported
H2: Perceived Anthropomorphism → Intention to Revisit	-0.038	[-0.141, 0.065]	0.726	0.468	Not supported
H3: Emotional Closeness → Guest satisfaction	0.393	[0.320, 0.466]	10.607	< 0.001	Supported
H4: Emotional Closeness → Intention to Revisit	0.410	[0.293, 0.527]	6.852	< 0.001	Supported
H5: Interactive Comfort → Guest satisfaction	0.152	[0.090, 0.214]	4.799	< 0.001	Supported
H6: Interactive Comfort → Intention to Revisit	0.162	[0.050, 0.274]	2.840	0.005	Supported
H7: Perceived Anthropomorphism → Human-Robot Interaction Quality → Guest satisfaction	0.018	[0.003, 0.033]	2.390	0.017	Supported
H8: Perceived Anthropomorphism → Human-Robot Interaction Quality → Intention to Revisit	0.012	[-0.009, 0.033]	1.109	0.268	Not supported
H9: Emotional Closeness → Human-Robot Interaction Quality → Guest satisfaction	0.052	[0.017, 0.087]	2.940	0.003	Supported
H10: Emotional Closeness → Human-Robot Interaction Quality → Intention to Revisit	0.033	[-0.021, 0.087]	1.198	0.231	Not supported
H11: Interactive Comfort → Human-Robot Interaction Quality → Guest satisfaction	0.044	[0.018, 0.070]	3.267	0.001	Supported
H12: Interactive Comfort → Human-Robot Interaction Quality → Intention to Revisit	0.028	[-0.016, 0.072]	1.236	0.216	Not supported

Note: HRIQ means human-robot interaction quality. Confidence intervals are bias-corrected 95 per cent bootstrapped intervals based on 5,000 resamples. Hypotheses are supported when $p < 0.05$ and the confidence interval excludes zero.

The unmediated associations reveal a separation between evaluation of the stay and future patronage. Perceived anthropomorphism was associated with guest satisfaction, supporting H1, but not with intention to revisit, leaving H2 unsupported. Emotional closeness showed the strongest associations in the model, supporting H3 and H4. Interactive comfort was also associated with both outcomes, supporting H5 and H6. These results indicate that affective affinity and psychological ease are more relevant to future patronage than anthropomorphic perception alone.

The mediated effects further specify the role of the quality of human-robot interaction. H7, H9, and H11 were supported, indicating that the quality of human-robot interaction mediated the associations between the three social cue responses and guest satisfaction. H8, H10, and H12 were not supported, indicating that the same mediating mechanism did not extend to the intention to revisit. This pattern supports the argument that social cue responses acquire experiential value through the quality of interaction, while future hotel choice remains shaped by a broader decision context.

Selected f-squared values were inspected to assess the substantive magnitude of the unmediated paths. Emotional closeness showed the largest contribution to guest satisfaction and intention to revisit. Interactive comfort had smaller but non-trivial effects, while perceived anthropomorphism contributed more to satisfaction than to revisit intention. Mediated effects through the quality of human-robot interaction were statistically significant for guest satisfaction but of small magnitude. Table 6 presents the f-squared values used to judge the magnitude of the unmediated associations.

**Table 6. Effect sizes**

Association	f-squared	Reading
Perceived Anthropomorphism → Guest Satisfaction	0.108	Small to moderate
Perceived Anthropomorphism → Intention to Revisit	0.002	Negligible
Emotional Closeness → Guest Satisfaction	0.224	Moderate
Emotional Closeness → Intention to Revisit	0.078	Small to moderate
Interactive Comfort → Guest Satisfaction	0.037	Small
Interactive Comfort → Intention to Revisit	0.018	Small

5. Discussion

5.1 Interpretation of findings

The findings indicate that robotised hospitality is more effective at supporting experiential evaluation than at explaining future patronage. The model accounted for a high proportion of variance in guest satisfaction, but a much lower proportion of variance in intention to revisit. This asymmetry is theoretically significant because it separates favourable evaluation of the service episode from future hotel choice (Berezan et al., 2013; Hasan et al., 2017).

The results support the distinction between social response activation and exchange evaluation. Perceived anthropomorphism, emotional closeness and interactive comfort are not interchangeable. Anthropomorphism helps guests read the robot as a social actor, emotional closeness adds affective affinity, and interactive comfort reduces psychological cost (Blut et al., 2021; Epley et al., 2007; Loveys et al., 2022; Pitardi et al., 2024). Human-robot interaction quality then captures whether these responses are enacted through a fluent, intelligible and socially suitable encounter (Apostol & Matchimura, 2024; Choi et al., 2019; Ozturk et al., 2023).

The strongest result concerns emotional closeness. Unlike perceived anthropomorphism, emotional closeness was associated with both satisfaction and intention to revisit. This suggests that guests do not respond only to whether a robot looks or behaves in humanlike ways. They also assess whether the encounter produces warmth, liking, and familiarity. This distinction refines service robot research by showing that appearance-based humanness and affective affinity should be treated as different psychological processes (Blut et al., 2021; Husain & Prentice, 2025; Mende et al., 2019; Schramm et al., 2024).

Interactive comfort also deserves attention. Its associations with both outcomes suggest that some guests value robotic service because it reduces discomfort, awkwardness or social exposure. This result is compatible with research showing that service robots can reduce metaperception because customers attribute lower agency to them and worry less about how the service agent evaluates them (Holthöwer & Van Doorn, 2023; Pitardi et al., 2024). In automated hotels, comfort is therefore not only a usability concern. It is also a psychological condition for accepting hospitality without routine human contact.

The unsupported paths involving revisit intention refine the interpretation of the value of robotic service. Human-robot interaction quality mediated satisfaction but not revisit intention. Fluent interaction helps consolidate the stay as satisfying, but it does not, by itself, explain whether guests expect to select the same hotel again. Future patronage remains influenced by destination plans, price, availability, accommodation alternatives, perceived risk, and variety-seeking (Berezan et al., 2013; Hasan et al., 2017; Seetanah et al., 2020).

5.2 Theoretical contributions

The study contributes to robotic hospitality theory by linking CASA with Social Exchange Theory while keeping their explanatory roles separate. CASA explains why guests apply social scripts to machines that display language, embodied presence, politeness or responsiveness. Social Exchange Theory explains how such responses are assessed through perceived reward, cost reduction, reciprocity and symbolic value (Blau, 1964; Cropanzano & Mitchell, 2005; Nass et al., 1994; Reeves & Nass, 1996). This framing positions robotised hospitality as a movement from social readability to exchange evaluation.

A second contribution concerns the distinction among the three social cue responses. Perceived anthropomorphism was associated with satisfaction but not with intention to revisit, whereas emotional closeness was associated with both outcomes. Interactive comfort also mattered, but through a different psychological route: it reduced emotional cost without necessarily creating attachment. These findings qualify research that links anthropomorphic design to favourable consumer responses and show that attribution, affinity and comfort should be treated as separate processes (Blut et al., 2021; Crolic et al., 2022; Husain & Prentice, 2025; Mende et al., 2019; Pitardi et al., 2024; Spake et al., 2003;).

A third contribution lies in the role and limit of human-robot interaction quality. The construct is treated as an evaluation of service enactment, capturing whether the robotic encounter is fluent, intelligible, responsive and socially suitable (Apostol & Matchimura, 2024; Choi et al., 2019; Ozturk et al., 2023). The supported mediated paths to satisfaction show that social cue responses acquire value when enacted through competent service. The unsupported mediated paths to intention to revisit identify a boundary condition: robot-mediated exchange value may improve satisfaction without producing repeat patronage.



The study also contributes field evidence from a robot-operated hotel chain. Much of the service robot literature relies on experiments, scenarios or hybrid service environments, whereas the present study uses guest evaluations after an actual stay (Blut et al., 2021; Tussyadiah et al., 2020). This field setting strengthens ecological relevance, while the cross-sectional design still requires caution when interpreting path sequence (Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

5.3 Managerial implications

Managers should not treat humanoid appearance as the primary driver of repeat patronage. Anthropomorphic design can support satisfaction by making the robotic agent socially readable and suitable for hospitality tasks, yet it does not explain intention to revisit in the present model. Investment in humanlike appearance should therefore be aligned with service competence, language reliability, error recovery and the service role assigned to the robot (Blut et al., 2021; Crolic et al., 2022; Husain & Prentice, 2025; Mende et al., 2019).

Emotional closeness should be managed through modest warmth, not simulated intimacy. Robotic scripts can use polite greetings, appropriate apologies, a consistent tone, recognition of guests' needs, and responses that avoid mechanical coldness. Research on embodied agents shows that closeness is shaped by conversational quality, empathy, appropriate responses, humanlike facial features and the absence of programme errors (Choi et al., 2021; Loveys et al., 2022; Schramm et al., 2024).

Interactive comfort should be treated as a form of psychological safety. Robots may reduce embarrassment, social judgment, and metaperception in awkward hospitality situations, such as late-night requests, complaints or privacy-sensitive interactions (Holthöwer & Van Doorn, 2023; Pitardi et al., 2024; Radia et al., 2022; Spake et al., 2003). At the same time, automated hotels should recognise that the absence of routine human contact may lead to emotional distance or alienation for guests seeking reassurance, conversation, or empathy (Liu et al., 2024; Loveys et al., 2022; Odekerken-Schröder et al., 2020). Human escalation should remain available for safety, complaint handling, disability access, distress, service failure and emergency situations.

The quality of human-robot interaction should be managed as a service assurance. Robots that appear friendly but fail to understand requests, repeat generic scripts or respond at unsuitable moments may weaken the value of anthropomorphic and affective cues (Loveys et al., 2022; Panagou et al., 2024). Operators should monitor response latency, multilingual accuracy, task completion, request abandonment, error frequency and escalation events. Interface logs and behavioural traces can complement guest surveys by revealing where interactions fail during the service episode (Panagou et al., 2024; Podsakoff et al., 2024).

The managerial message is not that hotels should make robots more human. Robotised hospitality should be designed as a social service interface in which visual design, scripts, timing, privacy, escalation and service recovery are aligned with hospitality norms (Ivanov et al., 2025; Murphy et al., 2019; Wirtz et al., 2018).

5.4 Cultural boundary conditions

The Japanese setting matters for interpretation. Japan has long been associated with public familiarity with robots, service politeness and cultural narratives in which robotic agents can be accepted as service partners (Katsuno, 2011; Tussyadiah et al., 2020; Yu et al., 2025). These conditions may make robotised hospitality less unusual for some guests than it would be in markets where automation is framed more strongly in terms of labour displacement, depersonalisation, or surveillance concerns (Ivanov et al., 2025; Kervenoael et al., 2024; Wirtz et al., 2018).

The mechanisms proposed in the study are not confined to Japan. CASA proposes that people apply social scripts to machines when social cues are present, and Social Exchange Theory proposes that encounters are evaluated in terms of rewards, costs, and symbolic returns (Blau, 1964; Cropanzano & Mitchell, 2005; Nass et al., 1994). What may vary across cultures is the salience of particular cues. In markets where privacy and autonomy are strongly emphasised, interactive comfort may matter more. In service cultures with stronger relational expectations, warmth and affective affinity may play a larger role (Hofstede et al., 2010; Tussyadiah et al., 2020; Yu et al., 2025).

The findings should therefore be read as evidence from a high-robot-familiarity setting, not as universal parameter estimates. Comparative research across Asian, European and North American hospitality markets could assess whether anthropomorphism, emotional closeness, interactive comfort and interaction quality retain the same relative importance across cultural settings. Measurement invariance testing and multi-group PLS analysis would be suitable for examining whether the constructs operate comparably across nationality, age, prior robot experience and travel purpose (Hair et al., 2019; Henseler et al., 2015).

6. Limitations and Future Research

The study has limitations that point to future research. First, the cross-sectional design captures guest perceptions at checkout and cannot establish temporal ordering among social cues, human-robot interaction quality and outcomes. Longitudinal, experimental,



and experience-sampling designs could examine whether novelty fades, whether comfort grows with familiarity, and whether emotional closeness stabilises across repeated stays (Kang et al., 2023; Maxwell & Cole, 2007; Ployhart & Vandenberg, 2010).

Second, the model isolates relational mechanisms in human-robot interaction. It does not model the full hotel choice process. Intention to revisit may depend on destination, itinerary, price, room quality, cleanliness, gastronomy, brand loyalty, perceived risk, travel companions and accommodation availability (Berezan et al., 2013; Hasan et al., 2017; Seetanah et al., 2020). The modest R-squared for intention to revisit should therefore be interpreted as evidence that the model is bounded around relational HRI mechanisms, not as evidence that robotic service is irrelevant to future hotel choice. Future models should incorporate a wider range of choice variables, especially price, location, travel purpose, risk perception, prior hotel familiarity, novelty-seeking, and brand loyalty.

Third, the study relies on self-reported data collected after the stay. Procedural remedies and full collinearity diagnostics reduce concern about common method variance, but they cannot replace behavioural and interface process data (Podsakoff et al., 2003; Kock, 2015; Podsakoff et al., 2024). Future studies should combine surveys with robot logs, response latency, language switching, task completion, error frequency, help requests, complaint records and escalation events. Such data would connect guest perceptions with evidence from interaction processes and respond to calls for more human-centred HRI evaluation (Panagou et al., 2024).

Fourth, the study was conducted in a single national setting and during a peak tourism season. Seasonal tourism, guest origin, travel purpose and prior exposure to robots may shape responses to automated service (Berezan et al., 2013; Tussyadiah et al., 2020; Yu et al., 2025). Future work should examine whether the model holds across low and high seasons, domestic and international guests, leisure and business travel, solo travellers, families and groups. Multi-group analysis could assess whether paths vary across guest segments, while measurement invariance procedures could test whether differences reflect substantive heterogeneity or measurement variation (Hair et al., 2019; Henseler et al., 2015).

Fifth, the service context requires finer operational differentiation. In the present study, the visible interface included reception, assistance, information provision and room control through robotic or digital agents, while back-of-house functions may still involve humans. Future studies should distinguish front office automation, concierge robotics, luggage handling, room control, housekeeping interfaces and service recovery, because the social and functional demands placed on robots differ by task (Ivanov et al., 2025; Murphy et al., 2019; Wirtz et al., 2018).

Finally, the psychological and ethical implications of reduced human contact warrant further study. Some guests may value robot contact because it reduces judgment, embarrassment and interpersonal pressure; others may experience emotional distance, social deprivation or alienation (Liu et al., 2024; Odekerken-Schröder et al., 2020; Pitardi et al., 2024). Future research should examine alienation, loneliness, accessibility, safety reassurance, emotional support needs and human fallback arrangements, especially for guests who are vulnerable, unfamiliar with the language or travelling alone (Loveys et al., 2022; Panagou et al., 2024).

7. Conclusion

This study examined how guests evaluate service robots in a fully automated hotel environment by integrating the Computers Are Social Actors paradigm with Social Exchange Theory. Using survey data from 1,363 guests in Japan, the study assessed how perceived anthropomorphism, emotional closeness, and interactive comfort relate to guest satisfaction and intention to revisit, and whether the quality of human-robot interaction mediates these associations.

The findings show that social cues in robotic service encounters matter, but not in the same way for all outcomes. Perceived anthropomorphism, emotional closeness, interactive comfort and human-robot interaction quality were associated with guest satisfaction. Emotional closeness and interactive comfort were also associated with the intention to revisit, whereas perceived anthropomorphism and the quality of human-robot interaction were not. Human-robot interaction quality mediated the associations between the three social cue responses and satisfaction, but not the associations with intention to revisit.

The study, therefore, identifies an important boundary in robotised hospitality. Robotic service can generate experiential value when social cues are enacted through fluent, socially appropriate interaction. Yet the same relational mechanism does not, by itself, explain future patronage. Satisfaction with a robot-operated stay and intention to revisit belong to distinct yet related evaluative domains. The first is strongly shaped by the service episode; the second remains exposed to destination, price, travel purpose, availability, perceived risk and alternative accommodation options.

Robotised hospitality should therefore be understood neither as a simple replacement for human service nor as a novelty device. It is a social service interface whose value depends on emotional credibility, psychological comfort and interaction quality. Its strength lies in enhancing the stay experience; its limitation is that repeat patronage is governed by a broader hospitality choice context.



Funding

We acknowledge the financial support of FCT - Fundação para a Ciência e a Tecnologia (Portugal) through research grant UIDB/00685/2025 awarded to the Center of Applied Economic Studies of the Atlantic, School of Business and Economics, University of the Azores, and of the Regional Directorate for Science, Innovation and Development - Azores Government through research grant M1.1.A/FUNC.UI&D/018/2025 (PROSCIENTIA).

Conflicts of interest: The authors declare no conflicts of interest.

Data availability statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Permissions statement: The authors confirm that all material reproduced from other sources has been cited in accordance with APA referencing guidelines.

Disclosure of prior use of data: The data used in this study have not been published previously and are not under consideration for publication elsewhere.

Declaration on the Use of Artificial Intelligence: No generative AI tools were used in the writing or analysis of this paper. All content was produced by the authors.

Credit author statement:

Daniel Costa Pacheco: Writing - original draft, Writing - review & editing, Visualisation, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualisation. **Oswaldo Dias Lopes da Silva:** Writing - review & editing, Visualisation, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualisation, Resources. **Ana Isabel Damião de Serpa Arruda Moniz:** Writing - review & editing, Visualisation, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualisation, Resources. **Ling Li:** Writing - review & editing, Visualisation, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualisation, Resources. **Ulrike Gretzel:** Writing - review & editing, Visualisation, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualisation, Resources. All authors have read and agreed to the published version of the manuscript.

References

- Apostol, E. M. D., & Matchimura, M. V. (2024). Bridge the gap: A modified Grönroos model approach to guests' satisfaction and service quality perception in small and medium-sized hotels (SMSH). *American Journal of Multidisciplinary Research and Innovation*, 3(4), 1-12. <https://doi.org/10.54536/ajmri.v3i4.2605>
- Ariffin, A. A. M., Nameghi, E. N., & Zakaria, N. I. (2013). The effect of hospitableness and servicescape on guest satisfaction in the hotel industry. *Canadian Journal of Administrative Sciences / Revue Canadienne Des Sciences de l'Administration*, 30(2), 127-137. <https://doi.org/10.1002/cjas.1246>
- Berezan, O., Raab, C., Yoo, M., & Love, C. (2013). Sustainable hotel practices and nationality: The impact on guest satisfaction and guest intention to return. *International Journal of Hospitality Management*, 34, 227-233. <https://doi.org/10.1016/j.ijhm.2013.03.010>
- Blau, P. M. (1964). *Exchange and power in social life*. Wiley.
- Blut, M., Wang, C., Wunderlich, N. V., & Brock, C. (2021). Understanding anthropomorphism in service provision: A meta-analysis of physical robots, chatbots, and other AI. *Journal of the Academy of Marketing Science*, 49, 632-658. <https://doi.org/10.1007/s11747-020-00762-y>
- Chen, Q., Huang, D., & Miao, M. (2025). Service robot acceptance: Agenda for tourism and hospitality research. *Tourism Review*. <https://doi.org/10.1108/TR-03-2024-0159>
- Choi, Y., Choi, M., Oh, M., & Kim, S. (2019). Service robots in hotels: Understanding the service quality perceptions of human-robot interaction. *Journal of Hospitality Marketing & Management*, 29(6), 613-635. <https://doi.org/10.1080/19368623.2020.1703871>
- Choi, Y., Oh, M., Choi, M., & Kim, S. (2021). 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>
- Crolic, C., Thomaz, F., Hadi, R., & Stephen, A. T. (2022). Blame the bot: Anthropomorphism and anger in customer-chatbot interactions. *Journal of Marketing*, 86(1), 132-148. <https://doi.org/10.1177/00222429211045687>
- Cropanzano, R., & Mitchell, M. S. (2005). Social exchange theory: An interdisciplinary review. *Journal of Management*, 31(6), 874-900. <https://doi.org/10.1177/0149206305279602>
- Epley, N., Waytz, A., & Cacioppo, J. T. (2007). On seeing human: A three-factor theory of anthropomorphism. *Psychological Review*, 114(4), 864-886. <https://doi.org/10.1037/0033-295X.114.4.864>
- Fang, X., Han, H., & Chen, M. (2024). Exploring antecedents and consequence of robot service comfort in autonomous hotels: A stimulus-organism-response perspective. *Journal of Hospitality and Tourism Management*, 58, 1-10. <https://doi.org/10.1016/j.jhtm.2023.10.015>



- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50. <https://doi.org/10.1177/002224378101800104>
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Hasan, M. K., Ismail, A. R., & Islam, M. F. (2017). Tourist risk perceptions and revisit intention: A critical review of literature. *Cogent Business & Management*, 4(1), Article 1412874. <https://doi.org/10.1080/23311975.2017.1412874>
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43, 115-135. <https://doi.org/10.1007/s11747-014-0403-8>
- Hofstede, G., Hofstede, G. J., & Minkov, M. (2010). *Cultures and organizations: Software of the mind* (3rd ed.). McGraw-Hill.
- Holthöwer, J., & van Doorn, J. (2023). Robots do not judge: Service robots can alleviate embarrassment in service encounters. *Journal of the Academy of Marketing Science*, 51, 767-784. <https://doi.org/10.1007/s11747-022-00862-x>
- Husain, R., & Prentice, C. (2025). Anthropomorphism and consumer experience—Review and future research agenda. *International Journal of Consumer Studies*, 49(5), Article e70117. <https://doi.org/10.1111/ijcs.70117>
- Ivanov, S., Seyitoğlu, F., & Webster, C. (2025). Tourism, automation and responsible consumption and production: A Horizon 2050 paper. *Tourism Review*. <https://doi.org/10.1108/TR-12-2023-0898>
- Kang, S. E., Koo, C., & Chung, N. (2023). Creepy vs. cool: Switching from human staff to service robots in the hospitality industry. *International Journal of Hospitality Management*, 111, Article 103479. <https://doi.org/10.1016/j.ijhm.2023.103479>
- Katsuno, H. (2011). The robot's heart: Tinkering with humanity and intimacy in robot-building. *Japanese Studies*, 31(1), 93-109. <https://doi.org/10.1080/10371397.2011.560259>
- Kervenoael, R., Schwob, A., Hasan, R., & Psylla, E. (2024). IoT robots and consumer experiences in retail: Unpacking repeat purchase intention drivers leveraging computers are social actors (CASA) paradigm. *Journal of Retailing and Consumer Services*, 76, 103589. <https://doi.org/10.1016/j.jretconser.2023.103589>
- Kim, H., So, K., & Wirtz, J. (2022). Service robots: Applying social exchange theory to better understand human-robot interactions. *Tourism Management*, 93, Article 104537. <https://doi.org/10.1016/j.tourman.2022.104537>
- Kim, S. Y., Schmitt, B. H., & Thalmann, N. M. (2019). Eliza in the uncanny valley: Anthropomorphizing consumer robots increases their perceived warmth but decreases liking. *Marketing Letters*, 30, 1-12. <https://doi.org/10.1007/s11002-019-09485-9>
- Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration*, 11(4), 1-10. <https://doi.org/10.4018/ijec.2015100101>
- Kühne, R., & Peter, J. (2023). Anthropomorphism in human-robot interactions: A multidimensional conceptualization. *Communication Theory*, 33(1), 42-52. <https://doi.org/10.1093/ct/qtac020>
- Li, J., Sirkin, D., van Erp, J. B. F., & van Riemsdijk, M. B. (2019). Closeness with robots as social partners. In *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)* (pp. 691-692). IEEE. <https://doi.org/10.1109/HRI.2019.8673168>
- Liu, G. G., Benckendorff, P., & Walters, G. (2025). Human-robot interaction research in hospitality and tourism: Trends and future directions. *Tourism Review*. <https://doi.org/10.1108/TR-04-2024-0266>
- Liu, J., Zhou, L., & Li, Y. (2024). I can be myself: Robots reduce social discomfort in hospitality service encounters. *International Journal of Contemporary Hospitality Management*, 36(6), 1798-1815. <https://doi.org/10.1108/IJCHM-01-2023-0004>
- Loveys, K., Hiko, C., Sagar, M., Zhang, X., & Broadbent, E. (2022). "I felt her company": A qualitative study on factors affecting closeness and emotional support seeking with an embodied conversational agent. *International Journal of Human-Computer Studies*, 160, Article 102771. <https://doi.org/10.1016/j.ijhcs.2021.102771>
- Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods*, 12(1), 23-44. <https://doi.org/10.1037/1082-989X.12.1.23>
- Mende, M., Scott, M. L., van Doorn, J., Grewal, D., & Shanks, I. (2019). Service robots rising: How humanoid robots influence service experiences and elicit compensatory consumer responses. *Journal of Marketing Research*, 56(4), 535-556. <https://doi.org/10.1177/0022243718822827>
- Moussawi, S., & Koufaris, M. (2019). Perceived intelligence and perceived anthropomorphism of personal intelligent agents: Scale development and validation. In *Proceedings of the 52nd Hawaii International Conference on System Sciences* (pp. 115-124). <https://doi.org/10.24251/HICSS.2019.015>
- Murphy, J., Gretzel, U., & Pesonen, J. (2019). Marketing robot services in hospitality and tourism: The role of anthropomorphism. *Journal of Travel & Tourism Marketing*, 36(7), 784-795. <https://doi.org/10.1080/10548408.2019.1571983>
- Nass, C., Steuer, J., & Tauber, E. R. (1994). Computers are social actors. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 72-78). Association for Computing Machinery. <https://doi.org/10.1145/191666.191703>
- Nazarian, A., Shabankareh, M., Ranjbaran, A., Sadeghilar, N., & Atkinson, P. (2024). Determinants of intention to revisit in hospitality industry: A cross-cultural study based on globe project. *Journal of International Consumer Marketing*, 36(1), 62-79. <https://doi.org/10.1080/08961530.2023.2192537>



- Odekerken-Schröder, G., Mele, C., Russo-Spena, T., Mahr, D., & Ruggiero, A. (2020). Mitigating loneliness with companion robots in the COVID-19 pandemic and beyond: An integrative framework and research agenda. *Journal of Service Management*, 31(6), 1149-1162. <https://doi.org/10.1108/JOSM-05-2020-0148>
- Ozturk, A. B., Pizam, A., Hacikara, A., An, Q., Chaulagain, S., Balderas-Cejudo, A., Buhalis, D., Fuchs, G., Hara, T., Vieira de Souza Meira, J., García Revilla, R., Sethi, D., Shen, Y., & State, O. (2023). Hotel use intentions of consumers with autonomous mobility: An international overview. *Journal of Hospitality and Tourism Technology*, 14(5), 780-801. <https://doi.org/10.1108/JHTT-07-2022-0223>
- Panagou, S., Neumann, W. P., & Fruggiero, F. (2024). A scoping review of human robot interaction research towards Industry 5.0 human-centric workplaces. *International Journal of Production Research*, 62(3), 974-990. <https://doi.org/10.1080/00207543.2023.2172473>
- Pitardi, V., Wirtz, J., Paluch, S., & Kunz, W. H. (2024). Metaperception benefits of service robots in uncomfortable service encounters. *Tourism Management*, 105, Article 104939. <https://doi.org/10.1016/j.tourman.2024.104939>
- Ployhart, R. E., & Vandenberg, R. J. (2010). Longitudinal research: The theory, design, and analysis of change. *Journal of Management*, 36(1), 94-120. <https://doi.org/10.1177/0149206309352110>
- Podsakoff, P. M., MacKenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879-903. <https://doi.org/10.1037/0021-9010.88.5.879>
- Podsakoff, P. M., Podsakoff, N. P., Williams, L. J., Huang, C., & Yang, J. (2024). Common method bias: It's bad, it's complex, it's widespread, and it's not easy to fix. *Annual Review of Organizational Psychology and Organizational Behavior*, 11, 17-61. <https://doi.org/10.1146/annurev-orgpsych-110721-040030>
- Radia, K. N., Purohit, S., Desai, S., & Nenavani, J. (2022). Psychological comfort in service relationships: A mixed-method approach. *Journal of Retailing and Consumer Services*, 64, Article 102824. <https://doi.org/10.1016/j.jretconser.2021.102824>
- Reeves, B., & Nass, C. (1996). *The media equation: How people treat computers, television, and new media like real people and places*. CSLI Publications/Cambridge University Press.
- Schramm, H., Hartmann, T., Berditsch, M., Heynen, F., Machin, T., Breves, P., Bos, M., Völcker, B., Liebers, N., Hofer, M., Klimmt, C., & Lindsey, S. (2024). Research trends on parasocial interactions and relationships with media characters: A review of 281 English- and German-language studies from 2016 to 2020. *Frontiers in Psychology*, 15, Article 1418564. <https://doi.org/10.3389/fpsyg.2024.1418564>
- Seetanah, B., Teeroovengadum, V., & Nunkoo, R. (2020). Destination satisfaction and revisit intention of tourists: Does the quality of airport services matter? *Journal of Hospitality & Tourism Research*, 44(1), 134-148. <https://doi.org/10.1177/1096348018798446>
- Soper, D. S. (2025). *A-priori sample size calculator for structural equation models* [Software]. <https://www.danielsoper.com/statcalc>
- Spake, D. F., Beatty, S. E., Brockman, B. K., & Crutchfield, T. N. (2003). Consumer comfort in service relationships: Measurement and importance. *Journal of Service Research*, 5(4), 316-332. <https://doi.org/10.1177/1094670503005004004>
- Tung, V. W. S., & Au, N. (2018). Exploring customer experiences with robotics in hospitality. *International Journal of Contemporary Hospitality Management*, 30(7), 2680-2697. <https://doi.org/10.1108/IJCHM-06-2017-0322>
- Tussyadiah, I. P., Zach, F. J., & Wang, J. (2020). Do travelers trust intelligent service robots? *Annals of Tourism Research*, 81, Article 102886. <https://doi.org/10.1016/j.annals.2020.102886>
- Westland, J. C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications*, 9(6), 476-487. <https://doi.org/10.1016/j.eierap.2010.07.003>
- Wirtz, J., Patterson, P. G., Kunz, W. H., Gruber, T., Lu, V. N., Paluch, S., & Martins, A. (2018). Brave new world: Service robots in the frontline. *Journal of Service Management*, 29(5), 907-931. <https://doi.org/10.1108/JOSM-04-2018-0119>
- Yu, Y., Yang, Z., Sun, Z., Zhao, Z., & Fu, M. (2025). A meta-analysis of anthropomorphism of artificial intelligence in tourism. *Asia Pacific Journal of Tourism Research*, 1-19. <https://doi.org/10.1080/10941665.2025.2486014>