

Cognitive Psychology

The Impact of Service Robot Communication Style on Consumers' Continued Willingness to Use

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Integrating service robots has transformed service interactions, with their communication behaviors crucial in consumer engagement and satisfaction. Yet, the influence of their communication styles on consumer attitudes and behaviors is understudied. Utilizing the SOR theory, this study investigates how the communication styles of service robots (social-oriented vs. task-oriented) affect consumer willingness for continued use, through situational experiments and questionnaires. The study finds that service robots with a social-oriented communication style are more likely to enhance consumer willingness to continue usage, with positive emotions mediating this relationship. Additionally, the service context moderates the impact of communication style on these positive emotions. This study expands the application of communication style effects to human-robot interactions, offering new insights into service robots' design and effective communication.

Introduction

Background

There is a growing use of robots in service sectors. For example, chatbots such as Jaime, a digital assistant at ANZ Bank, assist users by posing questions and providing responses, akin to medical assistants offering advice to patients (Bornet et al., 2020; Čaić et al., 2019). Service robots excel at performing simple, standardized tasks swiftly and efficiently, having higher levels of automation (Holthöwer & van Doorn, 2023; Wirtz et al., 2018).

Although service robots have high commercial value and can efficiently handle large-scale tasks through automation (Luo et al., 2019), they can also provoke negative reactions from consumers, leading to reluctance to accept robot-provided services (Bornet et al., 2021). For instance, robots may evoke negative attitudes (S. Y. Kim et al., 2019), and people may engage in compensatory consumption (Mende et al., 2019) due to the sense of discomfort or identity threat caused by robots. Sometimes, consumers may even abandon a purchase upon learning that a robot is the service provider (Luo et al., 2019). However, in specific consumption contexts, the unique characteristics of service robots can make them more appealing for providing services (Pitardi et al., 2021). Therefore, it is crucial to explore the

impact of consumers on their continued willingness to use service robots.

Research Gap

Existing studies have focused on these robots' technical aspects and anthropomorphic features to improve consumers' positive responses. Factors such as appearance (Tussyadiah et al., 2020), identity (Čaić et al., 2020a), and conversational skills (H. C. Kim & Kramer, 2015) have been shown to influence users' attitudes and behaviors. With advances in artificial intelligence, service robots are capable of human-like communication through learning (Čaić et al., 2020a). A study by Bleier et al. (2019) found that a chatbot's communication style (conversational tone vs. news tone) significantly affects user experience and suggested that further research should explore the communication style of service robots to optimize customer service interactions. Therefore, which communication style is more likely to trigger higher consumer willingness to continue using the service? Does consumer preference for a service robot's communication style vary across different service contexts? There is no clear answer yet.

To address this research gap, this study extends the exploration of communication styles in human-robot interaction, analyzing their effects on users' cognitive and emotional responses.

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Research Contributions

This paper makes three contributions: First, it enriches research on consumer adoption of service robot technology by extending the concept of communication styles to human-robot interaction. Second, it considers service context as a moderating variable, examining how service robots' communication styles affect consumers' emotional responses and behaviors across different service contexts. This provides a new perspective for investigating the boundary conditions of research related to service robots and consumer behavior. Third, drawing on SOR theory, it introduces positive emotions as a mediating variable, further enriching and expanding the application of SOR theory in human-robot interaction.

Conceptual framework and Hypotheses Development

Concepts

Service Robot

Service robots are defined as artificial intelligence that aids consumers in achieving their goals. These robots, which may or may not have avatars, are considered service robots as long as they maintain a high degree of autonomy and the ability to interact with consumers (Tussyadiah et al., 2020). Service robots that mimic human appearance and behavior can engage in quasi-social interactions in various service environments, such as acting as waiters, bank tellers, and receptionists. When engaged in these interactions, these AI entities are often perceived as social creatures due to their social-like interactions. Research indicates that service robots represent an automated social presence (Van Doorn et al., 2017), with higher levels of such presence increasing their acceptance as social entities by users.

Many studies suggest a reluctance among consumers to accept service robots, associating their use with skepticism and negative emotions. For example, in the hospitality industry, service robots can induce compensatory consumer spending by evoking feelings of eeriness and the perceived threat of replacing human identity (Mende et al., 2019). Similarly, older adults may perceive less warmth and competence from robot coaches compared to human coaches, leading to a reluctance to engage in activities such as sports games organized by robots (Čaić et al., 2019). Nonetheless, there are potential positive outcomes from the use of service robots. They can co-create service value with consumers (Čaić et al., 2020b) and are often more tolerated in service failure scenarios compared to human attendants (Merkle, 2019). The preference for service robots also varies depending on the type of task; for instance, older individuals may prefer robots for assistance with household chores or reminders but are less receptive to their involvement in more personal aspects of daily life, such as accompanying them on walks or helping with personal care (Smarr et al., 2012).

Communication Style

Communication style was first defined by Sheth (1976) as a specific mode of communication. Sheth argues that in sales scenarios, the communication styles of salespeople can be categorized into three types: task-oriented, interaction-oriented, and self-oriented. The task-oriented communication style is goal-focused with a strong sense of purpose; the social-oriented style, also known as interaction-oriented, focuses on building strong social relationships and emphasizes individuality; and the self-oriented style is neither concerned with the sales goal nor the consumer, but rather centers on the salesperson.

A service robot is defined as a physical, automated entity with advanced social interaction capabilities. Consumers' perception of these robots as human-like is influenced by factors such as the degree of anthropomorphism in their appearance (Park & Lee, 2009), their conversational style (Hildebrand & Bergner, 2021), the relevance of their conversations, and the use of emoticons in these interactions (Rapp et al., 2021). AI products with social interaction capabilities exhibit distinct communication styles, which consumers respond to and evaluate during interactions (H. Wang et al., 2021).

Recent literature by Wu et al. (2017) differentiates AI communication into styles similar to those of friends versus engineers. According to Wang et al. (2021), in service failure scenarios, consumers exhibited reduced aversion when interacting with intelligent customer service robots using a social-oriented communication style compared to a task-oriented style.

Further studies demonstrate that the communication style of service robots influence various consumer perceptions, including self-efficacy (Song et al., 2023), perceived interactivity (Bai, 2023), trust, willingness to recommend, and willingness to reuse (Shu et al., 2020). Robots employing a social-oriented communication style are typically perceived by consumers as friendly and well-intentioned, while those using a task-oriented style are viewed as efficient and competent. These perceptions directly influence consumer expectations and, in turn, their evaluations of the provided service (Feine et al., 2019).

Positive Emotion

The academic classification of emotions primarily divides them into two categories: Positive Affect, which includes excitement, surprise, and pleasure, and Negative Affect, which comprises disgust, sadness, and anger (R. Sun, 2020). Positive emotions are transient mental states specific to certain situations, characterized by relaxation, happiness, and excitement. Individuals experiencing positive emotions are more likely to have a positive perception of their surroundings. The study of emotions in consumer behavior began in 1991 when researchers observed that consumers perceive products and services differently during consumption, leading to varied emotional responses (Westbrook & Oliver, 1991).

Menon and Dube (2004) argued that factors such as product functionality, the service provider's attitude, and

the perceived value significantly influence consumer satisfaction and elicit emotional responses. Later research defined consumer emotions based on the emotional reactions consumers experience after purchasing products and services (Choiniere et al., 2009; Y. Sun & Yang, 2014).

There is no consensus on the precise mechanism underlying consumer emotion generation. Some scholars suggest that consumer emotions are formed by matching purchased products and services with similar experiences in memory, a process known as “categorization” (Alford & Sherrell, 1996). Others view consumer emotions from an attribution perspective, proposing that they are triggered by various factors (Oliver, 1993), including product and service quality, consumer-specific reasons, and external elements such as a service provider’s smile, which can evoke positive emotions (Du et al., 2022). In service encounters, studies link consumer emotions to satisfaction and behavioral intentions, indicating that consumer evaluations of experiences—whether positive or negative—and their subsequent approach or avoidance behaviors are largely influenced by the emotions experienced during the service interaction (Grace, 2009). Positive consumer emotions are known to enhance loyalty and satisfaction (Su & Huang, 2011; C. Yang & Liu, 2014). In service recovery scenarios, positive emotions can enhance repurchase behavior, while negative emotions significantly detract from customer satisfaction (Geng, 2007).

Consumers' Continued Willingness to Use

Service robots enhance user willingness by providing reliable and accurate information, timely services, and maintaining consistency with the user’s past technology experiences, thereby meeting utilitarian motivations (Bleier et al., 2019). The anthropomorphism, social presence, and interactivity of service robots enrich the communication experience, making it more engaging and increasing the user’s willingness to use the technology (Voss et al., 2003). Satisfaction is a crucial antecedent that drives continued usage. Gan et al. (2018) demonstrated that entertainment, social, utilitarian, and technological satisfaction are all significant predictors of the willingness to continue using a service. Extending this, Cheng and Jiang (2020) analyzed how informational satisfaction, entertainment satisfaction, media appeal, social satisfaction, and privacy risks impact the willingness to continue using a service robot. Additionally, Lau et al. (2021), drawing on self-determination theory, found that fulfilling consumers’ intrinsic needs such as competence, autonomy, and relevance significantly motivates continued use. Consumers’ motivation also influences ongoing engagement with technology. For instance, Choi & Drumwright (2021) explored how motivations for social interaction, personal identity, consistency, time efficiency, and information acquisition affect the willingness to continue using service robots. Lastly, emotional shifts play a crucial role in sustained usage intentions. Research highlights the importance of service robots eliciting emotional responses, particularly empathy during service failures. Demonstrating high empathy can psychologically draw consumers closer, build trust, and thereby enhance

their intention to continue using the service (Y. H. E. Yuan & Wu, 2008).

Service Context Attributes

Hirschman and Holbrook (1982) identified two distinct consumer types: hedonic and economic. Economic consumers prioritize fulfilling tangible needs during shopping, focusing on saving money, time, and effort. In contrast, hedonic consumers view shopping as an enjoyable activity, deriving pleasure from the process itself. It is important to note that hedonism and utilitarianism in consumer behavior are not opposites on a single spectrum but are separate dimensions. Therefore, consumers may exhibit varying degrees of both when interacting with products and services, necessitating classification based on their dominant shopping concept (Yi. Yang et al., 2017). Products can also be categorized by their hedonic and utilitarian attributes. However, a product can possess both attributes, and these concepts are not strictly defined academically. Products with prominent hedonic attributes are classified as hedonic, while those with utilitarian attributes are considered utilitarian.

In service contexts, consumer motivations can vary widely. Consumers with utilitarian motives seek efficiency and functionality, emphasizing convenience, utility, and economic value. They expect quick service with minimal financial waste. Conversely, services driven by hedonic motives focus on emotional qualities to provide consumers with enjoyable experiences marked by fun, surprise, and excitement (Lehdonvirta, 2009; Sym et al., 2010). Studies have classified service attributes as either utilitarian or hedonic (Brakus et al., 2009; Chattaraman et al., 2010), with utilitarian attributes meeting specific consumer goals through instrumental properties, and hedonic attributes relating to psychological enjoyment and entertainment (Brakus et al., 2009; Prebensen & Rosengren, 2016). In contexts where utilitarian attributes dominate, consumers respond more favorably to robots perceived as capable and adult-like, demonstrating a greater willingness to use such robots. In hedonic service contexts, however, consumers prefer robots with a warm, childlike appearance. Research in the tourism and hospitality industries has categorized service environments as either hedonic-dominated or utilitarian-dominated (Longoni & Cian, 2022). The findings suggest that in these sectors, the social perceptions (warm vs. competent) of service robots should align with the service environment to enhance consumer satisfaction. For example, airport tax refund counseling is considered a utilitarian service, while information counseling at tourist attractions is categorized as hedonic (Longoni & Cian, 2022).

Theoretical Framework

SOR Theory

The Stimulus-Organism-Response (SOR) theory, initially proposed by Mehrabian and Russell (1974) within the field of environmental psychology, provides a framework for understanding how external stimuli influence internal

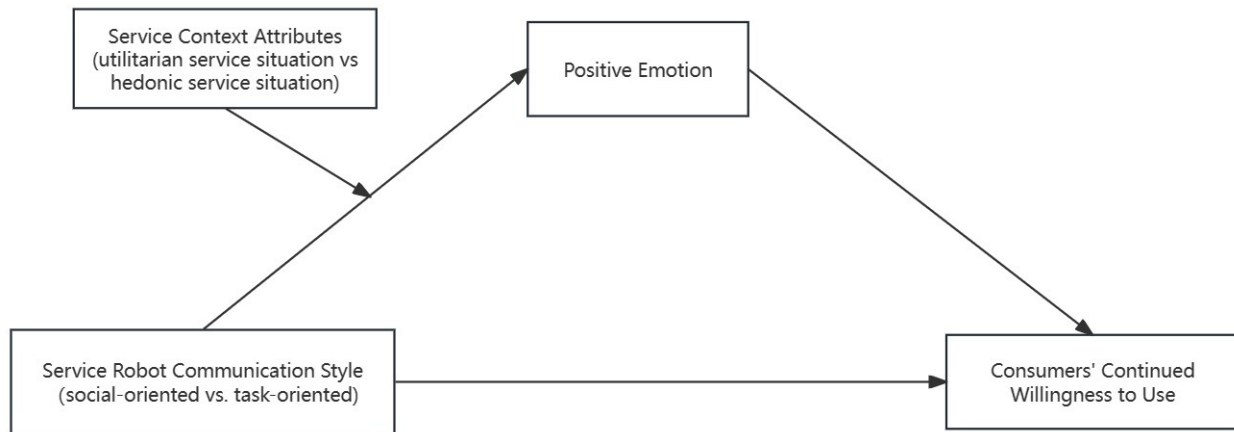


Fig. 1. Conceptual model

emotional responses, which subsequently lead to behavioral decisions. The theory posits that behavioral responses are shaped by diverse environmental stimuli that elicit varying emotional and cognitive impacts on individuals. These impacts are eventually expressed through individual behavior.

In virtual environments, Animesh et al. (2011) found that technological factors (e.g., social interaction) and spatial factors (e.g., density and stability) influence consumers' purchase intentions by affecting their sense of social presence. He and Gong (2010) demonstrated that online shopping experiences influence purchase behavior by affecting consumers' emotional cognition. Chu (2018) observed that service quality and brand recognition impact consumers' choice of purchase channels by influencing perceived utilitarian, hedonic, and social values.

This study focuses on a scenario where a service robot provides a service, treating the robot's communication style as an external stimulus. The consumer's positive emotion is considered an intrinsic factor of the organism, while their willingness to continue using the service and satisfaction are viewed as behavioral responses. The study argues that the communication style of the service robot (task-oriented vs. social-oriented) influences the consumer's willingness to continue using the service by affecting their positive emotions and satisfaction.

The conceptual model designed for this study is shown in Fig. 1.

Hypotheses Development

Service Robot Communication Style and Consumers' Continued Willingness to Use

Although service robots possess significant commercial value, such as the ability to automate tasks and handle large-scale operations simultaneously (Luo et al., 2019), they often provoke negative reactions, leading to a reluctance among some consumers to accept services provided by robots (Čaić et al., 2019). Factors such as the appearance (tangibility, anthropomorphism), voice, and interactive ca-

pabilities of service robots impact consumer attitudes and behaviors (Araujo, 2018; Go & Sundar, 2019).

Additionally, effective communication during human-robot interaction is crucial. When robots engage in quasi-social interactions in a human-like manner, they activate social perceptions in people, fostering a strong sense of socialization. This perception leads to the belief that robots are capable of sociability and forming social relationships. The communication behavior of service robots directly impacts consumers' service experiences, their evaluations of service quality, and their willingness to continue using the robots. A social-oriented communication style strengthens the psychological connection between the service robot and the consumer, making the robot appear more socio-emotional and enhancing the interpersonal relationship. Consequently, a social-oriented communication style not only fosters stronger social emotions between consumers and the service robot but also meets interpersonal interaction guidelines, fulfilling consumers' emotional needs and care expectations. Based on this, we propose H1.

Hypothesis 1. (H1): The social-oriented (vs. task-oriented) communication style of service robots is more likely to increase consumers' continued willingness to use.

Mediator Role of Positive Emotion

The experience of the service significantly influences consumer emotions, with the communication behavior of service providers eliciting emotional responses that shape consumer attitudes and behaviors. Positive emotions, triggered by personnel factors within the service scenario, lead to increased consumer willingness to recommend and repurchase, highlighting the substantial impact of service personnel's behaviors on consumer emotions (Pettigrew & Tropp, 2006). Interactions between service personnel and consumers enhance the connection and perceived value of dialogue, thereby fostering positive emotions. A service robot's social-oriented communication style not only improves the interpersonal interaction experience (Zhang &

Gao, 2011) but also helps achieve consumer pleasure goals (Barone et al., 2000). Furthermore, this communication style creates an emotional bond with consumers, making them feel understood and cared for—an interaction that positively influences their emotions (Pons et al., 2006). Additionally, a personalized, social-oriented communication style enhances consumers' perception of uniqueness. When service recovery, remedial actions that address consumers' unique needs tend to elicit stronger positive emotions (Fernandes & Oliveira, 2021). Based on this, we propose H2.

Hypothesis 2. (H2): The social-oriented (vs. task-oriented) communication style of service robots is more likely to increase consumers' positive emotion.

Positive emotions frequently motivate individuals to continue engaging with a particular activity or product. These emotions significantly influence consumer acceptance of a brand (Fernandes & Oliveira, 2021), prompting a variety of consumer behaviors. Positive emotions enhance the perceived appeal of a product, thereby increasing consumers' willingness to use and engage with it. For instance, a study focusing on higher-end restaurants revealed that positive experiences that evoke consumer pleasure positively impact consumer behavior (C. Yuan et al., 2022). Furthermore, positive emotions play a critical role in fostering consumer loyalty (Y. H. E. Yuan & Wu, 2008), underscoring their importance in shaping both short-term behaviors and long-term attitudes toward brands and products. Based on this, we propose H3.

Hypothesis 3. (H3): Positive emotion enhances consumer's continued willingness to use.

Drawing from SOR theory, it is understood that consumer perceptions shape their emotional experiences, which in turn affect their behaviors. Perceptions of anthropomorphism, social presence, and interactivity in AI influence consumers' willingness to use AI products (Fernandes & Oliveira, 2021). Anthropomorphic and approachable service robots provide consumers with a vivid interaction experience (C. Yuan et al., 2022). Service robots with social-oriented communication styles can engage in lively conversations with consumers, creating a joyful communication experience and fostering a relaxed and pleasant atmosphere (Y. Wang & Hou, 2019). Consequently, this paper concludes that positive emotions mediate the relationship between the communication style of service robots and consumers' continued willingness to use them, underscoring the importance of emotional aspects in the design and implementation of service robots. Based on this, we propose H4.

Hypothesis 4. (H4): Positive emotion mediates the relationship between service robot communication style (social-oriented vs. task-oriented) and consumers' continued willingness to use.

Moderating Role of Service Context Attributes

Service attributes are typically classified into two types: utilitarian and hedonic. In utilitarian service situations,

consumers have clear objectives and tasks they aim to achieve, emphasizing efficiency and pragmatism. Conversely, hedonic service situations are characterized by consumers seeking emotional experiences, with the expectation of enjoying the service process. In utilitarian-dominated service contexts, consumers react more favorably to robots perceived as competent (i.e., adult-like), demonstrating a stronger willingness to utilize such robots (He & Gong, 2010). On the other hand, in hedonic service environments, consumers respond more positively to robots that appear warm (i.e., childlike) (Chattaraman et al., 2010). This differentiation in consumer response is influenced by their utilitarian and hedonic evaluations of products and services, which also affect their emotional responses. In hedonic contexts, social-oriented communication styles align more closely with consumers' emotional needs, making social-oriented service robots better suited to meet these expectations. In utilitarian contexts, however, consumers prioritize the benefits of efficient, fast, and clear service, placing less emphasis on emotional and social interactions. This paper hypothesizes that social-oriented communication styles are more associated with hedonic attributes and can simultaneously satisfy consumers' utility needs. Therefore, service robots employing social-oriented communication styles are expected to elicit higher positive emotions from consumers in hedonic service situations compared to utilitarian ones. This hypothesis underscores the importance of aligning communication styles with the dominant service attributes to enhance consumer satisfaction and emotional engagement. Based on this, we propose H5 and H6.

Hypothesis 5. (H5): Compared to utilitarian service attributes, hedonic service attributes are more effective at eliciting higher positive emotions from consumers.

Hypothesis 6. (H6): Compared to utilitarian service situations, the mediating effect of positive emotions is stronger in hedonic service situations.

Methods

Pilot Study: Mediating Mechanisms of the Impact of Service Robot Communication Style on Consumers' Continued Willingness to Use

We conducted an experimental, scenario-based online study to verify the effectiveness of manipulating the communication style of service robots and to conduct a preliminary test of Hypothesis H1. All participants provided informed consent before taking part in this study. Consent was obtained in written form. For written consent, participants were provided with a consent form outlining the study's purpose, procedures, potential risks, and benefits. Participants signed the form before participating in the survey. The recruitment period for this study commenced on 01 May 2023 and concluded on 01 September 2023. For participants under the age of 18, we obtained consent from a parent or guardian in addition to the assent from the minors. The parent or guardian was provided with a detailed consent form and was required to sign it to document their

consent. In the pilot study, we draw inspiration from the methodology employed by Chattaraman et al. (2019) and Go & Sundar (2019) to craft the stimulus material for experiments focused on service robot communication styles.

Participants and Design

The questionnaires were distributed through an online platform (www.credamo.com), one of the most popular online research platforms in China. The pilot study comprises four segments: The initial section of the questionnaire notified participants that they were involved in a consumer behavior study and guaranteed strict confidentiality of their data. Participants were then shown an image of Xiaozhi, the restaurant's intelligent voice service robot. Participants were randomly assigned to one of two experimental conditions, where they read dialogues demonstrating different communication styles for a minimum of 20 seconds and imagined themselves as consumers in these scenarios. In the second part of the questionnaire, participants answered questions about the service robot's communication style and their willingness to continue its usage, following the review of all materials. The third part of the questionnaire gathered demographic information, such as gender, age, education, and occupation. Upon completing the questionnaire, participants received 1 yuan as a reward. A total of 62 questionnaires were distributed. Participants were randomly assigned to experimental scenarios characterized by task-oriented or social-oriented. Upon reviewing the designated materials, participants employed a Likert 7-point scale to render subjective assessments concerning the accuracy of the communication style presented within the materials.

Procedure

The participants were randomly assigned to the experimental groups to read the psychological counseling scenario. The participants were asked to read the scenario and imagine themselves in the scenario (More details are shown in Fig. 2).

Finally, participants answered the Service Robot Communication Style scale from Van Dolen et al. (2007): (1) I think Xiaozhi is trying to provide a service related to ordering food. (2) I think Xiaozhi is mainly concerned with the details related to ordering food. (3) I think Xiaozhi is only providing services related to ordering food. (4) I think Xiaozhi is following the process to ensure that the ordering service is completed. (5) I think Smartie is easy to talk to. (6) I think Xiaozhi is providing service and assistance in good faith. (7) I think Xiaozhi is providing the service by treating me as a real person, not just the customer it served. (8) I think Xiaozhi enjoys communicating with me and makes me feel relaxed. The questionnaire items measuring consumers' continued willingness to use the service robot were adapted from Venkatesh et al. (2012). This scale included three items that asked subjects to rate their willingness to continue using the service robot. Additionally, the items measuring situational realism were adapted from Bleier et al.'s (2019) scale, which consisted of three items that evalu-

ated the realism of the imagined scenarios. Meanwhile, we have also included age, gender, and education as control variables in the data processing.

Results

This paper first analyzed the questionnaire's reliability to ensure accurate measurements, employing SPSS26.0 to assess the reliability of scales measuring communication style, continued usage willingness, and service robot satisfaction. Results indicate good reliability for the questionnaire scales, with Cronbach's α values of 0.897 for social-oriented, 0.818 for task-oriented communication styles, and 0.820 for consumer's continued usage willingness, all above 0.7. Subsequently, the questionnaire's validity was analyzed to confirm its accuracy in reflecting the study's content. Factor analysis via SPSS26.0 was conducted to evaluate how well the scales for communication style, continued usage willingness, and satisfaction align with the respective constructs. The analysis revealed significant results, with KMO values of 0.813 for communication style, 0.67 for continued usage willingness, and 0.692 for satisfaction; Bartlett's test values were 278.8, 71.4, and 99, respectively (all $P < 0.001$), confirming the scales' validity.

In this study, an independent samples t-test was utilized to analyze the effectiveness of manipulating service robot communication styles. The results revealed a significant difference in how subjects rated social and task-oriented styles. Specifically, those exposed to social-oriented dialogues rated social orientation higher ($M_{\text{social-oriented}} = 6.01$, $M_{\text{task-oriented}} = 4.28$, $F(1, 62) = 20.218$, $p < 0.001$), while those who experienced task-oriented dialogues rated task orientation higher ($M_{\text{social-oriented}} = 4.12$, $M_{\text{task-oriented}} = 5.74$, $F(1, 62) = 6.983$, $p < 0.001$). This indicates a successful manipulation of communication styles. Additionally, a one-sample t-test confirmed the contextual realism of the conversational contexts used in the experiment ($M = 6.51$, $SD = 0.46$, $t(62) = 109.799$, $p < 0.001$), suggesting high realism.

Furthermore, another independent samples t-test examined the impact of communication style on consumers' continued willingness to use service robots, with willingness as the dependent variable and communication style (0=task-oriented, 1=social-oriented) as the independent variable. The findings showed significant differences in willingness based on the communication style ($N_{\text{social-oriented}} = 37$, $M_{\text{social-oriented}} = 6.01$, $SD = 0.44$; $N_{\text{task-oriented}} = 25$, $M_{\text{task-oriented}} = 4.72$, $SD = 1.12$, $F(1, 62) = 14.65$, $p < 0.001$). Consumers exposed to a social-oriented style demonstrated a higher willingness to continue using the service robots compared to those exposed to a task-oriented style, thus preliminarily supporting hypothesis H1.

Study 1

Study 1 aimed to validate the primary effect proposed in this paper: service robots with social-oriented (vs. task-oriented) communication styles enhance consumers' continued willingness to use. It also explored the impact of different communication styles on users' emotional experiences, positing that positive consumer emotions serve as the ex-

Task-Oriented	Social-Oriented
<p>Xiaozhi: Welcome, I am the service robot Xiaozhi, do you have a reservation?</p> <p>Consumer: Yes.</p> <p>Xiao-zhi: Okay, may I have your cell phone number, Xiao Zhi needs to confirm your reservation information.</p> <p>Consumer: 6547.</p> <p>Xiaozhi: Your message has been confirmed. Ms. Wang, please follow me to the reserved seat.</p> <p>(ordering food)</p> <p>Xiaozhi: Please confirm your menu. One Shredded Pork with Fish, one Sweet and Sour Spare Ribs and one Stir-fried Seasonal Vegetables.</p> <p>Consumer: Uh-huh, right.</p> <p>Siu Chi: May I ask if you need anything else?</p> <p>Consumer: Please tell the chef to put in less salt.</p> <p>Xiaozhi: OK, I will pass your order and needs to the kitchen. Your meal will be ready in half an hour, please wait.</p>	<p>Xiaozhi: Hi, welcome to our restaurant, nice to meet you, I'm Xiaozhi, I'll be serving you next Oh~ May I ask if you've made a reservation before?</p> <p>Consumer: Yes.</p> <p>Xiao Zhi: May I have your cell phone number, Xiao Zhi needs to confirm your reservation information.</p> <p>Consumer: 6547.</p> <p>Xiao Zhi: Xiao Zhi has confirmed your information, thank you very much for coming to our restaurant. Your table is ready, it's near the window, where the view from the window is very nice. I hope you will like it, please follow me!</p> <p>(Ordering food)</p> <p>Xiaozhi: Ms. Wang, you have ordered one Shredded Pork with Fish, one Sweet and Sour Spare Ribs and one Stir-fried Seasonal Vegetables. Do you need anything else?</p> <p>Consumer: Please tell the chef to put in less salt.</p> <p>Xiaozhi: OK, please don't worry, Xiaozhi will pass your order and needs to the kitchen. Your meal will be ready in half an hour, please wait a little patience Oh. If you have any other needs, you can call Xiaozhi at any time. Xiaozhi is happy to serve you!</p>

Fig. 2. Experiment materials

planatory mechanism through which communication styles influence continued willingness to use. Specifically, the hypothesis tested was that social-oriented (vs. task-oriented) styles would induce higher positive emotional experiences among consumers.

Participants and Design

The distribution of the questionnaire resulted in a total of 300 responses, out of which 274 were deemed valid after filtering out inadequate responses and the screening questions. Among the participants, 62.8% were women, 37.2% were men. Under the social-oriented group, 148 valid responses were received, comprising 54 males and 94 females. Under the task-oriented group, 126 valid responses were received, comprising 48 males and 78 females. Meanwhile, 33.9% were between 21 and 25 years old, 29.9% were between 26 and 30 years old, 27% were over 30 years old. Regarding educational background, the majority of the subjects held bachelor's degrees, comprising 72.6% of the sample. Graduate students and those with higher qualifications made up 18.2%, while 5.5% had college degrees, and 3.6% possessed secondary school degrees. In terms of occupation, enterprise employees formed the largest group at 55.1%, followed by students at 29.6%.

The participants were randomly assigned to two sets of experimental scenarios and instructed to imagine and assume that they had experienced the scenario described in the text before answering the questionnaire questions. Each participant was allowed to fill in the questionnaire only once.

The questionnaire used a seven-level Likert scale to estimate each item, with 1 indicating strong disagreement and 7 indicating strong agreement. The questionnaire was distributed through the network for a pilot test before the for-

mal survey to ensure the item's validity. Purify the measurement terms before factor analysis.

Procedure

The participants were randomly assigned to two sets of experimental groups to read the psychological counseling scenario (More details are shown in Fig. 3). Participants imagined themselves in the scenario. Each participant was required to read the material for 20 seconds before responding. Participants were asked to imagine themselves in the scenario described in the material and then complete a questionnaire. The questionnaire included independent variables, moderating variables, dependent variables, mediating variables, control variables, screening questions, and demographic variables. The screening questions are designed to prevent random or careless responses by the participants.

The items used to measure the communication style of the service robot and the consumer continued willingness to use the robot were consistent with those in the plot test. Specifically, the items for communication style were adapted from the scale by Van Dolen et al. (2007), and those for measuring consumer willingness were adapted from Venkatesh et al. (2012). Additionally, consumer satisfaction was measured using three items adapted from Evans et al. (2000), which required subjects to rate their satisfaction with the service. Lastly, the measure of consumers' positive emotions used four items from Watson et al. (1988), asking subjects to rate their positive emotional experiences. Respondents indicated their preference on a seven-point scale (1 = "strongly disagree", 7 = "strongly agree").

Task-Oriented	Social-Oriented
<p>Xiaozhi: Welcome. May I ask if you would like to check in?</p> <p>Consumer: Yes.</p> <p>Xiaozhi: Okay. Have you made a reservation in advance?</p> <p>Consumer: I have made a reservation online.</p> <p>Consumer: Yes. Please tell me the name and cell phone number you reserved when you made the reservation.</p> <p>Consumer: Wang Chen, 15698413.</p> <p>Xiaozhi: OK. Please wait a moment.</p> <p>Wisdom: Your information has been confirmed. You have booked a standard room for tonight and tomorrow night, right?</p> <p>Consumer: Yes.</p> <p>Xiaozhi: Okay. Please show your ID card and face the camera for identity verification.</p> <p>(Verification in progress)</p> <p>Xiaozhi: Verification successful. Please wait.</p> <p>Xiao Zhi: You have successfully checked in, your room number is 6666, this is your room card, please take it. Wish you a happy stay!</p>	<p>Xiaozhi: Hi, it's nice to meet you, I'm Xiaozhi, I'll be serving you next ~ May I ask if you need to check in?</p> <p>Consumer: Yes.</p> <p>Xiao Zhi: Xiao Zhi understands, may I ask if you have booked in advance?</p> <p>Consumer: Yes.</p> <p>Xiaozhi: Good. Welcome to our hotel! Please provide the name and cell phone number reserved for the booking, Xiaozhi need to confirm your booking information.</p> <p>Consumer: Wang Chen, 15698413.</p> <p>Xiaozhi: OK, please wait. Please give Xiaozhi some time, Xiaozhi needs to confirm your reservation information.</p> <p>Xiao-Zhi: XiaoZhi has already confirmed your information, you have booked the standard room for tonight and tomorrow night, right?</p> <p>Consumer: Yes.</p> <p>Xiao Zhi: Okay, please show your ID card, and face the camera, so that Xiao Zhi can verify your identity information, thank you for your cooperation with Xiao Zhi's work~!</p> <p>(Verification in progress)</p> <p>Xiaozhi: verification success, please wait, Xiaozhi immediately for you to check in.</p> <p>Xiaozhi: Wait a long time, your check-in has been processed, your room rate number is 6666, this is your room card, please take it. If you need other services, please feel free to call Xiaozhi very honored to provide you with services. We hope you can spend a pleasant time in our hotel!</p>

Fig. 3. Experiment materials

Results

Cronbach's α coefficient was used to test scale reliability. The reliability coefficients were: Social-oriented service robot communication style = 0.865, task-oriented service robot communication style = 0.818, consumers' positive emotion = 0.863, consumers' continued willingness to use = 0.848, consumers' satisfaction = 0.898.

KMO was used to test scale validity. The validity coefficients were: Service robot communication style = 0.841 with Bartlett's test of sphericity value of 1030.7 ($P < 0.001$). Consumers' continued willingness to use = 0.719, with a Bartlett's test value of 360.68 ($P < 0.001$). Consumers' positive emotion = 0.749, with Bartlett's test value of 578.39 ($P < 0.001$). These results indicate that the scales used in the questionnaire exhibit good validity.

Manipulation test. The independent sample T-test analyzes the effectiveness of manipulating service robot communication styles. The results indicated a significant difference between the two subject groups in their perceptions of social-oriented and task-oriented communication styles. Specifically, Subjects exposed to social-oriented conversations rated the social orientation higher ($M_{\text{social-oriented}} = 5.92$, $M_{\text{task-oriented}} = 4.39$, $F(1, 274) = 21.89$, $p < 0.001$, $t = -12.972$, 95% CI = [-1.764, -1.299]). Conversely, those exposed to task-oriented conversations rated task orientation higher ($M_{\text{social-oriented}} = 3.99$, $M_{\text{task-oriented}} = 5.38$, $F(1, 274) = 24.219$, $p < 0.001$, $t = -9.547$, 95% CI = [1.103, 1.676]), confirming successful manipulation of the communication

styles. Additionally, a one-sample t-test assessed the contextual realism of the questionnaire, revealing that the conversational contexts were perceived as highly realistic (Mean = 6.43, SD = 0.65, $t(274) = 163.877$, $p < 0.001$).

Hypothesis test. This study examines the impact of service robot communication style on consumers' continued willingness to use and on consumer satisfaction. An independent samples t-test analyzes these effects, treating consumers' continued use intention and satisfaction as dependent variables, and the communication style of the service robot (0=task-oriented, 1=social-oriented) as the independent variable. The results, detailed in Table 1, demonstrate significant differences in consumer continued willingness to use ($N_{\text{social-oriented}} = 148$, $M_{\text{social-oriented}} = 6.14$, SD = 0.52; $N_{\text{task-oriented}} = 126$, $M_{\text{task-oriented}} = 5.33$, SD = 1.38, $F(1, 274) = 38.55$, $p < 0.001$) and satisfaction ($N_{\text{social-oriented}} = 148$, $M_{\text{task-oriented}} = 6.25$, SD = 0.53; $N_{\text{task-oriented}} = 126$, $M_{\text{task-oriented}} = 5.43$, SD = 1.45, $F(1, 274) = 51.79$, $p < 0.001$). This indicates that social-oriented communication styles enhance consumers' willingness and satisfaction more than task-oriented styles, thus supporting hypothesis H1.

Then, the effect of service robot communication style on consumers' positive emotions is analyzed using an independent samples t-test. The dependent variable is the positive emotions of consumers, and the independent variable is the communication style of the service robot (0=task-oriented, 1=social-oriented). Detailed in Table 1, there is a significant difference in the positive emotions elicited by different communication styles of service robots ($N_{\text{social-}}$

Table 1. Results of service robot communication style on consumers' continued willingness to use, satisfaction, and positive emotion

Variable	Group	N	M	SD	t	p
Consumers' continued willingness to use	task-oriented	126	5.33	1.38	-6.22	<0.000
	social-oriented	148	6.14	0.52		
Satisfaction	task-oriented	126	5.43	1.45	-5.60	<0.000
	social-oriented	148	6.25	0.53		
Positive emotion	task-oriented	126	4.51	1.42	-8.175	<0.000
	social-oriented	148	5.70	0.86		

Table 2. Results of mediation tests of positive emotion

Variables	Direct effect of X on Y					
	Effect	SE	LLCI	ULCI	t	P
Communication Styles	0.1260	0.1048	-0.803	0.3323	1.203	0.2301
	Indirect effect of X on Y					
	Effect	SE	LLCI	ULCI		
Total	0.8091	0.1231	0.5668	1.0514		
Positive Emotion	0.6831	0.1349	0.4312	0.9668		

oriented = 148, $M_{\text{social-oriented}} = 5.70$, $SD = 0.86$; $N_{\text{task-oriented}} = 126$, $M_{\text{task-oriented}} = 4.51$, $SD = 1.42$, $F(1, 274) = 35.88$, $p < 0.001$). Social-oriented communication styles induce higher positive emotions compared to task-oriented styles, confirming hypothesis H2.

Mediating effect test. The mediating role of positive emotions was tested using the SPSS Process, selecting Model 4 of the Bootstrap method with a resample size of 5000 and a 95% confidence interval. The independent variable was the communication style of the service robot (0=task-oriented, 1=social-oriented), with positive emotion as the mediator, and age, gender, and education as control variables. Consumers' continued willingness to use and satisfaction were tested as dependent variables in sequence to assess the mediating effect of positive emotions on the relationship between robot communication style and consumer continuation willingness. The analysis results are shown in Table 2, which indicates that the communication style's direct effect on consumers' continued willingness to use was not significant ($p = 0.2301$). However, the mediation analysis showed that positive emotions significantly mediated the relationship between communication style and consumers' willingness to continue use, with a significant indirect effect (BootLLCI=0.4312, BootULCI=0.9668). Positive emotions fully mediated this relationship (LLCI=-0.803, ULCI=0.3323), with an indirect effect size of 0.6808, supporting hypotheses H2, H3, and H4.

Discussion. Study 1 consisted of two experimental groups: a task-oriented communication style group and a social-oriented communication style group. Both groups underwent a situational imagery manipulation in which participants were immersed in a specific communication scenario. The primary objective was to assess the effect of different communication styles on consumers' willingness

to continue using the product. The results indicated that a social-oriented communication style is more likely to increase consumers' willingness to continue using the service robot compared to a task-oriented style, thereby supporting Hypothesis H1. Additionally, the social-oriented communication style was found to be more effective in enhancing consumers' positive emotions, confirming Hypothesis H2. Based on these findings, the study further examined the mediating role of positive emotions and confirmed the full mediation effect, thereby supporting Hypothesis H3.

Pilot Study: The Moderating Role of Service Context Attributes

We conducted an experimental, scenario-based online study to validate the logical coherence and relevance of the expressions and context embedded within the experimental materials, ensuring they align with the research requirements. In the pilot study, we draw inspiration from the methodology employed by Liu et al. (2022) to craft the stimulus material for experiments focused on service context attributes.

Participants and Design

The study initially recruited 50 subjects for a pre-test, with a mean age of around 25 years, including 21 males (42%) and 29 females (58%). Subjects were randomly divided into two groups, each reading material related to either a hedonic or utilitarian service context. Drawing on previous research (Voss et al., 2003), the materials selected included an amusement park's counseling service in a hedonic context and an airport tax refund service in a utilitarian context. Details of the situation are depicted in Fig.

Utilitarian: Please imagine that you have been traveling abroad for some time. Today is the last day of your trip; you are boarding a plane in a few hours and are now at the tax refund counter at the airport. You find a robot offering counseling services. The robot can give you clear instructions on what you need for your tax refund and the detailed procedures. It can also provide solutions to problems you may encounter during the refund process based on extensive case records and numerical data. The bot supports various languages and can respond instantly to queries."

Hedonic: "Please imagine that you are planning to visit an amusement park. When you arrive, you find the service robot Xiaozhi greeting visitors at the entrance. Xiaozhi can help visitors plan their tour route, suggest items, and provide information along the way (such as show times, places to eat and shop, sightseeing bus rides, etc.). Xiaozhi supports various languages and can respond instantly to visitors' inquiries."

Fig. 4. Experiment materials

5. After reviewing the materials, subjects rated the service situations on their utilitarian and hedonic qualities, asking how entertaining, fun, hedonic, and utilitarian they found the services. These evaluations were conducted using a 7-point Likert scale, ranging from 1 ("utilitarian") to 7 ("hedonic").

Results

This study employed independent sample t-tests to analyze subjects' ratings of utilitarian and hedonic attributes across two distinct service scenarios. The findings revealed significant differences in the utilitarian and hedonic attributes of the service scenarios ($M_{\text{utilitarian}} = 2.33$, $M_{\text{hedonic}} = 5.51$, $F(1, 50) = 1.92$, $p < 0.001$). These results suggest successful manipulation of utilitarian and hedonic service scenarios.

Study 2

Study 2 investigates the moderating role of service context attributes. The survey was administered by disseminating an experimental questionnaire through an online platform (www.credamo.com). To ensure the reliability and validity of the responses.

Participants and Design

The distribution of the questionnaire resulted in a total of 300 responses, out of which 271 were deemed valid after filtering out inadequate responses and the screening questions. Among the participants, 59% were women, 41% were men. Meanwhile, 21.4% were between 21 and 25 years old, 23.2% were between 26 and 30 years old, and 46.1% were over 30 years old.

Study 2 employed a contextual dialogue similar to that of study 1. The primary goal of this experiment was to examine the moderating effect of service context on the relationship between service robot communication style and

consumer continued willingness to use, necessitating the design of stimulus materials incorporating both elements. Specifically, a 2 (Service Context: utilitarian vs. hedonic) \times 2 (Service Robot Communication Style: task-oriented vs. social-oriented) factorial design was employed, resulting in four groups with distinct conversational contents: utilitarian-social-oriented, utilitarian-task-oriented, hedonic-social-oriented, and hedonic-task-oriented.

Under the utilitarian-social-oriented group, 67 valid responses were received, comprising 25 males and 42 females. Under the utilitarian-task-oriented group, 65 valid responses were received, comprising 26 males and 39 females. Under the hedonic-social-oriented group, 73 valid responses were received, comprising 32 males and 41 females. Under the hedonic-task-oriented group, 66 valid responses were received, comprising 28 males and 38 females.

The manipulation of the service robot's communication style aligned with prior research, and the service context manipulation drew from a previous study (Voss et al., 2003) that defined amusement park consulting (hedonic) and airport tax refund consulting (utilitarian) as distinct contexts. Subjects were randomly assigned to one of four groups: utilitarian-social-oriented, utilitarian-task-oriented, hedonic-social-oriented, and hedonic-task-oriented, and presented with the respective dialogues (refer to Fig.6). They then completed a questionnaire to assess their reactions to the materials. The questionnaire used a seven-level Likert scale to estimate each item, with 1 indicating strong disagreement and 7 indicating strong agreement.

Procedure

The participants were randomly assigned to the experimental groups to read the psychological counseling scenario (same materials as in the pilot study). Participants imagined themselves in the scenario. Each participant was required to read the material for 20 seconds before responding. Participants were asked to imagine themselves in

	Task-Oriented	Social-Oriented
Utilitarian	<p>Consumer: Hello, I need to apply for a tax refund, I would like to know what materials need to be prepared and the specific process.</p> <p>Xiaozhi: Hello. You need to prepare the following materials: 1. valid passport and visa; 2. shopping invoice and shopping ticket; 3. bank card or credit card used when purchasing goods. Please make sure that your shopping invoice contains the following information: product name, price, date of purchase and store name.</p> <p>Consumer: Okay, I understand. Then what is the specific process like?</p> <p>Xiao Zhi: You can follow the following steps: 1. place the prepared materials in the designated area of the tax refund counter; 2. the staff will review your materials and process your tax refund slip; 3. you need to drop the tax refund slip into the refund box at the airport; 4. wait for your refund.</p> <p>Consumer: What should I do if I lose or forget to drop off my tax return?</p> <p>Xiaozhi: You don't need to worry, we have prepared a solution for you. If you encounter problems during the refund process, you can contact our staff for assistance. We will try our best to help you solve the problem and make sure you can receive your refund in time.</p> <p>Consumer: Okay, thanks.</p> <p>Xiaozhi: You're welcome, and we wish you the best of luck with your tax refund! If you have any other questions, please feel free to contact us.</p>	<p>Consumer: Hello, I need to apply for a tax refund, I would like to know what materials need to be prepared and the specific process.</p> <p>Xiaozhi: Hello! We are glad to serve you! Tax refund process for the first operation of the friends may be a little complicated, but do not worry, Xiaozhi will try to help you Oh.</p> <p>Consumer: Okay, what materials do I need to prepare?</p> <p>Xiao Zhi: You need to prepare your passport and visa, shopping invoices and tickets, as well as the bank card or credit card you use when shopping. If there are other questions, Xiaozhi is happy to continue to answer your oh.</p> <p>Consumer: I would also like to ask about the specific process?</p> <p>Xiao Zhi: Xiao Zhi is happy to answer your questions. The process is like this: first, you need to give the prepared materials to the staff at the tax refund counter, they will review your materials and process your tax return; then you need to deliver the tax return to the tax return box at the airport, and finally wait for the refund.</p> <p>Consumer: What should I do if I lose my tax return or forget to drop it off?</p> <p>Xiaozhi: If you encounter problems during the refund process, don't worry. You can contact us at any time and we will do our best to help you solve the problem and make sure you receive your refund in a timely manner. We care about your experience and satisfaction, you can always give us your suggestions and comments.</p> <p>Consumer: Yes, thank you.</p> <p>Xiaozhi: You are too kind! If you have any other questions or need further assistance, please feel free to let Xiaozhi know. We hope you are able to successfully complete your tax refund and have a pleasant travel experience.</p>
Hedonistic	<p>Xiaozhi: Hello, welcome to the amusement park.</p> <p>Consumer: Hello, it's my first time to come to this amusement park, I don't quite understand the facilities of the amusement park program, can you provide me with some suggestions for playing?</p> <p>Xiaozhi: Okay. First of all, please determine which rides and shows you would like to participate in. The programs in the amusement park include: roller coaster, water park and children's play area, etc.; and the shows include musical fountain, magic show, acrobatic show and float show, etc.</p> <p>Consumer: Sounds like fun. I want to watch the float show and go on the roller coaster. Can you help me plan a suitable route?</p> <p>Xiaozhi: Okay. As the roller coaster is very popular, the queue may be large, so you are advised to go there as early as possible to line up. The float show schedule is 4:00 p.m., you can arrive early to watch the location to give you a better viewing experience.</p> <p>Consumer: Okay, and can you tell me where the shopping and eating places are?</p> <p>Xiaozhi: Okay. I will consolidate all the information into one map for your convenience. During your tour, you can check the map at any time to find out the location of restaurants, shopping places, and the time of the float parade.</p> <p>Consumer: Okay, thanks.</p> <p>Xiaozhi: You're welcome. If you have any other questions or need further assistance, please feel free to let me know!</p>	<p>Xiaozhi: Good morning~ Welcome to the amusement park! I'm Xiaozhi, looking forward to your enjoyable play experience, how can I help you?</p> <p>Consumer: Hi, it's my first time at this amusement park and I don't know much about the facilities, can you give me some suggestions?</p> <p>Xiaozhi: No problem~ Xiaozhi is very happy to help you. Xiaozhi would like to know what rides and shows you would like to participate in the amusement park? There are roller coasters, water parks and children's play areas in the amusement park; you can also watch musical fountains, magic shows, acrobatic shows and float shows.</p> <p>Consumer: I would like to experience some exciting rides first and then watch a float parade.</p> <p>Xiaozhi: Fantastic! Our roller coaster is a very popular item that can bring you an unparalleled thrilling experience. I would recommend that you get in line as early as possible so that you can experience the ride as early as possible. The float parade is at 4:00 p.m., so I suggest you arrive early for a better viewing experience.</p> <p>Consumer: Sounds great. Can you tell me where the restaurants and shopping areas are?</p> <p>Xiaozhi: Of course, there's no problem! We have several restaurants and food stalls for you to choose from so that you can enjoy your meal, as well as many shopping locations where you can find all kinds of interesting souvenirs and gifts. Xiaozhi will put all the information together on a map for your convenience. During your tour, you can check the map at any time to find out where the restaurants are located, where to shop, and when the float parade will take place.</p> <p>Consumer: Awesome! Thank you for helping me plan my trip today.</p> <p>Xiaozhi: You're welcome. I hope you have a great time at the amusement park! If you have any other questions or need further assistance, please feel free to let me know. Thank you for your inquiry!</p>

Fig. 5. Experiment materials

the scenario described in the material and then complete a questionnaire. The questionnaire included independent variables, moderating variables, dependent variables, mediating variables, control variables, screening questions, and demographic variables. The screening questions are designed to prevent random or careless responses by the participants.

The items used to measure the communication style of the service robot and the consumer's willingness to continue using the service robot were consistent with those used in the pilot study. The items assessing the communication style were adapted from the scale developed by Van Dolen et al. (2007), and those measuring consumers' willingness to continue using the service robot were adapted from Venkatesh et al. (2012). Details of these measures are provided in Study 1. The items assessing the service contextual attributes were adapted from Liu et al. (2022), which required subjects to evaluate the utilitarian and hedonic attributes of the service on a 7-point Likert scale, ranging from 1 ("utilitarian") to 7 ("hedonic"), consisting of three items in total (See Table A1 at the end of the article). Meanwhile, we have also included age, gender, and education as control variables in the data processing.

Results

Cronbach's α coefficient was used to test scale reliability. The reliability coefficients were: Service context attributes=0.91, Social-oriented service robot communication style = 0.908, task-oriented service robot communication style = 0.889, consumers' positive emotion =0.932, consumers' continued willingness to use=0.914, consumers' satisfaction= 0.919.

KMO was used to test scale validity. The validity coefficients were: Service context attributes=0.712, with Bartlett's test of sphericity value of 625.79($P<0.001$). Service robot communication style = 0.862 with Bartlett's test of sphericity value of 1421.78 ($P<0.001$). Consumers' continued willingness to use=0.757, with Bartlett's test value of 571.253 ($P<0.001$). Consumers' satisfaction = 0.75, with a Bartlett's test value of 601.928 ($P<0.001$). Consumers' positive emotion =0.842, with a Bartlett's test value of 904.534 ($P<0.001$). These results indicate that the scales used in the questionnaire exhibit good validity.

Manipulation test. The independent sample T-test shows a significant difference in utilitarian and hedonic attributes. The results showed that there was a significant

Table 3. Manipulation results of service robot communication style

Variable	Group	N	M	SD	t	p
Task-Oriented Communication Style	Task	131	5.66	0.94	8.939	0.000
	Social	140	4.19	1.69		
Social-Oriented Communication Style	Task	131	4.48	1.61	-7.784	0.000
	Social	140	5.73	0.93		

difference between subjects' utilitarian and hedonic attributes for utilitarian and hedonic service situations ($M_{\text{utilitarian}} = 2.18$, $M_{\text{hedonic}} = 5.39$, $F(1, 271) = 18.535$, $p < 0.001$), indicating that, the manipulation of utilitarian and hedonic service situations was successful.

Second, this study employed an independent samples t-test to assess the effectiveness of manipulating the service robot's communication style. The results revealed significant differences between the two groups' ratings of social-oriented and task-oriented communication styles. Specifically, as detailed in Table 3, subjects exposed to social-oriented dialogues gave higher ratings for social-oriented ($M_{\text{social-oriented}} = 5.73$, $M_{\text{task-oriented}} = 4.48$, $F(1, 271) = 56.48$, $p < 0.001$), while those viewing task-oriented dialogues rated task orientation higher ($M_{\text{social-oriented}} = 4.19$, $M_{\text{task-oriented}} = 5.66$, $F(1, 271) = 81.4$, $p < 0.001$), confirming the successful manipulation of the communication styles. Additionally, a one-sample t-test analyzing the contextual realism of the questionnaire indicated that the conversational contexts were perceived as highly realistic (Mean = 6.41, SD = 0.40, $t(271) = 265.09$, $p < 0.001$).

Hypothesis test. This study utilized independent samples t-tests to analyze the impact of service robot communication styles (0=task-oriented, 1=social-oriented) on consumers' positive emotions and their willingness to continue using the service. Consumers' positive emotions served as the first dependent variable. The results indicated significant differences in positive emotions between the communication styles: socially-oriented ($N=140$, Mean=5.67, SD=1.01) and task-oriented ($N=131$, Mean=4.34, SD=1.62); $F(1, 271) = 40.873$, $p < 0.001$. Socially-oriented styles elicited higher positive emotions compared to task-oriented styles. Subsequently, consumers' willingness to continue using the service robot was analyzed with communication style as the independent variable. There was a significant difference in willingness between the social-oriented ($N=140$, Mean=5.87, SD=0.81) and task-oriented styles ($N=140$, Mean=5.06, SD=1.61); $F(1, 271) = 42.99$, $p < 0.001$, thus confirming Hypotheses H1 and H2.

Mediation effect test. To test the mediating role of positive emotions, the analysis was carried out using the SPSS Process Model 4 in the Bootstrap method was selected with 5000 resamples and a 95% confidence interval. The service robot communication style (0=task-oriented, 1=social-oriented) was the independent variable, positive emotion was the mediator, and age, gender, and educational level were control variables. Consumers' willingness to continue using the service was the dependent variable. The results show that the effect of service robot communication style on con-

sumers' intention to continue using the service robot is not significant after adding the mediator ($p=0.393 > 0.05$). However, the mediation effect of "service robot communication style-positive emotion-consumers' intention to continue using the service robot" is significant (BootLLCI=0.5083, BootULCI=1.114, excluding 0). Positive emotion fully mediates this relationship (LLCI=-0.3338, ULCI=0.1316, including 0), with an indirect effect size of 0.9123 (See Table 4). Therefore, hypotheses H2, H3, and H4 are supported.

Moderating effect test. For the moderating effect test of service context, this study uses SPSS Process to test the moderating effect (Model7, sample size 5000, confidence interval 95%). Service robot communication style was used as the independent variable, positive emotion as the mediator variable, service context attributes as the moderating variable, and consumers' willingness to continue using the service as the dependent variable to test the moderating effect of service context and the mediator effect with moderation.

First, the moderating effect of service context is tested. Adopting the conventional method to test the moderating effect, the product term of service communication style and service context was calculated, and regression analysis was conducted on positive emotions, and the results showed (see Table 5) that the product term of service communication style and service context had a significant predictive effect on positive emotions ($B=0.706$, $t=2.170$, $p < 0.05$). It indicates that positive mood strengthens the positive effect of service communication style and positive mood and hypothesis H5 is valid.

This paper categorizes the service context attributes into utilitarian and hedonic groups. Under the utilitarian group ($N=132$), the sample size of the task-oriented group is 65, and the social-oriented group is 67. Under the hedonic group ($N=139$), the task-oriented group sample size is 66, and the social-oriented group is 73. ANOVA was conducted with service communication styles as the independent variable, and positive emotions as the dependent variables. The results are shown in Table 6. Positive emotions in the utilitarian group ($M_{\text{social}}=5.343 > M_{\text{task}}=4.373$, $p=0.000$) and the hedonic group ($M_{\text{social}}=5.972 > M_{\text{task}}=4.299$, $p=0.000$) showed significance. The results again support hypotheses H5 and H6.

Thirdly, to test the mediating effect with moderation, the results (see Table 7) show that after including the service context in the model, the service robot communication style significantly affects consumer persistence intention through positive emotions ($B=0.4826$, LLCL=0.2402, ULCL=0.9606, excluding 0), confirming a significant mod-

Table 4. Results of mediation tests of positive emotion

Variables	Direct effect of X on Y					
	Effect	SE	LLCI	ULCI	t	P
Communication Styles	-0.1011	0.1182	-0.3338	0.1316	-0.8556	0.3930
	Indirect effect of X on Y					
	Effect	BootSE	BootLLCI	BootULCI	t	P
Total	0.8112	0.1538	0.5083	1.114	5.2736	0.000
Positive Emotion	0.9123	0.1519	0.6271	1.2307		

Table 5. Results of the moderating service context attributes

Outcome Variables	Predictor Variables	R	R2	F(df)	B	t
Positive Emotion		0.47	0.22	12.68***		
	Communication Style				0.968	4.164***
	Service Context Attributes				-0.073	-0.312
	Communication Style * Service Context Attributes				0.706	2.170*

***p<0.001, **p<0.01, *p<0.05

Table 6. Results of communication style on consumers' continued willingness to use and positive emotion under utilitarian and hedonic groups

Service Context Attributes	Groups	M	SD	F	p
Utilitarian	Task	4.373	1.689	6.948	<0.000
	Social	5.343	1.191		
Hedonic	Task	4.299	1.556	14.306	<0.000
	Social	5.972	0.697		

Table 7. Analysis of moderating effects

Service Context Attributes	B	SE	LLCI	ULCI
Path : Communication Style→ Positive Emotion→ Consumers' Continued Willingness to use				
Moderated intermediation	0.4826	0.2402	0.0293	0.9606
	B	BootSE	BootLLCI	BootULCI
Utilitarian	0.6614	0.1870	0.3207	1.0636
Hedonic	1.1440	0.2019	0.7697	1.5499

erated mediation effect. This means that the service context enhances the positive effect of communication style on consumers' willingness to continue using the service through positive emotions, supporting hypothesis H6.

Specifically, as shown in Table 6, the indirect effect of positive emotion between social-oriented and task-oriented communication styles in utilitarian service contexts is 0.9678; in hedonic service contexts, the effect is 1.6741. Therefore, the mediating effect of positive emotions is stronger in hedonic service contexts compared to utilitarian service contexts.

This slope (see Fig. 6) analyses show that the social-oriented (vs. task-oriented) communication style of service

robots increases consumers' willingness to continue using them. Compared to utilitarian service contexts, hedonic service contexts are more likely to elicit higher positive emotions from social-oriented service robots. The mediating effect of positive emotions is stronger in hedonic service contexts.

Discussion. Study 2 employed a between-group design involving two communication styles (task-oriented vs. social-oriented) and two service context attributes (utilitarian vs. hedonic) using a situational-imaginative manipulation approach. A two-way ANOVA was conducted to examine the moderating role of service robot communication style on positive emotions and the moderating effect of service

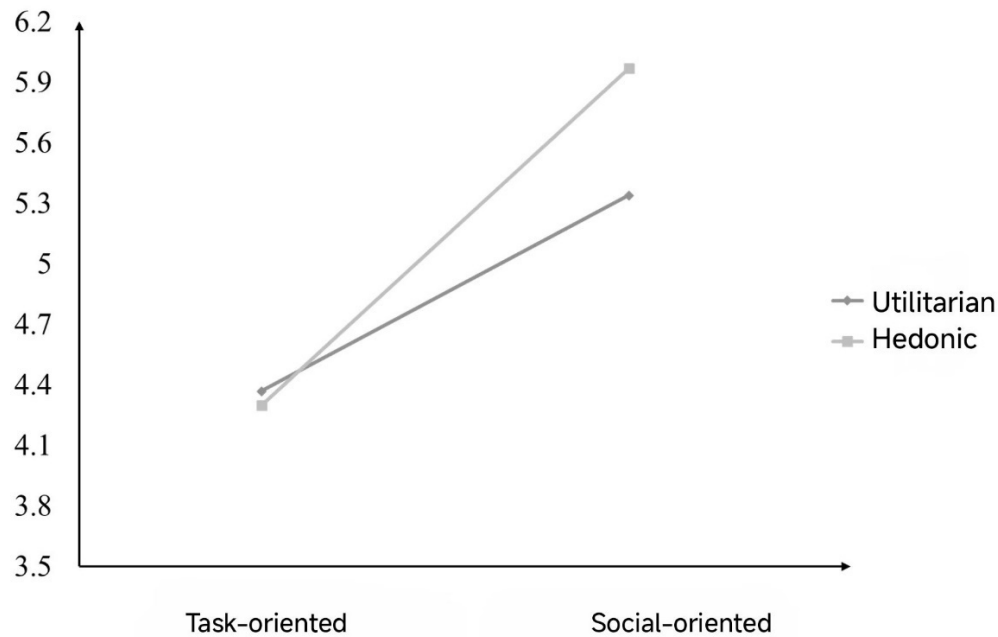


Fig. 6. The effect of service context attribute and communication styles on positive emotions

context (hedonic vs. utilitarian) on the mediating role of positive emotions.

The results of this study reaffirm the impact of service robot communication style on consumers' continued willingness to use the service and its underlying mechanisms, supporting H1 that social-oriented communication styles elicit higher positive emotions in hedonic service contexts compared to utilitarian contexts. Moreover, the mediating effect of positive emotions was found to be stronger in hedonic service contexts, thereby affirming H5 and H6.

Conclusions

This study examines the impact of service robot communication styles (socially-oriented vs. task-oriented) on consumer attitudes and behaviors during interactions with service robots. Drawing on Stimulus-Organism-Response (SOR) theory, three scenario experiments were conducted along with an online questionnaire, focusing on positive emotions as the mediating variable and service context attributes as the moderating variables. The preliminary experiment utilized a one-way (service robot communication style: task-oriented vs. social-oriented) between-group design, successfully demonstrating that a social-oriented communication style significantly increases consumers' continued willingness to use the service robot compared to a task-oriented style.

Study 1, building on the initial scenario manipulation, replaced the service scenario and further confirmed that a social-oriented style not only enhances consumers' intentions to continue using the service robot but also elevates their positive emotions, as evidenced by Bootstrap analysis. Study 2 explored the moderating role of service context attributes in a 2 (service context: utilitarian vs. hedonic) ×

2 (communication style: task-oriented vs. social-oriented) between-groups design. The results indicated that in hedonic service contexts, a social-oriented communication style elicited significantly higher positive emotions from consumers compared to utilitarian contexts, reinforcing that positive emotions have a stronger mediating effect in hedonic settings due to the close relationship between hedonic consumption contexts and consumers' emotional experiences.

This paper aims to alert companies currently using or considering the use of service robots to the significant impact of a service robot's social-oriented communication style on eliciting emotional responses from consumers, which in turn influences their continued willingness to use the robot. By conveying emotions such as friendliness, warmth, and professionalism through a social-oriented communication style, service robots can trigger positive emotions in consumers, thereby increasing their satisfaction and loyalty. These emotional responses not only help consumers better accept service robots but also motivate them to take more positive actions, such as recommending the service to others and repurchasing.

When a service robot engages in natural and fluid social interactions with consumers, it is more likely to be perceived as a trustworthy partner rather than merely a tool or device. This sense of social identity enhances consumers' emotional connection and sense of belonging to the service robot, which, in turn, increases their willingness to continue using it. In healthcare, service robots require a highly specialized social-oriented communication style to interact and communicate effectively with patients. In education, a social-oriented communication style is crucial for service robots to stimulate students' enthusiasm and interest in learning. In the entertainment field, the social-oriented

communication style of a service robot is a key factor in determining whether it can attract and maintain consumer interest. Companies should optimize the communication style of service robots to adapt to different scenarios and consumer needs, thereby enhancing consumers' willingness to continue using them.

Significance

This study theoretically demonstrates that service robot communication styles can have varying effects on consumers' willingness to continue using them. This research enriches the understanding of social cognition and social relationship construction in the field of human-robot interaction and provides an important theoretical foundation for the design of service robots, their interaction styles, and user experiences.

While it has been proposed that the communication style of service robots affects perceptions of enthusiasm and competence from a social cognition perspective, no prior study has examined the impact and mechanism of service robot communication style on users' willingness to continue use from the perspective of consumers' emotional responses.

Moreover, consumers' service experiences are influenced by factors such as service quality, the behavior and interaction of service providers, the service environment and atmosphere, and personal preferences. Providing consumers with a friendly and effective interaction experience is crucial for satisfying users' needs and expectations, thereby enhancing their overall service experience. This paper uses service context as a moderating variable to explore the effects of service robots' communication styles on consumers' emotional responses and behaviors in different service contexts, offering a new perspective for exploring boundary conditions in studies related to service robots and consumer behavior.

As robots become more prevalent in service environments, organizations seeking to use service robots need to understand consumer attitudes and behaviors toward them. Successfully integrating robots into customer service is a major challenge for most organizations. Companies require actionable guidance on how, when, and to what extent they should adopt service robots and how to use AI to engage customers more systematically and strategically (Tsai et al., 2021). For example, in restaurants, service robots can interact with guests using a social-oriented communication style to improve customer satisfaction; in healthcare facilities, service robots can act as guides or caregivers, enhancing patient trust through social-oriented communication.

By gaining an in-depth understanding of consumer behavior, robots can be trained to engage in more natural and smooth social interactions across different scenarios, thereby improving their service quality and efficiency. Service robots can become life assistants for consumers, helping with daily chores such as shopping, cleaning, and cooking, allowing consumers to better enjoy their lives. Additionally, for consumers with special needs, such as the elderly or individuals with disabilities, service robots can provide high-quality, equitable services that support au-

tonomous living. Interaction with robots can also offer consumers a more personalized and convenient service experience, enhancing their comfort and satisfaction with daily life. Therefore, this study aids companies and platforms in understanding consumers' emotional responses to service robots, ultimately increasing their continued willingness to use these robots.

Limitation and Implication

All of the research hypotheses in this paper have been validated, but there are still shortcomings and limitations.

First, regarding research methodology, this study utilizes situational experiments and questionnaires. While this design effectively controls external interference, it may still introduce some bias. Future research could employ a more diverse array of methods to further validate these findings. Second, the measurement of service robot communication style is limited to simulated dialogues in experimental scenarios, which might not accurately reflect real-world interactions. Future studies could use real application dialogue data or third-party evaluations to assess communication styles more authentically. Additionally, categorizing service scenarios into utilitarian and hedonic may not be sufficiently comprehensive. Future research could implement a more nuanced classification method, considering factors such as consumers' personal preferences, service purposes, and usage environments, to better examine the moderating effects of service scenarios.

Furthermore, the assessment of the mediating effect of positive emotions is based mainly on self-reported data, which may not fully capture consumers' actual emotional responses. Future studies might explore using physiological indicators (e.g., heart rate, electrodermal activity) or natural language processing techniques to analyze emotional expressions more accurately. Lastly, as a contextual questionnaire study, our pre-test involved a small number of subjects, particularly in the pilot study, where there were only about 30 participants in each group. In future studies, we aim to determine the appropriate number of participants for the pre-test using G-power analysis.

In conclusion, while this research has provided valuable insights, it also highlights numerous areas for improvement and deeper investigation. Future studies should explore the effects of service robot communication style on consumers' continued usage and satisfaction from multiple perspectives to provide more comprehensive theoretical support and practical guidance for the design and application of service robots.

Competing Interests

We have no known conflict of interest to disclose.

Author Contributions

Conceptualization: Jinsong Chen.

Data curation: Yuexin Zhang, Luona Wang.

Formal analysis: Yuexin Zhang, Luona Wang.
Funding acquisition: Jinsong Chen.
Investigation: Yuexin Zhang, Luona Wang.
Methodology: Yuexin Zhang, Luona Wang.
Project Administration: Jinsong Chen.
Software: Yuexin Zhang
Supervision: Jinsong Chen.
Validation: Jinsong Chen.
Visualization: Yuexin Zhang, Luona Wang.

Data Accessibility Statement

All data, analysis code, and research materials are available at [<https://osf.io/v5q6u/>]

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Table A1. Measurements.

Variable	Items	Reference
Communication styles of service robots	I think Xiaozhi tries to provide information related to the service.	Van Dolen et al. (2007)
	I think Xiaozhi focuses on service-related details.	
	I think Xiaozhi is only providing information related to the service.	
	I think Xiaozhi is following a process to ensure the service is completed.	
	I think Xiaozhi is easy to talk to.	
	I think Xiaozhi is sincere in providing me with service and help.	
	I think Xiaozhi provides its services with me as a real person, not just as a customer of its services.	
	I think Xiaozhi enjoys interacting with me and makes me feel relaxed.	
Service Context Attributes	1. How do you rate the service in terms of enjoyableness and functionality? (1 = more functional than enjoyable, 7 = equally functional and enjoyable, 4= more enjoyable than functional)	Liu et al. (2022)
	2. How do you rate the service in terms of fun and usefulness? (0 = more useful than fun, 4 = equally useful and fun, 7 = more fun than useful)	
	3. How do you rate the service in terms of hedonic and utilitarian attributes? (1 = more utilitarian than hedonic, 4 = equally utilitarian and hedonic, 7 = more hedonic than utilitarian)	
Consumers' willingness to continue using	When I go on my next trip, I will use a service robot.	Venkatesh et al. (2012)
	When I go on my next trip, I will interact with the service robot.	
	I plan to continue using service robots in the future.	
Satisfaction	I was pleased with the service provided by Xiaozhi.	Evans et al. (2000)
	I was pleased with Xiaozhi.	
	Based on this travelling experience, I was satisfied with the service.	
Positive emotion	I think Xiaozhi makes me feel relaxed.	Waston et al. (1988)
	I think Xiaozhi makes me feel happy.	
	I think Xiaozhi makes me feel surprised.	
	I think Xiaozhi makes me feel excited.	
Screening questions	What is the name of the robot that serves you?	

Supplementary Materials

Peer Review Communication

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