Utilitarian vs. hedonic roles of service robots and customer stereotypes: A person-environment fit theory perspective

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Abstract

Purpose – Drawing on person-environment fit theory, this study investigates how the relationships between service task types (i.e., utilitarian and hedonic service tasks) and perceived authenticity (i.e., service and brand authenticity) differ under different conditions of service providers (human employee vs. service robot). This study further examines whether customers' stereotypes toward service robots (competence vs. warmth) moderate the relationship between service types and perceived authenticity.

Design/methodology/approach – Using a 2 x 2 between-subjects experimental design, Study 1 examines a casual restaurant, while Study 2 assesses a theme park restaurant. Analysis of covariance and PROCESS are used to analyze the data.

Findings – Both studies reveal that human service providers in hedonic services positively affect service and brand authenticity more than robotic employees. Additionally, the robot competence stereotype moderates the relationship between hedonic services, service, and brand authenticity, while the robot warmth stereotype moderates the relationship between hedonic services and brand authenticity in Study 2.

Practical implications – Restaurant managers need to understand which functions and types of service outlets are best suited for service robots in different service contexts. Robot-environment fit should be considered when developers design and managers select robots for their restaurants.

Originality/value – This study blazes a new theoretical trail of service robot research to systematically propose customer experiences with different service types by drawing upon person-environment fit theory and examining the moderating role of customers' stereotypes toward service robots.

Keywords Service Robot; Utilitarian Service; Hedonic Service; Authenticity; Stereotype; Person-Environment Fit Theory

Paper type Research paper

1. Introduction

A service robot is defined by Jörling *et al.* (2019) as "*information technology in a physical embodiment, providing customized services by performing physical as well as nonphysical tasks with a high degree of autonomy*" (p. 405). In restaurants, service robots have been utilized to replace or facilitate the human roles of servers, hosts, and chefs (H. Song *et al.*, 2022) and are implemented in various restaurant segments (Wang and Papastathopoulos, 2023). Empirical studies have shown that service robots' appearance (Song *et al.*, 2023) and interaction styles (Chang and Kim, 2022) are the key factors creating a pleasant robotic service experience.

Recently, H. Song *et al.* (2022) found that customers' perceived authenticity plays a major mediating role between robotic service experience and their behavioral intentions (e.g., visit intention). Visit intention is crucial for the success of robotic restaurants (Islam *et al.*, 2022), emphasizing the need for further research on robotic service (H. Song *et al.*, 2022). However, limited studies have offered a comprehensive theoretical explanation of how different robotic services could lead to customers' perceived authenticity and how customers' stereotypes of service robots could leverage such perceived authenticity, resulting in visit intention.

Authenticity in service robot implementation is worth further investigation because in restaurant branding, both human and robot roles performed at service encounters should jointly create a consistent branded experience for customers (Hwang *et al.*, 2022). Authenticity refers to something/someone being "real,'" "genuine," or "true" (Napoli *et al.*, 2014). Human employees, as brand ambassadors, deliver brand values to customers via service operations, the same as service robots (Tung *et al.*, 2023). Initial studies on the authenticity of service robots have examined the differences between robots and human employees in different hospitality roles and functions (Hwang *et al.*, 2022; H. Song *et al.*, 2022). However, investigating the

scope of customers' perception toward service robots should be expanded from a single role/function comparison into their evaluation of the entire brand (Hwang *et al*., 2022) and the whole service environment (Hoang and Tran, 2022).

Hoang and Tran (2022) indicated that the person-environment fit theory (Caplan, 1987), traditionally used to explain human matching with environments, is suitable to be utilized for explaining robot-environment fit at service encounters. As service robots are implemented for human roles, the focal role of "person" can be replaced with "service robots" to interpret how service robots can match with a service environment to offer customers a consistent branded hospitality experience. Therefore, in line with Hoang and Tran (2022), this study blazes a new theoretical trail of service robot research by using the person-environment fit theory to systematically propose customer experiences with different service types (e.g., utilitarian and hedonic service) as the objective person-environment interaction and customers' perceived authenticity of service and brand as the subjective evaluation of person-environment interaction.

Utilitarian service involves the functional and instrumental aspects of service, while hedonic service encompasses its social and emotional aspects (Prebensen and Rosengren, 2016). We propose that a better fit of person-environment interaction in the subjective evaluation leads to higher perceived authenticity (i.e., service authenticity and brand authenticity) in robotic service experiences (Schmader and Sedikides, 2018). Service authenticity reflects customers' perception of sincere and authentic service in a robotic service experience, whereas brand authenticity refers to their perception of honest and authentic brand experiences delivered by the brand's service robots (Davis *et al*., 2019).

The person-environment fit theory (Caplan, 1987) suggests that subjective evaluations can be leveraged by customers' contact with reality (i.e., human employee vs. service robot) and the accuracy of self-assessment (i.e., robot competence and warmth stereotypes). The

subjective evaluations subsequently lead to customers' future behavioral intentions (i.e., visit intention).

This study incorporates customers' robot competence stereotype and robot warmth stereotype as moderators to enhance the effects of robotic utilitarian and hedonic service to service and brand authenticity. This study conceptualizes the robot competence stereotype as customers' gestalt view of individual perception regarding capability, skill, and efficiency toward service robots and the robot warmth stereotype as customers' gestalt view of individual perception regarding friendliness, sincerity, and caring toward service robots (Chang and Kim, 2022).

With stereotypes as moderators, this study contributes a comprehensive conceptualization to connect "objective" and "subjective" while integrating "past" and "present." Moving from the original focus of the person-environment fit theory on settings of employees' perceived workplace stress (Caplan, 1987) to customers' commitment to the online brand community (Shen *et al*., 2018), this study is one of the first attempts to apply person-environment fit theory to customers' robot service experiences.

Taken together, this study aims to propose and examine a person-environment fit theory perspective on robotic service experience. Specifically, we examine how the relationships between types of service tasks (i.e., utilitarian and hedonic) and customers' perceived authenticity (i.e., service and brand authenticity) differ under varying conditions of service providers (human employee vs. service robot). Moreover, we investigate whether customers' stereotypes toward service robots (competence vs. warmth) moderate the relationship between service types and customers' perceived authenticity.

2. Literature review

2.1 Person-environment fit theory

Person-environment fit refers to the compatibility between people and their environment (Van Vianen, 2018). Originally proposed in organizational psychology, the person-environment fit theory explains how the person-environment match leads to strains, illness, well-being, and employee behaviors (Caplan, 1987). To predict human behavior in person-environment interaction (e.g., employee quitting behavior at the workplace), it's better to analyze the factors of both personal and environmental attributes than one or the other (Van Vianen, 2018). When personal (e.g., needs and abilities) and environmental (e.g., supplies and values) attributes are compatible, optimal behavioral outcomes of a person-environment interaction are expected (Van Vianen, 2018).

The fit mechanism in person-environment fit theory involves the initial stage of matching an objective environment and an objective person to an objective person-environment fit (Caplan, 1987). Given individuals' assessment of reality, the objective environment would be interpreted as a subjective environment and the objective person would be considered a subjective person, resulting in a subjective person-environment fit (Caplan, 1987). Based on a person-environment fit theory perspective, we offer the research framework in Figure 1.

(Figure 1 is about here)

Source: Authors own creation

During a dining service experience, the "contact with reality" factor would be whether customers are served by human employees or service robots, while the "accuracy of self-assessment" factor would be customers' stereotypes toward robots. The service delivered by human employees or service robots is an environmental attribute, while customers' stereotypes toward robots are personal attributes. At the end of the dining service experience, customers gather all of the available information to make subjective evaluations of the person-

environment interaction, resulting in their perceived authenticity toward a robotic service experience at a restaurant. The perceived authenticity then supports customers in making decisions regarding their intention to visit the restaurant.

2.2 Utilitarian and hedonic consumption and services

Service robots can meet both utilitarian (i.e., cooking food) and hedonic (i.e., greeting, billing, and entertaining) needs in service contexts. Additionally, previous research has examined the influences of utilitarian and hedonic values on memorable brand experiences (Hwang *et al*., 2021) and brand authenticity (Hwang *et al*., 2022) moderated by robots and humans. However, scholars have argued that unilateral studies of robotic utilitarian and hedonic services may leave meaningful and valuable differences unexplained (Shin, 2022). Therefore, there is a need to highlight the difference between service types (i.e., utilitarian and hedonic service) and perceived authenticity (i.e., service and brand authenticity) under different service providers (human employee vs. service robot) based on simulated service scenarios from different service settings (i.e., tourism and hospitality).

Utilitarian and hedonic services play important roles in the service context (Parsa *et al*., 2020). Utilitarian services are mainly functional or instrumental, while hedonic services reflect customers' need for excitement, pleasure, and fun (Batra and Ahtola, 1991). Current studies on service robots regarding utilitarian and hedonic services are focused on the following themes: the moderating effects of service robot attributes (e.g., appearance, gender) on decision-making behavior (Ahn *et al*., 2022) and the mediating effects of servicescape and robot service competence on behavioral intention (Gong *et al*., 2022).

This study investigates how the effects of utilitarian and hedonic services may differ between robotic employees and human employees on service and brand authenticity, which remains less clear. Furthermore, the moderating effects of robot stereotypes between service

types (i.e., utilitarian and hedonic service) and perceived authenticity (i.e., service and brand authenticity) in the hospitality context have rarely been researched.

2.3 Authenticity in marketing and hospitality

In the marketing discipline, two types of authenticity are explored: indexical and iconic. Indexical authenticity focuses on distinguishing between genuine and counterfeit objects, while iconic authenticity pertains to the reproduction of authenticity (Grayson and Martinec, 2004). Given the significant role of consumption experience in forming consumers' authenticity perception (Hwang *et al*., 2022), recent scholars have begun looking more closely at service experience and authenticity. Service authenticity has to do with whether the service offered is authentic or not (H. Song *et al*., 2022). Limited studies have confirmed that service authenticity significantly contributes to service value, service satisfaction (Bae, 2021), and behavior intention (H. Song *et al*., 2022). Research on this topic remains nascent.

2.4 Competence and warmth stereotypes

Stereotypes are generalized beliefs regarding specific groups and can be categorized as competence and warmth stereotypes (Fiske, 2018). Competence stereotypes refer to perceived abilities such as skill, efficiency, and intelligence, while warmth stereotypes relate to perceived intent, such as helpfulness, friendliness, and sincerity (Fiske, 2018). The impacts of competence and warmth stereotypes have been extensively studied concerning service (Gidaković and Zabkar, 2021). With the implementation of robotic services in the service context, consumers may hold different stereotypes toward robots and human employees (Zhu and Chang, 2020), highlighting the need to understand the warmth and competence stereotypes in human-robot interactions (Liu *et al*., 2022).

In the area of service robotics, previous literature has examined the influence of competence and warmth stereotypes on the relationship between service robots and human actors (Yoganathan *et al*., 2021) and the mediating effect of anthropomorphism (i.e., robotic chefs) on predicting food quality (Zhu and Chang, 2020). Liu *et al*. (2022) investigated the impact of a robot's appearance (competent vs. warm) and service context (hedonic vs. utilitarian) on usage intention. The distinctive service types (robotic employees vs. human employees) within utilitarian and hedonic services and their consequences (i.e., service and brand authenticity), however, have rarely been subjected to empirical scrutiny.

Furthermore, whether the warmth and competence stereotypes of robots serve as moderators remains unaddressed in service contexts (Liu *et al*., 2022), and little research has examined the moderating roles in the relationship between utilitarian and hedonic services (robotic employees vs. human employees) and service and brand authenticity. This study advances such knowledge by exploring the moderating roles and shedding new light on service types and authenticity in this specific service context.

2.5 Hypothesis development

The person-environment fit theory and concepts of authenticity are theoretically related (Van den Bosch *et al*., 2019) as authenticity can be considered a subjective phenomenon that emerges when there is a fit between a person and the environment (Van den Bosch and Taris, 2014). Both hedonic and utilitarian values positively influence brand authenticity in the service industry (Hwang *et al*., 2022). Following this logic, the match between service employees (i.e., robot vs. human) and the environment (i.e., utilitarian services vs. hedonic services) is associated with authenticity in our study.

Customers' perception of authenticity is influenced by social identity theory and is shaped by social cues, interactions, and expectations (Underwood *et al*., 2001). When

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comparing human employees with service robots, customers tend to perceive a better fit with human employees, resulting in a stronger perception of authenticity due to interpersonal fluency (Schmader and Sedikides, 2018). Song *et al.* (2023) indicated that customers are reluctant to adopt service robots due to functional and technical service quality flaws, which affect the authenticity of the service. Utilitarian service is characterized as functional and technical (Kwon *et al.*, 2022). Therefore, human employees are perceived as more service-authentic than robot servers (Lin and Mattila, 2021). Therefore, human employees demonstrate a stronger effect on service authenticity than robots in the service context (H. Song *et al.*, 2022). Thus, we propose:

H1: Utilitarian services performed by humans lead to higher service authenticity than utilitarian services provided by robots.

Utilitarian services focus on providing utilitarian value to customers (Batra and Ahtola, 1991). Customers highly value brand authenticity through utilitarian services, and utilitarian value positively influences brand authenticity (Huang *et al*., 2022). Customer perceptions of authenticity may be affected by technical shortcomings in the implementation of robots, including inefficiency in responding to customer requests, inadequacy in unpredictable situations, and lack of tacit knowledge (Seyitoğlu, 2021). Compared to service robots, flawless service from human employees increases brand authenticity (Seyitoğlu, 2021), and the utilitarian value of the service from human employees has a positive effect on brand authenticity compared to robot employees (Hwang *et al.*, 2022). Therefore, we propose:

H2: Utilitarian services performed by humans lead to higher brand authenticity than utilitarian services provided by robots.

Hedonic service seeks emotional and pleasurable experiences that influence perceived service authenticity (Kwon *et al.*, 2022). Hedonic service tends to be more emotional than utilitarian service, and customers may perceive service robots with hedonic value as a gimmick (Parsa *et al*., 2020). In addition, many customers are concerned about service robots' lack of human-level social skills and emotions. Human employees outperform service robots by providing personalized service and establishing emotional connections, which can contribute to service authenticity (Seyitoğlu, 2021). Customers are more likely to have an authentic service experience when they receive emotional hedonic service by interacting with human employees rather than service robots (Hwang *et al.*, 2022). Therefore, we propose:

H3: Hedonic services performed by humans lead to higher service authenticity than hedonic services provided by robots.

Hedonic value encompasses the range of sensory and emotional experiences that customers encounter while consuming, which contribute to customers' brand authenticity (Kwon *et al.*, 2022). As a subjective evaluation, brand authenticity is evoked by a hedonic value that contributes positively to brand authenticity in the restaurant industry (Huang *et al.*, 2022). A restaurant with robotic service may be perceived as less authentic (H. Song *et al.*, 2022). Human service employees have been shown to be better than service robots in terms of providing a high-quality experience and making customers feel emotionally attached to the brand (Seyitoğlu, 2021). Therefore, customers may perceive a higher level of hedonic value from interacting with human service employees than with service robots in the service sector (Hwang *et al.*, 2021). Therefore, we propose:

H4: Hedonic services performed by humans lead to higher brand authenticity than hedonic services provided by robots.

As a subjective perception of judgment, service authenticity can be perceived through genuine and enjoyable interaction with the service provider (Bae, 2021). When a service is perceived as authentic, it can positively influence customers' attitudes toward the brand, including brand authenticity (Seyitoğlu, 2021). Brand authenticity is largely determined by its service (Hwang *et al*., 2022), which may encourage service organizations to connect with their brands by emphasizing service authenticity. Although Matthews *et al*. (2020) investigated the relationship between brand and employee authenticity, and H. Song *et al*. (2022) confirmed the impacts among relevant product levels (i.e., core, facilitating, and augmented) on service and brand authenticity, little inquiry has gauged the impact of utilitarian and hedonic services on service and brand authenticity by comparing human and robotic employees. Therefore, we propose:

H5: Service authenticity is positively related to brand authenticity.

Prior studies have examined the relationship between authenticity and visit intention (Kumar and Kaushik, 2022), focusing mainly on the human service context. However, many scholars argue that the relationship may differ in the robotic service context, as robots differ from human employees (H. Song *et al.*, 2022). Visit intention, a robust dependent variable, has been widely utilized as an indispensable theoretical concept in hospitality research (Yang *et al*., 2021), which is supported by many studies (Huang and Liu, 2022; Ruiz-Equihua *et al.*, 2023).

For example, studies have examined the impact of robot type and diner type on psychological comfort and visit intention (Huang and Liu, 2022), the association between

social cognition, psychological ownership, robot anthropomorphism, and customer visit intentions (Ruiz-Equihua *et al.*, 2023), and the influence of technology readiness and amenities on perceived ease of use, perceived usefulness, and visiting intentions (Yang *et al*., 2021). Therefore, it is imperative to explore the role of perceived authenticity further in shaping visit intentions across different service providers within different service types.

H. Song *et al*. (2022) found a positive relationship between perceived authenticity and visit intention in a robot restaurant. The influence of service authenticity on consumer behavior, including visit intention, has been emphasized (H. Song *et al*., 2022). Customers' perceived authenticity affects their purchase intention in restaurants (Kim and Song, 2020). Brand authenticity, which reflects consumers' perceptions of brand behavior, is regarded as a significant purchasing criterion (H. Song and J.-H. Kim, 2022). Thus, brand authenticity increases visit intention (Kumail *et al*., 2022). Therefore, we propose:

H6: Service authenticity is positively correlated to visit intention.

H7: Brand authenticity is positively linked to visit intention.

2.6 Moderating effects of robot competence and warmth stereotypes

In theatrical theory, directors use stereotypical images and memories to shape a role's characteristics on stage, enabling audiences to predict the role's future attitudes and behaviors (Bradby, 2002). Considering service encounters as service theatres (Larsen and Aske, 1992), with service robots as performers of the roles on the service stage, it is critical to consider the types of stereotypes that customers possess toward service robots to understand customers' evaluations of robotic service performances.

The robotic service context can be categorized as utilitarian and hedonic (Ahn *et al*., 2022), with relationships involving competence and warmth stereotypes in the robot-human

service context (Liu *et al*., 2022). Thus, robotic services are categorized as utilitarian services (i.e., cooking food) and hedonic services (i.e., greetings, billing, and singing birthday songs) in our study. The competence stereotype of robots is associated with capability, skill, and efficiency, whereas the warmth stereotype is associated with friendliness, sincerity, and caring (Chang and Kim, 2022).

Service authenticity refers to the sincerity and authenticity offered by the service provider (Napoli *et al*., 2014). Warmth has been linked to authenticity during service encounters (Portal *et al*., 2019). For example, customers perceive service providers offering warmth-oriented services as more sincere and authentic compared to those focusing on task- and competence-oriented responses (Huang and Ha, 2020). Brand authenticity is closely related to perceived sincerity, where a sincere brand is seen as warm (Napoli *et al*., 2014) and authentic (Pace, 2015). Warmth and competence stereotypes indirectly influence brand authenticity (Portal *et al*., 2019), and they also impact hedonic and utilitarian properties (Chattalas, 2015). Utilitarian and hedonic services are not usually mutually exclusive (Batra and Ahtola, 1991). Therefore, we propose:

H8-H11: The robot competence stereotype moderates the relationships between (H8) utilitarian services and service authenticity, (H9) utilitarian services and brand authenticity, (H10) hedonic services and service authenticity, and (H11) hedonic services and brand authenticity.
H12-H15: The robot warmth stereotype moderates the relationships between (H12) utilitarian services and service authenticity, (H13) utilitarian services and brand authenticity, (H14) hedonic services and service authenticity, and (H15) hedonic services and brand authenticity.

3. **Method**

We conducted two scenario-based experiments (2 [utilitarian service tasks: service robots vs. servers] x 2 [hedonic service tasks: service robots vs. servers]) to test the hypotheses and validate part of the results. Because it is unlikely that a restaurant only provides either utilitarian or hedonic service tasks, we included both service tasks in a restaurant setting in the scenarios. Focusing on different contexts, Study 1 involved a casual restaurant in China, while Study 2 chose a restaurant located in a theme park in China. We used different images in multiple experimental contexts to validate the statistical results in the hospitality and tourism industries (Liu *et al*., 2022; H. Song *et al*., 2022; Su and Li, 2023). Detailed experimental scenarios are shown in Appendix 1 (see supplementary material).

3.1 Pre-test

We conducted the pre-test to manipulate utilitarian and hedonic dimensions in the scenario descriptions. Based on the characteristics of utilitarian and hedonic consumption in the existing literature (Voss *et al*., 2003), we used cooking food as an example of a utilitarian service task in a restaurant setting since cooking food is the primary function of a restaurant. As entertaining customers (e.g., singing a birthday song) could create experiential benefits for customers, it is selected as an example of a hedonic service task in a restaurant setting.

Using the existing scale of hedonic and utilitarian dimensions (Voss *et al*., 2003), we asked 35 Chinese students in China to rate the hedonic and utilitarian dimensions on a seven-point scale (1 = strongly disagree; 7 = strongly agree) of two types of services tasks in restaurants: cooking food vs. entertaining customers (such as singing a birthday song). The results show that participants rated the utilitarian feature significantly higher for cooking food (M = 6.55) than entertaining customers (M = 4.80) ($t = 10.326$, $df = 34$, $p < 0.001$). Similarly, participants valued the hedonic feature significantly higher for entertaining customers (M =

5.24) than cooking food (M = 4.32) ($t = -6.024$, $df = 34$, $p < 0.001$). Thus, the pre-test showed that the scenario descriptions were designed as intended.

3.2 Measures

We adopted previously validated scales, including five items for service authenticity (Featherman *et al*., 2006), three items for brand authenticity (Moulard *et al*., 2016), and three items for visit intention (H. Song and J.-H. Kim, 2022). In Study 2, we adopted the scale from Gidaković and Zabkar (2021) to measure robot warmth and competence stereotypes. All scales were measured on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). We have included the factor loadings for all items and Cronbach's alphas for each construct in Table 1 (see supplementary material).

3.3 Data collection

A popular online marketing research company, Wenjuanxing, helped with data collection in China. The company helped us create an online survey link and shared it with qualified members in the database. Participants were randomly assigned to one of the four experimental scenarios. After viewing the assigned experimental scenario, subjects assessed that scenario and provided demographic background and dining experience information (see Appendix 2 in the supplementary material). In Study 1, we collected 223 valid responses in February 2022. The cell size is 49 to 58. In Study 2, we gathered 213 valid responses in July 2022. The cell size is 52 to 56. For both studies, Wenjuanxing charged each valid response 12 CNY.

3.4 Data analysis

A two-way analysis of covariance (ANCOVA) was conducted to examine H1 to H4. More specifically, independent variables were utilitarian and hedonic service tasks, dependent

variables were service and brand authenticity, and control variables were participants' demographic information and their experiences. The remaining hypotheses were tested using PROCESS models by Hayes (2022).

4. Results

4.1 Study 1

4.1.1 Manipulation check

The manipulation checks for independent variables were successful. For example, the subjects in the robot group agreed more on "the utilitarian services, such as cooking food, are provided by robots in this restaurant" than those in the human group ($M_{Utilitarian-Robot} = 6.85$; $M_{Utilitarian-Human} = 1.36$, $t[221] = 62.362$, $p < .001$). Similarly, the participants in the robotic server group were more likely to agree that "the hedonic services, such as greetings and entertaining customers, are offered by robots in this restaurant" than the participants in the human group ($M_{Hedonic-Robot} = 6.74$; $M_{Hedonic-Human} = 1.24$, $t[221] = 89.973$, $p < .001$).

4.1.2 Main effect

Using participants' demographic information and robotic restaurant dining experiences as control variables (Xie *et al*., 2022), the results (see Table 2 in the supplementary material) show that utilitarian and hedonic service tasks significantly influenced service and brand authenticity. For example, in the utilitarian service context, subjects perceived a lower service authenticity in robots than humans ($M_{Utilitarian-Robot} = 5.40$; $M_{Utilitarian-Human} = 5.78$; $F[1, 212] = 7.238$; $p < .05$). Similarly, in the utilitarian service context, subjects perceived a lower brand authenticity in robots than human servers ($M_{Utilitarian-Robot} = 5.71$; $M_{Utilitarian-Human} = 6.03$; $F[1, 212] = 8.535$; $p < .05$). Thus, H1 and H2 were accepted.

Furthermore, in the hedonic service context, subjects perceived a lower service authenticity in robots than humans (M $_{Hedonic-Robot}$ = 5.38; M $_{Hedonic-Human}$ = 5.80; F [1, 212] = 8.421; $p < .01$). Similarly, in the utilitarian service context, subjects perceived a lower brand authenticity in robots than humans (M $_{Utilitarian-Robot}$ = 5.74; M $_{Utilitarian-Human}$ = 5.99; F [1, 212] = 5.117; $p < .05$). Thus, H3 and H4 were accepted. Moreover, no interaction effect between utilitarian and hedonic services was found.

4.1.3 Service authenticity, brand authenticity, and visit intention

We tested H5-H7 using PROCESS (Model 4) with demographic information and dining experiences as control variables. Service authenticity had a positive influence on brand authenticity ($p < .001$; 95% CI .440 to .591), accepting H5. Both service authenticity ($p < .001$; 95% CI .204 to .438) and brand authenticity ($p < .001$; 95% CI .410 to .718) had a positive influence on visit intention, confirming H6 and H7. In addition, brand authenticity successfully mediated the relationship between service authenticity and visit intention (95% CI .193 to .410), as the confidence interval did not contain zero between the upper value and lower value. Among the control variables, participants' gender ($p < .05$; 95% CI .040 to .368) and dining experience ($p < .05$; 95% CI .032 to .305) were found to significantly influence brand authenticity. No control variables influenced visit intention.

4.2 Study 2

4.2.1 Manipulation check

Manipulation controls for both independent variables were successful. For example, the subjects in the robotic server group were more likely to agree that "the utilitarian services, such as cooking food, are provided by robots in this restaurant" than those in the server group (M $_{Utilitarian-Robot}$ = 6.83; M $_{Utilitarian-Human}$ = 1.28, t [211] = 88.113, $p < .001$). Similarly, the

participants in the robotic server group were more likely to agree that "the hedonic services, such as greetings and entertaining customers, are offered by robots in this restaurant" than those in the server group (M $_{Hedonic-Robot}$ = 6.80; M $_{Hedonic-Human}$ = 1.21, t [211] = 94.928, p < .001).

4.2.2 Main effect

The results show that in the utilitarian service context, participants perceived a similar level of service authenticity (M $_{Utilitarian-Robot}$ = 5.69; M $_{Utilitarian-Human}$ = 5.72; F [1, 202] = .061; p = .806) and brand authenticity (M $_{Utilitarian-Robot}$ = 6.06; M $_{Utilitarian-Human}$ = 6.06; F [1, 202] = .006; p = .939) when engaging with robotic or human servers. Thus, H1 and H2 were rejected (see Table 3 in the supplementary material).

In the hedonic service context, subjects perceived a lower service authenticity (M $_{Hedonic-Robot}$ = 5.53; M $_{Hedonic-Human}$ = 5.88; F [1, 202] = 6.488; p < .05) and brand authenticity (M $_{Hedonic-Robot}$ = 5.91; M $_{Hedonic-Human}$ = 6.21; F [1, 202] = 10.992; p < .01) in robots than humans. Thus, H3 and H4 were accepted. Moreover, no interaction effect between utilitarian and hedonic services was found.

Model 84 in PROCESS was used to test the remaining hypotheses. The process model results again confirmed the results of H1-H4 from the ANCOVA results. In addition, service authenticity had a positive influence on brand authenticity (p < .001, 95%CI .205 to .372), supporting H5. Both service authenticity (p < .001, 95% CI .168 to .361) and brand authenticity (p < .001, 95% CI .223 to .507) positively influenced visit intention, confirming H6 and H7.

Model 84 focuses on the moderated mediation relationship rather than the direct mediation relationship. There is a successful moderated mediation using hedonic service task as an independent variable, brand authenticity as a mediator, warmth stereotype as a moderator, and visit intention as a dependent variable (95% CI .095 to .246). Similarly, there is a successful moderated mediation using hedonic service task as an independent variable, brand authenticity

as a mediator, competence stereotype as a moderator, and visit intention as a dependent variable (95% CI .037 to .251). However, there was no moderated mediation effect using utilitarian service task (as an independent variable), service and brand authenticity (as mediators), and warmth stereotype or competence stereotype (as moderators).

4.2.3 Moderating effects

The results show that the robot role of competence does not moderate the relationship between utilitarian service and service authenticity ($p = .749$, 95% CI -.248 to .344) or the relationship between utilitarian service and brand authenticity ($p = .256$, 95% CI -.273 to .073), thus rejecting H8 and H9. Additionally, the robot role of warmth does not moderate the relationship between utilitarian service and service authenticity ($p = .749$, 95% CI -.248 to .344) or the relationship between utilitarian service and brand authenticity ($p = .256$, 95% CI -.273 to .073), thus rejecting H12 and H13.

The results show that the robot role of warmth does not moderate the relationship between hedonic service and service authenticity ($p = .053$, 95% CI -.541 to .004), thus rejecting H14. However, warmth moderates the relationship between hedonic service and brand authenticity ($p < .001$, 95% CI -.580 to -.280), thus supporting H15. The results show that when the robot role is very warm, it does not affect the pathway between hedonic service and brand authenticity. However, compared to the medium level of robot warmth, the low robot warmth has a higher effect on the relationship between hedonic service and brand authenticity.

The robot role of competence moderates the relationship between hedonic service and service authenticity ($p < .035$, 95% CI -.6847 to -.0344) and the relationship between hedonic service and brand authenticity ($p < .001$, 95% CI -.5493 to -.1617), thus supporting H10 and H11. The same moderating effect of robot competence is also observed in the association between hedonic service and service/brand authenticity. Tables 4, 5, and 6 show the results of

the moderation tests. Table 7 presents the results of hypothesis testing in Studies 1 and 2 (see supplementary material for the tables).

5. Conclusion and discussion

5.1 Conclusions

Building upon the theoretical support of person-environment fit theory (Van Vianen, 2018), this study conceptualized how customers compare the utilitarian and hedonic service delivered by human employees versus service robots on their evaluations of service authenticity and brand authenticity. Jointly explained by social identity theory (Schmader and Sedikides, 2018), in both utilitarian and hedonic service, we hypothesized that customers would rate human employees higher than robots on both perceived service authenticity and brand authenticity.

Meanwhile, adding theatrical theory (Bradby, 2002; Larsen and Aske, 1992), we propose customers' stereotypes toward robots would moderate the effects of utilitarian and hedonic service on authenticity evaluations. With two scenario-based experiments (i.e., casual restaurants vs. theme park restaurants), this study found humans outperformed robots in delivering hedonic service, thus enhancing customers' perceived service authenticity and brand authenticity. Service authenticity increases brand authenticity, and both service authenticity and brand authenticity can improve visit intention.

Interestingly, while customers rate humans higher than robots on the effectiveness of utilitarian service to create perceived authenticities at casual restaurants (Study 1), this difference is not found in utilitarian service at theme park restaurants (Study 2). We explain such inconsistency by customers' perceived robot-environment fit between casual restaurants and theme park restaurants (Hoang and Tran, 2022). Customers at casual restaurants value utilitarian service through the food quality and professional service interactions (Ryu *et al.*, 2010), and such expectations for utilitarian service would normally get lower when dining at

theme park restaurants because they spend more attention on hedonic values while at theme parks (Milman *et al.*, 2020).

From the social identity theory perspective (Underwood *et al.*, 2001), customers tend to identify with robots more at theme park restaurants because it's more logical to meet with robots at theme park restaurants than at casual restaurants. Therefore, for higher expectations of utilitarian service at casual restaurants, human employees can be a better fit with casual restaurants than robots. For lower expectations of utilitarian service at theme park restaurants, both humans and robots can fit under a similar level with theme parks.

With the moderating roles of stereotypes added into the setting of theme park restaurants (Study 2), we found that robot competence stereotypes significantly enhanced the effects of hedonic service on service authenticity and brand authenticity. This implies that customers' stereotype toward robot competence ensures their belief to gain hedonic value in robotic service experiences. Customers have the stereotypical belief of robot competence in delivering hedonic service, recognizing that robots are capable of bringing them social and emotional benefits at theme park restaurants.

Additionally, we also found that customers' robot warmth stereotypes can enhance the positive effects of robotic hedonic services on perceived brand authenticity. It reveals that for theme park branding, robots have the potential to support customers' perceived brand authenticity in hedonic services, and customers possess stereotypical beliefs about the warmth robots can deliver in hedonic services at theme park restaurants. Implications and suggestions for future research are offered in the following sections.

5.2 Theoretical implications

This study contributes meaningful theoretical implications. First, this is one of the first studies applying a person-environment fit theory perspective to service robot research (Hoang and

Tran, 2022). It conceptualizes brand and service authenticity in a robotic service experience as subjective evaluations of a person-environment interaction evolved from an objective person-environment interaction (i.e., utilitarian and hedonic service types). The evolution from objective service presentation to subjective experience assessment is leveraged by both environmental attributes (i.e., being served by human employees or service robots) and personal attributes (i.e., robot competence and warmth stereotypes).

We further strengthened the model by integrating social identity theory (Schmader and Sedikides, 2018) and theatrical theory (Bradby, 2002) to explain the formation of customers' perceived authenticity and the moderating effects of stereotypes. Being served by human employees or service robots is an important moment for customers to gain contact with reality in a dining service experience. The influence of robot competence and warmth stereotypes allows customers to adjust their self-assessment accuracy by combining past stereotypes with their present experiences in the dining setting.

Second, we confirmed hedonic service as a stable antecedent to both service and brand authenticity, in which customers perceived stronger authenticity when served by human employees than service robots. Several recent studies have compared human employees with service robots (H. Song *et al*., 2022), and the present study adds to this popular topic with two sets of empirical results to clarify humans versus robots in the formation of authenticity based on service types. Inconsistent results were found in Studies 1 and 2 for the effects of utilitarian service on authenticity.

Although robots are considered better operators in delivering functional and standardized tasks (Chang and Kim, 2022), frontline dining service interaction requires more advanced and contingent skills that humans can perform more effectively than robots. Such advanced and contingent skills are part of the utilitarian service of frontline dining service interactions. Therefore, when comparing humans and robots in hedonic service encounters,

human employees rate more highly in both studies. Such inconsistency found between the environments of casual restaurants and theme park restaurants also reveals an important implication for future studies to ensure cross-context equivalence in hypothesis testing for robot studies, as well as to explore potential cross-context differences among hospitality (e.g., casual restaurants) and tourism (e.g., theme parks) environments.

Third, we found significant moderating effects of robot competence and warmth stereotypes. When customers have low robot competence stereotypes, they perceive higher service and brand authenticity under hedonic robotic service. Meanwhile, when customers have low robot warmth stereotypes, they perceive higher brand authenticity under hedonic robotic service. Overall, lower expectations lead to better satisfaction. Additionally, stereotypes of robot competence seem to have a stronger influence on perceived authenticity than stereotypes of robot warmth.

Customers nowadays understand robots can fulfill some standardized job competence, such as delivering food (Chang and Kim, 2022). However, compared to humans, service robots still lack advanced emotional display capabilities (Song *et al*., 2023). This aligns with Yam *et al*.'s (2021) study, which suggests that customers are more forgiving of service robot failures because of the understanding that robots cannot compete with human warmth and emotional interactions.

5.3 Practical implications

This study has meaningful practical implications. First of all, our study finds that in terms of offering utilitarian services, although human staff still outperform robots in traditional Chinese restaurant contexts regarding perceived authenticity (i.e., service and brand), there is no significant difference between human servers and service robots in theme park contexts. Regarding hedonic service, human staff outperforms service robots in service and brand

authenticity for both Chinese restaurant and theme park contexts. Although service robots offer the advantages of efficiency, productivity, and an effective solution for labor shortages, using service robots may also have negatively affected service work cultures, employee workloads, and customer experiences (Crump, 2022).

Our findings indicate that customers in China may not be fully receptive to service robots in certain aspects of dining experiences. Service contexts also influence customers' acceptance of service robots. In particular, Chinese consumers seem to have higher levels of acceptance of service robots in theme parks than in traditional restaurants and in receiving utilitarian services over hedonic services provided by service robots. Despite the growing popularity of service robots in the service business, their implementation entails significant financial risks (Ma *et al*., 2021). Therefore, restaurant managers should carefully consider the suitability of service robots for different functions and types of service outlets, as well as the potential positive impact on customers' experiences.

Second, our study found that customers' stereotyping perceptions of service robots can significantly influence their service experiences. Specifically, when customers' attitudes toward service robots are less stereotypical, they tend to perceive higher levels of brand and service authenticity. Only when customers understand that service robots can do well in restaurants and other service contexts (Chang and Kim, 2022), particularly for standardized functions like cleaning and food delivery, can negative stereotypes be minimized and service experiences with robots be enhanced.

On the other hand, service operators should be aware of the existence of customer stereotypes toward service robots. Although our study focused on competency and warmth stereotypes, previous studies have suggested that gender and occupational stereotypes also affect perceptions of service robots (Hu *et al*., 2022). We suggest restaurant managers identify service positions in restaurants, hotels, and other contexts that may be influenced by customer

and employee stereotypes (e.g., gender, occupation, warmth, competency, etc.) and decide which positions are best performed by humans or service robots. Thus, restaurant managers could take advantage of the strengths and capacities of both service robots and human employees.

Third, comparing the results of Studies 1 and 2, we suggest collaboration between service automation technology developers and theme park managers in implementing service robots at theme park restaurants. We found customers recognize the effectiveness of service robots in offering utilitarian services the same as humans at theme park restaurants. It implies a promising area for managers to largely implement robots to replace human roles at theme park restaurants. Doing so could lower labor costs for theme parks while maintaining the same level of customers' perceived utilitarian values in the services.

Additionally, we found that customers in theme park restaurants possess stereotypical beliefs that robots are capable of bringing them quality hedonic services, which would be considered by them as a good fit for the authentic service of theme park restaurants and the authenticity of the theme park brand. Therefore, service automation technology developers should design robots that can fit with the service image of theme park restaurants and the theme park brand image. Such insights into robot-environment fit should be considered when developers design robots and theme park managers select robots for their restaurants.

5.4 Limitations and future research

First, since our study only featured Chinese cuisine, the perception of food authenticity is highly connected with cuisine type. Certain cuisines may be more compatible with service robots than others, so we encourage future studies to include other types of restaurants or other countries to verify the results of this study. Second, stereotypes also include multiple aspects, such as gender, age, ethnicity, and personality (Cauthen *et al*., 1971). Our study only included

competency and warmth. Future studies are encouraged to test other stereotypes, such as gender, accents, personality, etc., as applied in service robot contexts.

Additionally, since our study used a quantitative research design, there is a need for qualitative research methods, such as in-depth interviews or focus groups, to delve into how and why certain features of service robots could influence customer dining experiences. Furthermore, our study suffered from an imbalanced demographic background of participants, with more females and younger participants due to online marketing research. Future studies could include field research to ensure a more balanced representation of participants across demographics.

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Supplementary material:

The supplementary material for this article can be found online (https://drive.google.com/file/d/13wIZJ5EznJJIMVb6qUZcCr47uM4wCBag/view?usp=drive_link)