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A Southeast Asian Perspective on Hotel Service Robots: Trans Diagnostic Mechanics and Conditional Indirect Effects

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Keywords:

Anthropomorphism; Hotel service robots; Service robot acceptance; Performance expectation; Perceived threat; Southeast Asia

Abstract

Although earlier studies have been able to demonstrate how Europeans view service robots, it is not empirically possible to make the same claim regarding Asians, particularly from cross-national studies with a sizable sample size. We adopt a transdiagnostic approach with 1311 respondents to analyse the disorder that hotel service robots (HSR) cause in the hotel industry and give empirical data from an Asian context on the problem. The method has historically

been used in psychiatry, and we provide a significant discovery from a Southeast Asian perspective in employing the same approach. Adopting the methodology used in this study, we agree that earlier studies on hotel services have produced dubious conclusions. These anomalies are justified by the presence of several service situations. It is demonstrated via two situational experiments that customers prefer very human-like HSR and believe they will perform better in circumstances with high perceived control. Only in social situations are the effects meaningful, and they are reversed when there is less perceived control. However, the effect is not present for luxury hotels based on the geographic bounds of the current investigation, which gives this study a high level of novelty. These findings present a novel perspective on the acceptance of HSR by humans and robots in the hotel business. Professionals, academics and hoteliers who are considering whether to use robots that would either lower or raise their service standards may find this study to be of interest.

Keywords: *Anthropomorphism; Hotel service robots; Service robot acceptance; Performance expectation; Perceived threat; Southeast Asia*

Introduction

Rationale

The introduction of robots to carry out service tasks in the hotel industry serves as a viable differentiation strategy and has been seen as a novel and contemporary trend in the hospitality and leisure market (Tuomi et al., 2021; Pan, 2015; Tung and Au, 2018; Ivanov et al., 2017; Mest, 2017; Murphy et al., 2019). However, there are some exceptions to the novelty of these hotel service robots (HSR) which are deemed to contradict its utilitarian value (Brochado et al., 2016; Tung & Au, 2018; Tuomi et al, 2021). Based on these contradictions international additional intercontinental research on service robots is highly useful into providing salient insights into these contradictions.

These robots are anticipated to perform crucial "back-of-house" tasks specifically within the garde manger (cold kitchen) and hot kitchen in addition to some minor housekeeping chores, as well as "front-of-house" duties like despatching beverages, reception duties, room service, providing welcome services, chatbots, increasing its utilitarian value to improve guests' overall stay experiences (Tuomi et al,2021;Zhang et al.,2020; Murphy et al., 2017; Pinillos et al., 2016; Kim and Qu, 2014; Murphy et al., 2016),for instance, "Flippy" and "Connie" has been employed at the back and front of the house respectively (Kolodny, 2017; IBM, 2016), lowering costs, enhancing service effectiveness, and piquing customer interest (Ivanov et al., 2017). However, Hotel Service Robots (HSR) acceptance in extant literature remains severely vague (Chuah et al., 2021). Extant research has been carried out to address the wants and needs of HSR (Gretsel and Murrphy 2019; Ivannov et al. 2017, 2019; Murrphy et al. 2017, 2019; Rosete et al. 2020; Tun and Lau 2017; Tusyadiah 2020) driven by demand side perspectives towards HSR espousal (Ivannov et al. 2018a, b; Linn et al. 2019; Luu et al. 2019; Stok & Merkell 2017; Tusyadiah et al. 2017), and acceptance of HSR (Pak 2020; Tusyadiah et al. 2020), chores deemed as congruous for HSR (Ivannov and Webbster 2019a,b) guests experience of HSR (Tusyadiah and Pak 2018), influence of communication on work engagement (Choie et al. 2019), impact of HSR on consumer journey towards marque experience

(Chaan and Tunng 2019), engagement amongst guests and HSR (Nakanisi et al. 2020), intensity of HSR disposition on affinity (Qieu et al. 2020) functional process failure recuperation of HSR (Hoe et al. 2020), the prodding intensity of HSR (Tusyadiah and Miler 2019), visitor insights about HRS's resemblance (Yuu 2018, 2020; Yuu and Ngaan 2019), the effect of HSR on transaction perceptions (Zong et al. 2020) HSR service motivatons (Kevenol et al. 2020), HSR effect andhuman similitude (Zhu and Chang 2020). However, if hotel guests do not want to be served by robots, then hotels might revert to the laws of consumer orientation (Ivanov at al., 2020).

The novelty of HSR is still at its prefatory stage, which hinders a strong theoretical and practical understanding of its utility (Belanche et al., 2020; Tuomi et al, 2021). To mitigate this issue, this research conducted a cross country study across six Southeast Asian countries. Moreover, Europeans perception of HSR are known but the same cannot be confirmed about Southeast Asians (SEA) based on cross country studies with a large sample size (Lanzer et al., 2020). Guests are less receptive towards high anthropomorphism (Yu, 2020; Jia et al., 2021) triggering the uncanny valley effect. Voorhees et al., (2017) demarcates the service process into three distinct stages namely the pre consumption, consumption and post consumption. Lilicrap and Coussins (2010) reflects the stages into the "front of the house" and "back of the house" process of food and beverage services. In pursuant Bell et al., (2011) demarcates the chronical service sequential process the aforementioned stages leading to homogeneity in terms of process and heterogeneity in terms of tasks. Therefore in order to harmonise the service process, managers must decide on the levels of robotisation and humanisation respectively (Ivanov et al., 2017; Ivanov & Webster, 2019b) in order to reduce service breakdown.

Based on the preceding discussion, we posit that consumer demographics influences acceptance or rejection of HSR and this study provides empirical evidence on such a phenomenon while an examination on causal psychological routes and the dynamics of specific populations needs scrutiny. We provide closure to this significant gap by presenting a cross country study with a sample size of 1311 from six nations, acceptance or rejection of HSR within the context of SEA hotels and psychological routes influencing prescription of systemic outcomes of HSR. The more trustworthy technology and technological agents become, the more visitors will rely on them because they can now offer "near-human" experiences, contingent to that, research must adopt a multidisciplinary approach rather than focusing solely on "pure" humans (Sigala, 2018).

Nowadays hotel service robots (HSRs) are often human like or anthropomorphic (Chiang, 2022). Researchers have emphasised the perceived dominion function and the ostensive perils of HSR (Ferari et al., 2016). The hypothetical association of HSR as posturing intimidation to people with regards to reduced ostensive dominance, assumes contextual eeriness (Yang et al., 2021) providing congruence towards the uncanny valley effect. However no study thus far has provided empirical evidence about the preceding phenomenon from a SEA perspective of various hotel and resorts categories (1 to 5 stars). We address the issue of generality of previous findings and provide clarity through a cross sectional study within the context of

industrial cross country and academia respectively. According to Mordor Intelligence (2022) a renowned market intelligence and consultancy firm, Southeast Asians are ahead in robot adoption.

We further provide robustness in narrowing the research gap by means of employing a transdiagnostic approach to clarify this phenomenon, which is expected to go beyond understanding the rejection or acceptance of HSRs in the hotel industry. The cognitive-affective, interpersonal, and cognitive behavioural investigations that this study are grounded on are particularly well-suited to the trandiagnostic approach that seeks to identify core cognitive-behavioural processes which is hypothesised to be important across a range of issues and to develop a manipulative conditional indirect effect that targets these problems. The study's uniqueness is that guests at premium hotels were less likely to accept HSRs than guests at other hotel categories. Hence, this work makes three significant contributions. First, the acceptability of HSR by travellers and tourists; second, the effects of HSR on the travel and tourism industry's economy; and third, the implications of the aforementioned factors of HSR on the workplace and the replacement of humans) Bulchand (2022). This study offers a predictive model of interactions between robots and hotel guest service personnel through key psychological routes, we close these gaps in a considerable way. With the help of a cross-country study and a sizeable population from a location where technology-driven hotels are revolutionising hospitality experiences, this study adds new perspectives to the hospitality and tourism literature already in existence. In areas where tourism is a significant sector, robot usage (both industrial and service robots) is growing and advancing. The usage of service robots is developing quickly in Southeast Asian countries where tourism is a sizable industry, where this ground-breaking study was conducted.

We tested the operational factor of dual service scenarios (food and beverage and front desk) in social and non-social scenarios. This study is verified by two major operational service process through two experiments. This is possible by using different specific context centred scenarios which should decrease generalisability. In pursuant, we theorise that the acceptance or rejection of a service is primarily caused by the demographics of the study and not specifically on the service context alone, which sheds some doubts on Yang et al., (2021) assumption on diversity of service context as the solitary factor towards the effect of anthropomorphism on service robots, additionally, by using a transdiagnostic strategy, we lower psychological invariance. Conventional behavioural studies originated from cognitive behavioural theories leveraged on cognitive-affective, interpersonal, and cognitive behavioural features. A mechanistically transdiagnostic approach identifies psychological processes, triggers the efficiency motivation which induces a performance expectation effect (Yang et al., 2021), therefore applicable to human and functional machinery studies.

In pursuant we propose a novel technique known as the transdiagnostic mechanics which is traditionally employed in psychiatric studies. This method which is especially appropriate for researching behavioural patterns, cognition, and perception, which has a strategic fit for our study. We seek to have an understanding of how knowledge about our social scenarios develops through experience and the influence of these structures on memory, information processing, attitudes, and judgment of HSRs transdiagnostic account of behaviour and may facil-

itate the development of pathway-specific intervention strategies. In this interventionist study, we employ cluster sampling to test participants across hotels. We employed a two (anthropomorphism: upper limits vs. lower limits) × two (ostensive dominion: upper limits vs. lower limits) amid experimental layout. The participants received multiple HSRs exposures in front desk and food and beverage settings using three distinct technological service interventions (service delivery video, image of service setting, and HSR). Drawing on a sample of 1311 guests from twenty four metropolitan hotels and resorts across Southeast Asia, we evaluated consumer acceptance behaviour toward HSRs in low- and high- perceived control contexts. However, the theoretical and practical understanding of HSRs and humans, its adaptive process and acceptance for consumers and companies are scarce (Beckerle et al., 2018) and remains inconclusive.

The interest in emerging technologies has grown among consumers, industries, and wider society, as well as in hospitality and restaurant settings (Evanschitsky, et al., 2020; Claus & Zaikowsky, 2020; Stannislav & Crag, 2019; Wirtz et al., 2018; Sin & Jong, 2020). Robots are increasingly being used in restaurants as chefs as well as waiters, both service providers and clients must overcome the critical obstacle of the robotisation of travel and culinary experiences (Forné, 2021). Hence, HSR may be instrumental in reducing and increasing the utility of customisation and standardisation respectively of the leisure and hospitality industry, increasing the utilitarian effect on the market (Avyildiz et al, 2022). However, there has been very little attention given to the creation of a viable integrated approach for the coexistence of robotic systems and human-autonomous machines (Paraman and Annamalah, 2022) in the context of hotels from a cross country perspective. We employ transdiagnostic mechanics for the first time in the field of robotic services although traditionally it is used in psychiatry. The method is suitable for studies related to mood, behaviour, cognition, and perceptions and has been recommended as a substitute to solitary-testing protocol commonalities (Barlow et al., 2004; McEvoy et al., 2009). We proceed under the assumption that, as has been observed in studies of primates (Fors et al., 2018) sociality may infer phylogeny on how humans respond to HSRs interactions. We are interested to find if behavioural differences between humans and HSRs are consistent over time and across different contexts and we argue that biological and mechanical diversities are highly relevant to evolution of man and machines. However what is latent and misunderstood is its evolutional transformation (Brodbent, 2017; Brynjolson, MacAfee, & Cumings, 2014; Colins, 2015; Fre & Osborrne, 2017; van Dorn et al., 2017).

Cyber technology is predominantly transmogrifying industrial structures and utility shackles, creating myopic parameters beyond process optimisation (Paraman and Annamalah, 2022). Human adoption of HSR is at a prefatory stage (Liu et al., 2022) and it's vital to efficiently tune parameters and experimentally benchmark its performance. However, consumers' adoption of robotic technology can differ depending on service contexts and it is still unclear as to how their reactions to HSRs varies in various service situations, (Kao and Huang, 2022; Ivannov et al.,2018; Tusnsyadiah & Panrk 2018; Chan and Tung, 2019; Longoni et al.,2019; Ho et al., 2020; Shin and Jeong,2020; Xhu and Chang,2020).

Previous studies have also considered HSRs in restaurants and hotels (Kao and Huang, 2023; Lin and Mattila, 2021). However, no studies thus far has provided evidence on specific hotel categories within a SEA context although Indonesia and Thailand are poised for robust turn-around, while Singapore, Thailand, Philippines and Malaysia have eased most of their travel restrictions, changing the SEA tourism landscape (WiT, 2022). HSRs are likely to become more prominent in the SEA region's tourist and hospitality sectors and are predicted to expand exponentially (Mordor Intelligence, 2022; Kim et al., 2022; Keyser and Kunz, 2022, Hahn and Hahn, 2020) it is surprising to note that no study has proactively examined this phenomenon within this thriving region.

Social implications of robotic services

Microscopic fluctuations of anthropomorphism (Wirtz et al, 2018) can reduce eeriness. There is a substantial vacuum in the literature with regards to the usage of anthropomorphism in hotel settings (Ding et al., 2022). Prior research on anthropomorphism is varied, acceptability is still a challenge, and it is unclear how the physical and emotional aspects of HSR anthropomorphic traits differ from one another (Mori, 1970; Salles et al., 2020). Empirical research on interactions between humans and robots using projected scenarios are extremely limited (Vas, 2021; Lee et al., 2019; Zambito, 2019; Linthwaite, 2019; Moneta & Sinclair 2020). Projected scenarios can be utilised as a useful technique for helping customers (Van Pinx-teren et al., 2020). Since the hospitality sector is particularly vulnerable to the growth of HSR, there is a need for greater research in the field (Yang et al., 2021).

Hotel classification is a key factor in determining the ways in which HSRs are implemented and received in service settings. Budget and midscale hotels are more affected by HSR than luxury hotels because luxury hotel guests do not place a high value on the services offered by HSR (Chi et al., 2020). By comparison, mid-scale and low-cost hotels frequently aim to satisfy guests' demands through restricted service, in contrast to luxury hotels, which attempt to offer premium and personalised services (Kim & Kim, 2005). The value of service provided by human workers is vital for luxury hotels, whereas the opposite is true for other categories, as shown by robotic services, which do not differentiate between midscale and low-cost hotels in terms of customer satisfaction (Chan and Tung, 2019).

Such conflicting findings on impact of anthropomorphism on a guest's propensity to employ HSR (Yang et al., 2021) suggest that the operationalisation of anthropomorphic features and the engagement with HSR by humans in hotel settings require extensive, detailed, further analysis as we present in this research paper. Prior studies on HSR are restricted to a few developed nations like Japan and the USA, yet provide contradictory evidence regarding the effect on guest comments about their stay at a hotel and their interest in using HSR. Meanwhile, theoretical and practical understanding to identify HSR boundary conditions remains lacking (McCartney & McCartney, 2020; Murphy et al, 2019). The psychological propensity to assign human features to non-human features are reflected in the anthropomorphic design of HSRs (Heider & Simmel, 1944). Robotic deployment has become essential due to the recent pandemic, but it cannot be viewed as a *force majeure* that completely replaces human interaction in settings where the value of human connection and the spirit of hospitality are

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paramount (Arena, 2020; Blut et al., 2021). Building and maintaining relationships will be accomplished by the relevance marketers generate, the experiences they produce, and the service value of HSRs (Katz, 2022).

Research aims, method, and structure of the paper

In the present paper we assume that divergence in previous findings were based service situations. Therefore we conducted an experimental investigation of guests-robot interactions in two different service contexts—food and beverage and front desk, within a Southeast Asian context. We address this significant gap by providing contemporary theoretical and practical understanding by undertaking a cross country study of budget, midscale, and luxury hotels within six SEA countries, namely: Singapore, Philippines, Indonesia, Thailand, Vietnam and Malaysia to determine the degree of anthropomorphism on HSRs in the hotel industry.

We employ transdiagnostic mechanics for the first time in the field of marketing although traditionally it is used in psychiatry. The method is suitable for studies related to mood, behaviour, cognition, and perceptions and has been recommended as a substitute to solitary-testing protocol commonalities (Barlow et al., 2004; McEvoy et al., 2009). We seek to discover if behavioural differences between humans and HSRs are consistent over time and across different contexts and we argue that biological and mechanical diversities are highly relevant to evolution of man and machines.

In experiment 1, we investigate the level of control that guests believe they have over HSR in order to determine how anthropomorphism influences users' willingness to utilise services when they perceive varying degrees of control. In pursuant different outcomes of HSRs acceptance are observed by using dual psychological routes. Experiment 2 identifies acceptance of SR in a hotel service context.

An important, if not evolutionary, part of explaining the function of HSRs is the consumer experience based on categorical demographics within different classes of hotels. In this study, we suppositionally hold that the differences in demographics and service scenarios are the most plausible reason for previous research having produced contradictory outcomes. We offer fresh perspectives on how anthropomorphism affects psychological routes to employ HSRs in hotels. Our findings also offer a framework to help future researchers comprehend the connection between anthropomorphism and consumer readiness to utilise HSRs within the context of hotels from a Southeast Asian demographics perspective.

Literature review

Open innovation dynamics and service robots

The infusion degree of integrated innovative expansion can be controlled and managed positively through the Schumpeterian dynamics through human like machines namely HSR (Chesbrough 2006, 2013; Yun 2015; Yun et al. 2015; Yun et al. 2016a, b) in the context of the hospitality industry. Open innovation means periodic non static and non-linear responsive

systems, and transformative unfreezing of the status quo are rapidly accelerating in the Fourth Industrial Revolution due to paradoxical non-linear dilemmas (Yun et al., 2016; Lee et al., 2018; Yun et al., 2016; Yun and Liu, 2019; Yun et al., 2018), transitioning from stationary to being dynamic, it can both boost open innovation dynamics and lower costs becoming the engine that triggers innovative growth (Yun et al., 2020). Therefore, the need for a contemporary theoretical and practical understanding of a novel technological transaction model is crucial in all economical aspects of new learning (Yun et al., 2016). In view of the dynamic and uncontrollable environment, social, open and closed innovations involves transformative periodical market dynamics (Yun, 2015; Yun et al., 2018; Yun and Liu, 2019). Highly innovative and contemporary organisations are redrafting their robotic and digital strategies to be in sync with societal wants and needs (Valeeva et al., 2022).

In the labour intensive leisure and tourism industry, robotisation is an extremely viable and a transformative option (Ivanov & Webster, 2019a; Harari, 2017; Ivanov et al., 2019; Wirtz et al., 2018; Bowen & Whalen, 2017; Murphy et al., 2017; Tuomi et al., 2021)**.** Our study provides salient and factual insights towards extant hospitality literature of the market dynamics and its acceptance of HSR in a novel geographical parameter within the different ranks of hotel categories in the leisure industry.

Anthropomorphism and perceived control's effects on consumers' desire to accept HSR

Although anthropomorphism and has the tendency to inoculate genuine or hypothetical behaviour of nonhuman agents with humanlike characteristics (Epley et al., 2007), consumer perception research does not have a strong theoretical foundation and intuitive understanding of the phenomenon (Song et al., 2022; Paraman and Annamalah, 2022). Anthropomorphism is an inductive reasoning process that is concerned with the visible characteristics of inhuman items Kim and McGill (2011), However, the quest for human-like intelligence as a benchmark about anthropocentrism and anthropomorphism is vague and undefined (Korteling et al. 2021; Zhu & Chang, 2020).

A comparison between paradoxes helps to explain the anthropomorphism effect (Paraman and Annamalah, 2022). Additionally, users are concerned that human-like HSR could jeopardise their human identity and feel that engaging with HSR requires more effort than speaking with humans. Recent research has focused particularly on how the service setting affects customers' readiness to engage HSR. In some service contexts, Mende et al. (2019) discovered that clients feel extremely uneasy when an HSR has human-like morphologies, but less so in situations featuring other (non-human) morphologies. Lv et al. (2020) found that the anthropomorphism of HSRs can have a restorative effect on consumer tolerance but is lessened by time constraints in service failure.

If the hotel service settings are not taken into consideration, research findings may be inconsistent. To understand further the elements influencing consumers' inclination to adopt anthropomorphic HSR, it is necessary to define the service contexts. When ownership of service dominance varies, so will the degree of customer influence and control over the service process and the degree to which consumers perceive control. Consumers who consider themselves as having complete control over the customer service experience are highly perceived

in terms of control (Chi et al., 2020). Determining that perceived control affects how consumers perceive anthropomorphic SR, we propose the following fundamental hypotheses:

● H1a: The inclination to employ HSRS in a circumstance with a high perceived control condition is positively influenced by the level of anthropomorphism in SEA hotels.

● H1b: The level of anthropomorphism negatively affects users' willingness to engage HSRS in a situation with poor perceived control in SEA hotels.

Conditional indirect effects

Compared to other industries, tourist may provide hypersensitive assessment of HSRs. However the condition in which this effect holds needs to be carefully theorised. Therefore, an essential prerequisite for researching human-robot interaction (HRI) under the robotic service paradigm is understanding how a robot's human-likeness affects this experience (Murphy et al., 2019). Due to the variance in the perceived levels of control that customers perceive, several factors including performance expectations and perceived threat carry high importance.

The anticipated effects of HSRs on the provision and consumption of tourist and hospitality services have been found to be related to human-side perceived levels of autonomy and social interaction (Ivanov and Webster, 2017). All these interpretations share the idea that, in circumstances of significant perceived control, customer interactional schemas are motivated by the anthropomorphic design of HSRs.

This demonstrates that eliciting agent information affects anthropomorphism and that humans may assess alien entities using their own experience while an ethical reconfiguration is imminent (Epley et al., 2007; Paraman and Annamalah, 2022). In this situation, highly anthropomorphic HSRs can improve user interactions, reinforce users' impressions, and eventually boost users' propensity to utilise them. Considering this, we suggest that:

● H2a: Performance expectations in a high perceived control condition effectively mediate human likenesses towards inclination to accept HSRs in SEA hotels.

Customers dislike interacting with overtly anthropomorphic HSRs because they make them feel threatened, as shown by HRI research (Wang et al., 2015). Researchers from other fields have emphasised the importance of perceived control in people viewing HSRs as a threat (Ferrari et al., 2016). Such researchers assert that HSRs constitute their apparent lack of control, and people react uneasily to them in unexpected circumstances (Yang et al, 2021). Noting that efficiency and sociality are two goals with which the cognitive mechanisms of anthropomorphic entities collaborate, according to psychology literature (White, 1959), we thus suggest the following:

● H2b: Perceived threat in a situation where control is poorly perceived negatively mediates anthropomorphism towards HSR acceptance in SEA hotels.

The moderating role of sociality

Research into service encounters has focused on the social interactions between humans but is now evolving due to the high-tech and low touch influence that are changing consumer be-

havioural perception of services enhanced by and delivered using HSR technology, increasing abidance by the perceived performance standards (Ostrom et al., 2015; Larivière et al., 2017; Ostrom et al., 2015; Kwon, 2020). We assert that since social circumstances were employed, they may have an impact on how consumers feel about anthropomorphic HSRs.

In general, customer's willingness to engage HSRs may be influenced by the socially interacting environment. When robotic service is used instead of human workers at this level, it may have an impact on how luxury hotel visitors perceive their experience. The significance of HSRs simply is in its efficiency and cost reducing factors (Ivanov & Webster, 2017; Pinillos et al., 2016).Hence the following hypotheses:

● H3: Only in social settings does the relationship between anthropomorphism and perceived control have an impact on HSRs. In non-social contexts, it is not significant in SEA hotels.

Data Collection and Analysis

The potential respondents were invited via data from hotels which was handled very discreetly due to, the Innkeepers Act 1952 has imposed strict liability upon the innkeeper, based on their exposure to HSRs. The respondents were categorised into very experienced, moderately experienced and those who had some exposure to HSR. Respondents was categorised as to their demographics (60.2% female), age (33–65 years) while the face to face session was estimated to be from twelve to twenty minutes employing semi structured questions. First, the document was based on general questions of HSR with colour images to facilitate understanding. Next, a list of specific questions on food and beverage and front desk scenarios, including a short multimedia five minutes clip, featuring HSR with high and low human likeness was screened and concluded with feedback and general comments. Participants were provided cash incentives of USD 50.

Experiment 1

Trans diagnostic intervention studies for affective themes in randomised trial and analogous issues arise in a different type of trans diagnosis approach, such as examining whether a particular behavioural dimension relates to a particular factor trans diagnostically and similar to the argument for diagnostic categories, seem to require demonstrating that such dimensional relationships hold and do not differ across groups (Tulbure et al., 2019). Hence we enrolled participants via randomised groups of 698 respondents.

In experiment 1, we looked at how anthropomorphism and perceived control interacted to affect customers' propensity to accept HSR and to employ dual psychological paths (Figure 1). All of the study's respondents gave their approval for their participation in the data gathering. The population of the study was determined based on cluster sampling system.

The data collection was conducted from June 06, 2019 to May 15, 2021, from selected hotels across 20 distinct locations in six SEA nations. The locations of the study were; Philippines (Manila, Quezon, Makati) Malaysia(Kuala Lumpur, Langkawi, Penang) Singapore (Tanglin, Rochur, Tanjong Pagar) Indonesia (Jakarta, Bandung, Surabaya, Bali)Thailand (Bangkok, Chon Buri Ho, Phetchaburi) and Vietnam(Ho Chi Minh, Hanoi, Da Nang). The hotel sector

was chosen based on its high labour intensive and high touch service structure respectively and its employment of HSR.
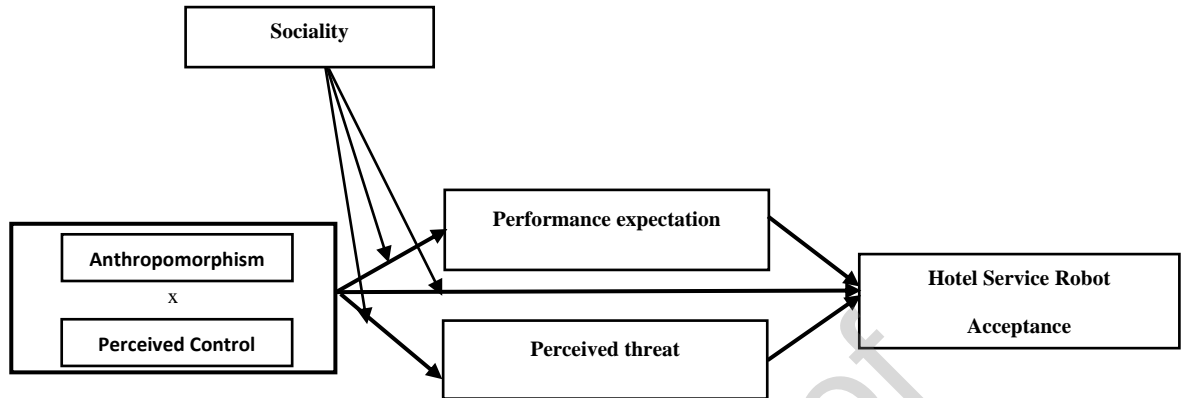
Figure 1: Theoretical Framework: A predictive model of robot and hotel guest service interactions (adopted from Yang et al., 2022 and slightly modified)

Here, we'll construct a model that may be used to assess and predict the dynamic consequences of HSR open innovation and then apply it to the hotel sector. A completed version of the Ethical Assessment Form was obtained from the relevant parties involved in this work prior to the commencement of the research. In Experiment 1, we examined the interaction effect of the predictors towards hotel guest acceptance of HSR via dual direct and indirect routes (Figure 1).

Methodology

Majority of respondents were from Singapore (n = 127, 18.2 %), followed by Philippines (n = 122, 17.5%), Malaysia (n = 129, 18.5%), Vietnam (n = 119, 17%), Indonesia (n=102, 15.6%) and Thailand (n=99, 14.2%).The trans diagnostic protocol (n = 698) consisted of 132 sessions, of 60-90-minutes each, delivered over a 90–92-weeks piloted by interns, presided and directed by all authors. The bootstrap test of moderated mediation provides adequate power (p ≥ .8) to identify effect sizes for sample sizes N ≥ 200 (Fritz and Mackinnon 2007; Preacher et al., 2007). Therefore, the sample sizes of all two experiments are sufficient to identify minor-to-moderate effects with good test power.

Pre-test 1A. Random selection was used to choose six groups of hotel guests, totalling 105 (57% male; Mage = 36). They rated how much the images resembled humans (on a scale of 7 for machine-like to +7 for humanlike).In this randomised experiment, the scalable trans diagnostic behavioural intervention in a cross country community setting domains is operationalised by exposing an image of an HSRs that is highly and lowly anthropomorphic in nature.

Significant variations in anthropomorphism between the groups were discovered via a one-way ANOVA. Because not enough people were uncomfortable, the uncanny valley wasn't reached, and there was no noticeable difference in terms of collective eeriness. The principal and salient quantitative output were analysed towards the population for diagnostic merit and stratification factors.

Pre-test 1B. Pre-test participants included six groups of 81 hotel guests, (47% females; Mage = 33). After viewing a scenario image, respondents were asked to pretend that that they were actually involved in the service process. One such example of little perceived control is the hotel front desk scenario. The second case study substitutes a strong perceived level of control with a restaurant service scenario. When compared to the restaurant service group, the front desk service group's perceived control was significantly lower, per ANOVA (M front desk = 0.71, M restaurants = 0.84, F (1.67) = 37.661, p.001) than the restaurant service group's perceived control.

Subjects and design. In this study, the anthropomorphism and perceived control between-subjects designs were used. We used 698 hotel guests from twenty four hotels spread across six SEA countries (43% of them were females; Mage = 33) to help us with this investigation.

Procedure.

The participants were then given a picture of a restaurant's lobby with a server robot facing the customer and an order tablet put flat on the counter .The server robot plays a short audio message that begins, "Welcome to (name of the food and beverage outlet)," "May I take your orders please." The menu is shown on the tablet, and three instruction boxes with suggestions for menu items based on themes appear in the tablet's top-right corner, along with a different "Takeaway" box. Additionally, robotic services make it possible to supply services at a reduced cost, enabling previously unaffordable services to be made available to clients, increasing the overall value of the service (Bowen & Morosan, 2018).

Outcome. Our results revealed that the manipulation of anthropomorphism was significant. When eeriness was utilised as the control variable, it was not statistically significant. Only the primary impact of the adjustment of perceived control (alplha= 0.881; Mhigh = 0.67; Mlow = 0.91; F (1,182) = 160.845; p.001) was statistically significant. Hence, the manipulation proved to be successful.

Dependent measures. When there was a greater level of perceived control, subjects found humanlike HSR to be more appealing (Mhigh = 1.32, Mlow = 0.67). H1a was supported and in situations of low perceived control, participants preferred less anthropomorphic HSR, H1b was therefore supported.
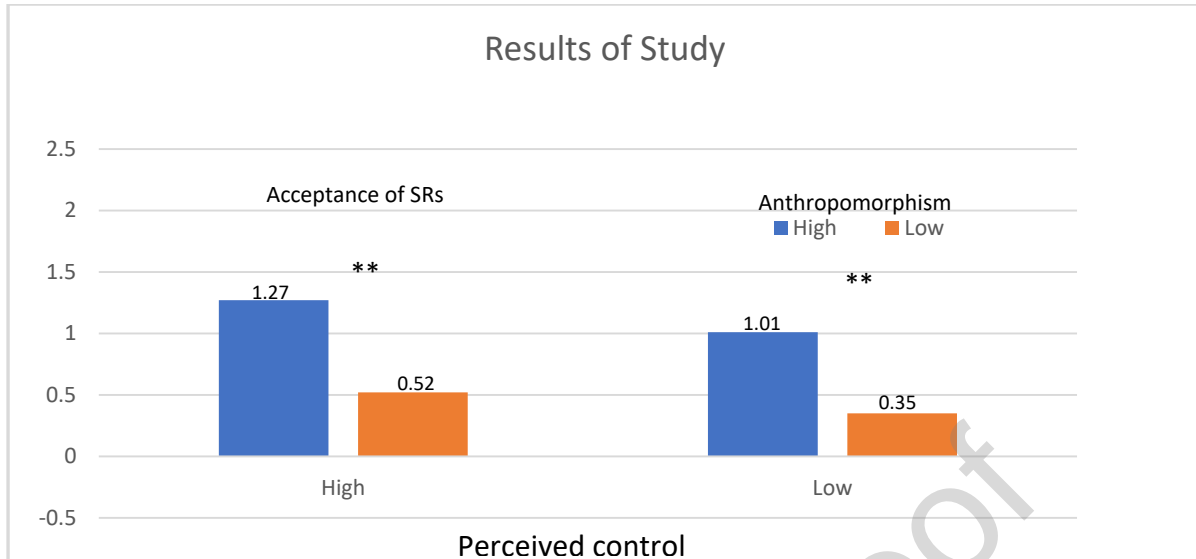
Figure 2: Results of Experiment 1

Mediation. We next looked at perceived threat (α = 0.872), and performance expectation (α=0.816) affected this mediating effect. The existence of H2a was demonstrated and H2b is supported. Anthropomorphism had no discernible immediate effects.

Discussion

Experiment 1 demonstrated that anthropomorphism was found to be positively connected with customer's acceptance to use HSR in circumstances with high perceived control, and performance expectation was found to be a helpful mediator. The desire of customers to employ HSR in circumstances where customers had little apparent control, however, was adversely affected by anthropomorphism. Perceived threat served as mediating factors when anthropomorphism affected customer desire to use HSR and as such, hotel guest's acceptance of HSR**.**

Experiment 2

Replicating the protocol of experiment 1, we enrolled participants via randomised groups of 613 respondents. The locations of this study was based on our interns' locality and also based on hotels privacy, rules and regulations. The specific locations of the study based on the nation were - Philippines (Manila, Mindanao, Cebu) Malaysia (Kuala Lumpur, Kota Kinabalu, Desaru), Singapore (Sentosa, ION Orchard, Tiong), Indonesia (Jakarta, Sumatra, Yogjakarata, Denpasar), Thailand (Bangkok, Khon Kaen, Chiang Mai, Phetchaburi) and Vietnam (Ho Chi Minh, Lam Dong, Can Tho). Ethical approval was received from the ethical committee of Segi University (No. 33/22).

Methodology

Pilot test 2a. Seventy-five respondents from 6 hotels took the pre-test, with 50.7% of them being female (Mage = 29.93). The level of eeriness between the two groups, however, did not differ significantly.

Pilot test 2b. In this pre-test, 141 individuals (49.1% female; Mage = 31.30) from 8 hotels. We started by displaying one of four scenarios to them. To gauge the degree of sociality, according to a two-way ANOVA analysis (Mhigh = 1.06, Mlow = 0.96) was significant.

Subjects and design. This study used a $2 \times 2 \times 2$ (see figures 3 and 4) between-subjects design. Post-Hoc Power Analysis is administered by employing G*Power, thus confirming the samples employed are reliable and valid.

Procedure. The participants saw a picture of a robot waving and smiling in the front desk service environment, and they heard a brief audio message that began: "Hi welcome to (name of the hotel). Please press 1 to check in; to check out, please hit the checkout button on the right of the touch panel. To check in, please navigate to the right touch panel. Do you want to enter using face identification technology? Check-in is finished; have a relaxing stay." The participants place their bags in the designated area and enter a code into a robot that asks them to "please enter a code" before taking them to their rooms. In pursuant, we queried respondents about human likeness of HSR, creepiness, and ostensive dominion (please see appendix 1 and 2 for items used) was suggested to calculate perceived threat and productiveness of HSRs on a Likert scale.

Manipulative check. An analysis of variance with three factors was employed and found to be statistically significant, neither the main impact nor the interaction effect was found to be significant when eeriness was used as a control variable, a successful manipulation, indeed.

Dependent measures. Anthropomorphism, perceived control, and sociality were all significantly correlated with urge to use according to a three-way ANOVA. Once more supported are H1a and H1b, non-categorical situations, however, there was no noticeable change in the participants' preferences and consequently, H3 is accepted.
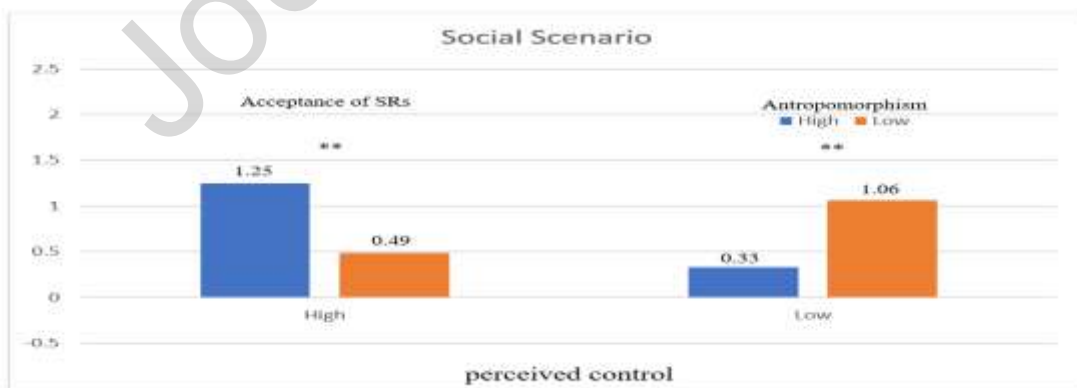
Figure 3: Results (social scenario) of Experiment 2
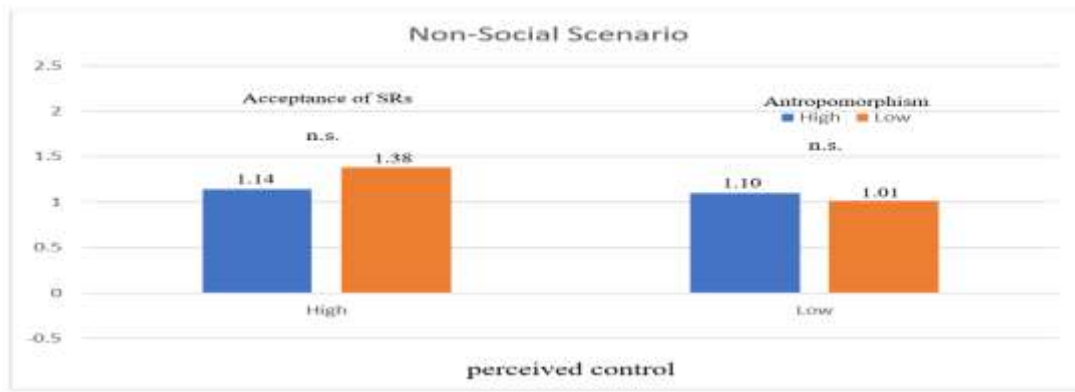
Figure 4: Results (non-social scenario) of Experiment 2

Mediation. We only examined the mediating role in categorical conditions since anthropomorphism or perceived control had no effect in non-categorical situations, there was no clear direct influence, H2a is supported while settings with little perceived control, H2b and H2c are also supported and the output based on p-value ($p < 0.05$) was established.

Results of Hypothesis Testing

No.	Hypothesised Paths	Remarks
H1a	The inclination to employ HSRs in a circumstance with a high perceived control condition is positively influenced by the degree of anthropomorphism.	Supported
H1b	The amount of anthropomorphism negatively affects users' willingness to engage HSRs in a situation with poor perceived control.	Supported
H2a	Performance expectations in a high perceived control condition effectively mediate human likeness influence on the inclination to engage HSRs.	Supported
H2b	Perceived threat in a situation where control is poorly perceived negatively mediates the effect of anthropomorphism on a person's inclination to employ HSRs.	Supported
H3	Only in socially inclusive circumstances does anthropomorphism and perceived control combine to influence readiness to utilise HSRs.	Supported

Discussion
Service robots, and open innovation in the hospitality food and beverage and front office sectors

In the context of hospitality service encounters, HSR is one of the most transformative technological innovations to date as the food and beverage and front office are generally very labour intensive as it requires very high level of customisation (Ivanov & Webster, 2019a; Noone and Coulter, 2012; Tuomi et al, 2021; Dobberstein, 2019) and low service failures, making the service innovation process much more dynamic and potentially less dependent on human employees (Buhalis & Sinarta, 2019) has since become the *"norme sociétale"*.

While Voorhees et al. (2017) suggest a generic nature of understanding consumption by stages,
Lillicrap and Cousins (2010) provides operational clarity which is squarely based on service perception and transactional expectations. Reflecting on the preceding discussion Larivière et al., (2017) and Ostrom et al., (2015) finds that the delivery process remains subjective and the usage of HSR becomes relevant and common (Froehle & Roth, 2004; Li et al., 2021). In the name of novelty, one restaurant had gone as far as to install a robot personal assistant on every table. Customers could interact and have simple conversations with the robot while waiting for their meals. The integration of robots as part of the Servicescape (Bitner, 1992) bears testament to the role of emerging technologies as points of differentiation (Liu & Mattila, 2019).The existing hospitality research has traditionally been contingent on high human touch services service while the impact of HSR remains inconclusive (Zemke et al., 2020; Lu et al., 2020).

This study provided significant closure to the preceding gap within Southeast Asian hotel setting. The unique effect definitely existed since Southeast Asia is only just beginning to deploy service robots. Due to the robot's rarity in daily life, guests from all hotel types, with the exception of premium hotels, were intrigued, fascinated, and delighted to utilise it. Demographic and psychographics variations influences HSR experience, while technology acceptance was a salient acceptance factor towards Millennials and Zoomers in Thailand (Sadangharn, 2021). However, these findings do not hold in our experiment of luxury hotels where a total rejection of HSR was highly visible leading to a demand to a return to pure human services. However, our results suggest that HSRs experience in medium and budget hotels has a high acceptance for HSRs towards frontline service. The dependability of our findings was improved by experiment 2 replicating experiment 1 in a number of more demanding service environments. Additionally, experiment 2 proved that only social and hotel-related circumstances showed influence on motivation when guests engaged with service professionals in impersonal situations revealed categorical border conditions.

Our study contributes salient empirical insights towards technological evolution in the hotel industry specifically in the food and beverage and front office areas via HSR helps to clarify the strategic robotic service ramifications of the labour intensive service process.

Conclusions, implications, and future research

Soft skills enable employees to adapt to a variety of situations without training, and they can demonstrate more empathy, generosity, and honesty than any computer to date. This means that hospitality institutions will need to instruct students in both the hard and soft skills needed to use, monitor, and assess more effectively the technological applications in the industry. Managers will need to provide adequate training to their current staff because the workforce will inevitably alter as a result. Experts continue to have reservations about how to adjust workforce resources to these novel practises.

Theoretical implications. The moderating function of sensory perception was also highlighted in this study, which added to the body of literature. More precisely, our experiment 2 was created to emphasise how the degree to which HSR facilitated a superior overall experience could affect the prospective benefits of HSR on service experience, whereas experiment 1

offered preliminary evidence on such benefits. Three key conclusions are offered by the investigation's results. We included the aspect of service scenarios and imported consumers' perceived control first in order to address the problem of inconsistent results. Our findings can be used to reconcile all of the preceding research into a single framework, the conclusions we derive from our findings complete the integration of existing connection of robotic services.

Furthermore, we discovered two separate psychological mechanisms by which anthropomorphism affects a customer's willingness to interact with HSR. Previous studies were only able to determine how elements that determines users' propensity to utilise is affected by anthropomorphic design. In addition, we discovered that depending on the various levels of dominance in the service environment, psychological factors can have a bipolar effect with HSR engagement. Additionally, the two different psychological strategies employed by customers were examined. Due to the awareness of distinct settings, the two psychological channels discovered in this study are each predominated by one of them, in contrast to earlier concurrent psychological processes. We also identified requirements and exclusion standards for changing the psychological systems. Third, this study intended acknowledges the diversity of the hotel business over the course of two experiments, in contrast to other studies that only looked at certain service scenarios to evaluate their research assumptions.

Practical Implications. Our findings point to practical advantages of implementing a trans diagnostic intervention research towards specialised context under the parameters of an expedient experimentation. We urge marketers and practitioners to operationalise terms realistic implementation and demonstrate that it is not necessary to move substantially towards HSR support representatives. Guests with high perceived control may have different concerns while evaluating a certain HSR. Guests like strong and effective HSR because they are more concerned with the performance standards in circumstances when there is a strong sense of control. Customers may perceive robotic service representatives with high human designs in this scenario as being more capable and as being more appealing. On the other side, in circumstances where there is less threat of HSR, consumers pay less attention to performance standards. These customers will therefore favour HSR service agents that exhibit little anthropomorphism. Finally, we find that user inclination to use HSR in non-social circumstances is unaffected by anthropomorphic designs. This means that anthropomorphic design for objects used in non-social environments should be avoided by designers.

Limitations. While several socio-spatial distance modalities might be employed, additional in situ observation techniques would also allow for the identification of complementing elements (Paraman and Ali, 2021). The numerous socio-spatial distance modalities used by HSR in other *in situ* monitoring of its emotional impact on consumers in diverse socially inclusive or exclusive contexts in the post pandemic environment constitute an important field of research. For instance, European students demonstrate greater perceived control than Asian students in a service-learning environment. A thorough cross-cultural investigation within the Asia-Pacific area could be helpful for future research on the effects of anthropomorphism on the manufacturing sector. In the travel and tourism sector, particularly for resorts where loy-

alty incentives are uncertain, it is critical to identify clear customer expectations and assurance perspectives (Paraman, 2020) as it is unlikely that luxury hotels will stop putting people first in order to retain a competitive and high-end service. Organizations also must address the ethical concerns related to the rise and increasing prevalence of service robots as part of their corporate digital responsibility (Vinh et al, 2020; Paraman and Annamalah, 2022) which remains a notable gap in HSR literature. Although our study investigated HSRs from the context of front desk and food & beverage outlets, a fruitful area of study is the delivery of food &beverage to rooms or room services. The respondents of this study was also bound by privacy and the innkeepers act which made the collection of dare challenging and time consuming. This study used cluster sampling and caution must be exercised in terms of replication in future studies as it is prone to higher sampling error and is prone to biases towards the inferences than the samples formed using other sampling methods respectively.

Future research. As associates in the Metaverse establish ties, it might also encourage increased temporal symbiosis between antagonists. However, it's also important to understand enhancing spatiality interactions. Guest will be able to view the facilities prior to their arrival, which has the potential to grow. Microscopy, the visualisation of medical data, and the creation of surfaces with unique optical properties are a few other applications for researchers to move quickly to explore these new and rapidly evolving applications within the global context.

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