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Exploring the varying effects of chatbot service quality dimensions on customer intentions to switch service agents

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This study aims to explore how the different dimensions of chatbot service quality influence customers' service-switching intentions when shopping online. The dimensions of chatbot service quality are identified through a critical review of the relevant literature. Subsequently, a structural equation model is applied to test the hypotheses utilizing 575 valid responses. This study reveals that synchronicity and perceived humanness do not have a significant direct impact on customers' willingness to switch from human services to chatbot services but ability to understand and problem resolution do. Moreover, perceived shopping enjoyment fully mediates the impact of synchronicity and perceived humanness, and partially mediates the impact of ability to understand and problem resolution on customers' intentions to choose chatbot services. Additionally, active control moderates the impact of ability to understand on willingness to switch. These findings empirically validate that the four dimensions of chatbot service quality are applicable to the context of the retail e-commerce industry and service quality research should consider specific industry contexts in which the services are delivered.

Keywords Chatbot service, Service quality, Service choice, Service-switching, Shopping enjoyment

Chatbots are computer programs powered by artificial intelligence and machine learning[1], utilizing human languages to interact with users[2]. In the retail e-commerce industry, an increasing number of online stores use chatbots as default service agents because they provide a variety of benefits to customers and retailers[1], such as automatically responding to consumers' requests 24 h a day[3], handling many customer communications simultaneously[1] and reducing the operating costs of retailers[4]. However, as a relatively recent technology, chatbots still suffer from providing many irrelevant answers[5], which results in a high rate of service failure and user skepticism[6]. As a result, it is observed that a considerable portion of customers still prefer human services, showing minimal engagement with chatbots, and in some cases, even do not try it at all.

Academically, the increase in chatbot usage and its associated pros and cons have sparked great interest among scholars since 2017[7]. The early empirical literature generally compared human–chatbots and human–human conversations[8]. More recently, scholars have focused on the factors influencing consumers' perceptions, attitudes and behaviors toward chatbots[9,10]. To make such assessments, studies have primarily utilized the Technology Acceptance Model (TAM)[2,8] and the Unified Theory of Acceptance and Use of Technology (UTAUT)[11,12].

Although these studies have established a good understanding of chatbots as information technology tools, they have overlooked the social presence of chatbots as service employees. According to the social response theory[13], when customers interact with an anthropomorphic designed computer, they perceive a sense of social presence[6], which refers to the feeling of being with another person[14]. Correspondingly, chatbots are perceived as service employees rather than just technological tools[15]. Therefore, it is necessary to integrate service quality theories to explore customer attitudes and their reactions toward the services provided by chatbots.

In recent years, some scholars have begun examining customers' intentions to adopt chatbots from a service quality perspective. However, there are three notable shortcomings in this area of research. First, limited attention has been given to the retail e-commerce industry. Most of the research focuses on chatbots in other industries or does not target a specific industry. For example, Meyer-Waarden et al.[16] and Li et al.[17] investigated chatbots used in the travel industry, Hsiao and Chen[18] studied chatbots used in the food service industry, while Chen et al. (2022) did not limit their research to a specific industry, covering sectors such as hotel services, travel, food services, finance, healthcare, consulting, retail, entertainment, careers and education[19]. However,

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there are significant differences in service quality dimensions between chatbots in the e-commerce industry and those in other sectors. For instance, e-commerce chatbots typically prioritize efficiency and accuracy, while entertainment-focused ones emphasize fun, interactivity and user experience design. This aligns with Kharub et al.[20], who pointed out that the dimensions of service quality need to be adjusted to reflect the specific requirements of an industry and the services being provided. Therefore, it is essential to examine the service quality dimensions that are applicable to the retail e-commerce industry.

Second, the majority of existing chatbot studies examine customers' emotional or cognitive responses toward chatbots, such as satisfaction with[17,21] and trust in[22,23] chatbots, as mediators linking customers' experiences of using chatbots to their intentions to reuse them. However, the purpose of customers' online shopping is to complete shopping tasks and achieve an enjoyable shopping experience[24]. Therefore, customers are more concerned with their overall shopping experience than with their experience of using chatbots. According to the means-end theory, chatbot services, which assist customers in their purchase journey by providing necessary information, are a means to deliver a positive shopping experience[25]. Thus, it is necessary to investigate whether perceived shopping enjoyment—defined as the extent to which the shopping experience within a store is perceived as enjoyable[26]—plays a role in translating the various dimensions of chatbot service quality into customers' willingness to switch from human services to chatbot services.

Third, since service quality reflects customers' overall perceptions and subjective evaluations of the service during the delivery process[19], it will be influenced by customers' characteristics. Previous research has explored how customers' characteristics, such as technology anxiety[17], the need for human interaction[8] and social self-efficacy[27], moderate the relationship between chatbot service quality and customers' intentions to use chatbots. However, these moderators tend to focus on customers' psychological resistance to chatbot services, leaving customers' proactiveness or ability to influence the service delivery process out of the picture. Since chatbots still rely on input pattern matching and attempt to find a predefined response that matches the input[28], how customers phrase their questions can impact the quality of the services provided. Therefore, it is necessary to examine the moderating role of active control, which refers to customers' ability to manipulate their interactions with an information system[29].

As a result, this study focuses on the following three research questions (RQs), aiming to uncover how various dimensions of chatbot service quality influence customers' willingness to switch from human services to chatbot services.

RQ1. In the context of the retail e-commerce industry, what are the varying effects of various chatbot service quality dimensions on customers' willingness to switch from human services to chatbot services?

RQ2. Does perceived shopping enjoyment mediate the relationship between various chatbot service quality dimensions and customers' willingness to switch from human services to chatbot services?

RQ3. How does customers' ability to manipulate their interactions with chatbots influence their willingness to switch from human services to chatbot services?

This study's contribution is twofold. Theoretically, it empirically validates that the four dimensions of chatbot service quality are applicable to the context of the retail e-commerce industry. Moreover, the mediating role of perceived shopping enjoyment highlights that service quality research should consider specific industry contexts in which the services are delivered. Additionally, the moderating role of active control extends the research on service experience co-creation from human-to-human interactions to chatbot-to-human interactions. Practically, the research findings can guide online retailers to improve the service quality of chatbots.

Theoretical background

The Stimulus-Organism-Response (SOR) model was initially proposed by Mehrabian and Russell[30] and then modified by Jacoby[31]. This model argues that clues (Stimulus) perceived from the environment can trigger an individual's internal cognitive and/or affective assessment state (Organism), which in turn produces positive or negative behaviors (Response) to the stimuli[30]. Given the exploratory nature of the SOR model in identifying external factors driving customer behavior[32], prior studies have used it to understand customers' perceptions and responses to chatbot services. For example, Cheng et al.[1] examined the impact of chatbots' empathy and friendliness (Stimulus) on customers' reliance on and resistance to the chatbots (Response) through trust in the chatbots (Organism), while Shahzad et al.[33] assessed the impact of the chatbot service quality (Organism) on e-brand loyalty and electronic word of mouth (Response) among luxury fashion brand users through chatbot user trust and chatbot user experience (Organism). Therefore, this study utilized this model to explore the impact of various chatbot service quality dimensions (Stimulus) on customers' willingness to switch from human services to chatbot services (Response) through perceived shopping enjoyment (Organism), as detailed below.

Stimulus: dimensions of chatbot service quality

Based on a review of the existing literature on chatbot services across various industry contexts, we identified diverse service quality dimensions and then selected the most representative ones from those with the same or similar meanings, as shown in Table 1. Furthermore, aligning with previous literature[34,35], these selected service quality dimensions are further categorized into functional and emotional process quality, outcome quality and environment quality.

Consequently, ability to understand and synchronicity are identified as dimensions of functional process quality, perceived humanness is chosen as the dimension of emotional process quality and problem resolution is designated as the dimension of outcome quality. Specifically, ability to understand refers to customers' perception that chatbots understand human dialogues, the context of a conversation and the nuance of human language[17]. Synchronicity refers to the degree to which participants' input into the communication and the response they receive from the communication are simultaneous[42]. Perceived humanness refers to the human-like characteristics displayed by chatbots, such as motivations, intentions and emotions[19,40]. Problem resolution

Categories of quality dimensions	Representative quality dimension	Various quality dimensions	Definitions	References
Functional process quality	Ease of use	Ease of use	It is simple and intuitive for customers to interact with and navigate the chatbot's interface and features	36
		User interface	The overall ease of use, ease of navigation and overall design of the chatbot	18
		Accessibility	Easy to locate, easy to use, easy to understand and readily compatible with different technological devices	37
	Ability to understand	Competence	The required skills and knowledge that the customer service agent needs to have in order to perform the service	16
		Self-learning/continuous improvement	The chatbot continuously improves functions by self-learning	19,36
		Understandability	The customer's perception that a chatbot service understands human dialogues, the context of a conversation and the nuance of human language	17,19
		Credibility	The believability of a source or message	16
		Accuracy of response	Chatbots can respond to customers' requirements accurately	36
		Customization/personalization	The chatbot recommends personalized products or services based on customer preferences without requiring their explicit request	19,36,38
	Synchronicity	Responsiveness	The ability to provide swift service, which involves timely responses, immediate answers and prompt service	16,17,20,39
		Availability	The extent to which the chatbot is ready for use anywhere, anytime	36,40
		Efficiency	Technically ease of use and speed of chatbots	19,40
Emotional process quality	Perceived humanness	Empathy	Caring, individualizing attention the employee provides its customers	16,20,36,39,41
		Assurance	The knowledge and courtesy of employees and their ability to inspire trust and confidence	17,20,39
		Human-like/anthropomorphism	Chatbots display human-like characteristics, motivations, intentions and emotions	19,40
Outcome quality	Problem resolution	Problem-solving	The ability of chatbots to effectively resolve any problems encountered by the customer during online shopping	18,38
		Reliability	The ability to perform the promised service dependably and accurately	16,17,20,41
		Consistency	The quality of service provided by the chatbot is stable	36
		Trendiness	Updates the customer with current news about new products or emerging trends	38
		Entertainment	Providing customers with entertaining content that they enjoy	20,38
Environment quality	Visual design	Tangibles	Physical facilities, equipment and appearance of personnel	16
		Design	The richness of the environment's representation, which is determined by characteristics of form, notably graphics, images, animation, vidio and so on	37

Table 1. Identification and categorization of chatbot service quality dimensions.

refers to the extent to which the problems encountered by customers during online shopping are effectively and efficiently addressed by chatbots[18,38].

In addition, ease of use and visual design are excluded from chatbot service quality dimensions in this study because our research focuses on the chatbot of the Taobao platform, where the human service and chatbot service share the same interface (visual design) and interaction method (text-based input), as shown in Table S1 in supplementary file. Therefore, these two dimensions do not influence customers' service-switching intentions.

Organism: perceived shopping enjoyment

As shown in Table 2, existing studies on chatbot services have examined various mediators bridging the relationships between various chatbot service quality dimensions and customers' intentions to use or reuse chatbot services, such as trust in chatbots[23], satisfaction with[8] and perceived value of chatbot services[19]. These mediators all reflect customers' emotional or cognitive responses toward the use of chatbots rather than their shopping experience. For example, satisfaction, as examined in Li et al.[17], is the user's positive emotional state resulting from an appraisal of the tasks performed by chatbots. However, although the experience of using chatbots significantly contributes to a positive shopping experience, perceived shopping enjoyment is influenced by additional factors such as product discovery, product knowledge and social value[25,43]. Previous literature has demonstrated that perceived shopping enjoyment mediates the influence of customers' use of technologies, such as web forms of interactive media[44] and image interactive technology[45], on their attitudes toward these technologies. Since customers use chatbots to achieve their shopping goals, this mediating role is expected to extend to chatbots acting as service employees.

Response: willingness to switch from human services to chatbot services

Existing studies on chatbot services primarily focus on the determinants of customers' adoption[5] or reuse intention[46], as shown in Table 2. However, this overlooks the fact that customers can choose between human services and chatbot services. The willingness to switch from human to chatbot services refers to customers' transition from an initial preference for human services in some scenarios to a subsequent preference for chatbot services. This study uses "willingness to switch" as the dependent variable for the following reason. Customer services were previously handled by humans and the aim of developing and applying chatbots was to

References	Stimulus	Organism	Response	Moderators	
	Chatbot service quality dimensions	Cognitive/affective assessment	Intention to use/reuse		Key findings
23	Anthropomorphism, empathy, social presence	Customer's trust in chatbots	Customer's willingness to use chatbots		The customer's trust in chatbots mediates the impacts of anthropomorphism (negative), empathy (positive) and social presence (positive) on willingness to use chatbots
18	User interface, problem-solving	Anthropomorphism, trust, satisfaction	Continuous using intention		Anthropomorphism and problem-solving are the antecedents of trust and satisfaction, which further influence continuous intention. In contrast, user interface solely influences trust
1	Empathy Friendliness	Trust towards the chatbot	Reliance on the chatbot, resistance to the chatbot	Task complexity, disclosure of the chatbot	The consumers' perception of both the empathy and friendliness of the chatbot positively impacts their trust in it, which further increases their reliance on the chatbot and decreases their resistance to the chatbot in future interactions
19	Semantic understanding, close human-AI collaboration, human-like, continuous improvement, personalization, culture adaption, efficiency	Perceived value of AI chatbot satisfaction with AI chatbot	Intention to continuous use		The perceived value of AI chatbots and the satisfaction with AI chatbots are two key mediators in the relationship between AI chatbot service quality and customers' continuous use of intention
20	Reliability, responsiveness, assurance, empathy, entertainment	Emotional engagement	Intention to use		Empathy and entertainment positively influence customers' emotional engagement, which further influences customers' intention to use. However, reliability, responsiveness and assurance do not influence customers' emotional engagement
17	Understandability, reliability, responsiveness, assurance, interactivity	Confirmation, satisfaction	Use continuance	Technology Anxiety	Understandability, reliability, assurance and interactivity are positively associated with post-use confirmation, which further influence satisfaction and use continuance. However, responsiveness is not significantly related to post-use confirmation
16	Tangibles, competence reliability, responsiveness, empathy, credibility	Perceived usefulness, perceived ease of use, trust	Intention to reuse		Tangibility positively influences perceived ease of use and perceived usefulness, reliability positively influences perceived usefulness, credibility positively influences trust, perceived usefulness positively influences intention to reuse. However, all the mediation effects are non-significant
8	Information quality, service quality, perceived enjoyment, perceived usefulness, perceived ease of use	Satisfaction	Continuance intention	Need for interaction with a service employee	Information quality, service quality, perceived enjoyment and perceived usefulness positively influence consumers' satisfaction, which further influences their continuance intention. Moreover, perceived enjoyment, perceived usefulness and perceived ease of use also directly influence customers' continuance intention
46	Process quality, outcome quality, service environment quality	User satisfaction, reliability immersion	Reuse intention		Process quality, outcome quality and service environment quality were found to have no significant impact on user satisfaction and reliability. However, user satisfaction and reliability significantly influence reuse intention

Table 2. Mediators influencing the relationships between various chatbot service quality dimensions and customers' intentions to use chatbot services.

replace or complement human services[47]. Nonetheless, chatbot services currently have noticeable shortcomings, such as low adaptability and low empathy[48], while human services offer significant advantages over chatbots, including personalized service, high perceived homophily and social bonding[49]. This results in many consumers still preferring human services over chatbot services[49]. Therefore, it is necessary to explore the factors driving customers' willingness to switch from human services to chatbot services.

Hypothesis development

Functional process quality

Ability to understand

A smooth service process requires the chatbot to be able to provide relevant responses according to customers' requests[5]. The prerequisite for chatbots to provide relevant information to customers is their ability to understand customers' inquiries[19]. This foundational capability ensures that the chatbot can engage with the customer in a meaningful way and address their needs appropriately. As a result, chatbots with a high level of ability to understand are considered more capable of providing better solutions to customers[17]. However, current technology does not allow chatbots to fully understand customers' inquiries due to their reliance on input pattern matching and a pool of predefined responses[28]. Consequently, service failures, such as chatbots' inability to comprehend personalized or contextualized requests, giving "mechanical" responses[50] or providing irrelevant information, may lead to a decrease in customers' intentions to choose chatbot services. Therefore, we propose the following hypothesis:

H1a The ability of chatbots to understand is positively related to customers' willingness to switch from human services to chatbot services.

On the other hand, the ability of chatbots to understand enables two-way communication between chatbots and customers, distinguishing them from static information delivery tools, such as a list of frequently asked questions[51]. Previous studies have found that two-way communication between customers and e-commerce websites can significantly affect customers' perception of hedonic value, which includes fun, pleasure and excitement in online shopping[29]. Therefore, we propose the following hypothesis:

H1b The ability of chatbots to understand is positively related to perceived shopping enjoyment.

Synchronicity
Chatbots provide real-time automated responses to customer inquiries[3], which can reduce the time spent obtaining the information they want or resolving issues encountered during online shopping. In addition, chatbot services are available 24 h a day[3], which can be particularly appealing to customers needing assistance outside of regular business hours. As a result, customers might favor the quicker automated responses from chatbots over the slower response times typically associated with human services. It has been reported that if the alternative was to wait 15 min for a response, 62% of customers would rather choose chatbot services than human services[52]. Therefore, we propose the following hypothesis:

H2a The synchronicity of chatbot services is positively related to customers' willingness to switch from human services to chatbot services.

On the other hand, chatbots elicit higher customer satisfaction with online shopping via shorter perceived waiting times[15]. This is because when customers receive timely assistance, they are less likely to experience negative emotions. It has been reported that about 53% of customers find waiting too long for replies to be the most frustrating part of interacting with businesses[52], a sentiment that also applies to interactions with online stores. Consequently, when customers experience long waiting times, they will evaluate online stores negatively[53]. Therefore, we propose:

H2b The synchronicity of chatbot services is positively related to perceived shopping enjoyment.

Emotional process quality

Perceived humanness
Chatbots have been developed to incorporate human-like characteristics such as warmth[54], intimacy[55], empathy and friendliness[23,56] when communicating with customers. Increasing the perceived humanness of chatbots enhances customers' trust in chatbots[23] and leads to more effective conversations[57]. This is because human-like chatbots induce higher perceived competence in performing the role of service employees[58], which is crucial in shaping service value perceptions. Therefore, we propose the following hypothesis:

H3a The perceived humanness of chatbots is positively related to customers' willingness to switch from human services to chatbot services.

When chatbots are designed to communicate with customers in a human-like way—using a warm, friendly, intimate or empathetic manner—customers are more likely to perceive good intentions and feel emotional support. Moreover, human-like characteristics displayed during chatbot-human interactions, such as the chatbot's use of humor and emojis in responses, can entertain and engage customers[59] and mitigate service failures[60], leading to a pleasant purchase journey. In addition, human-like chatbots are expected to meet customers' need for interaction with human service employees to some extent[5]. This could provide customers with socialization value during the online shopping process, which is a key driver of a positive shopping experience for customers[21,61]. Therefore, we propose the following hypothesis:

H3b The perceived humanness of chatbots is positively related to perceived shopping enjoyment.

Service outcome quality

Problem resolution
Successful service outcomes are characterized by efficiently and effectively resolving customers' problems or requests[62]. As a replacement for human service employees, chatbots utilize machine learning and natural language processing to solve customers' problems[63] by providing relevant information through voice or text. Customers are typically outcome-oriented, meaning they prefer chatbots when they can efficiently resolve their problems or requests[62]. However, chatbots rely on input pattern matching to find a predefined response that matches the input. Such an approach works well in a conversation featuring well-defined and routine issues but does not provide satisfactory results in open-ended conversations that deal with unstructured problems[28]. As a result, chatbots often provide many irrelevant answers to customers[5]. A Gartner survey of 497 online customers found that the ability of chatbots to move the customers' problems forward was the top driver of adoption, explaining 18% of the variance in customers' likelihood of using chatbots again[64]. Therefore, we propose the following hypothesis:

H4a The extent of problem resolution offered by chatbots is positively related to customers' willingness to switch from human services to chatbot services.

Customers typically ask a variety of questions with varying levels of complexity throughout their purchase journey[1], ranging from inquiries about the material, size and features of products to questions about logistics methods and timelines, as well as return, exchange and refund procedures. Those who invest time and effort in interacting with chatbots but do not have their issues resolved may experience disruptions or even a halt in their shopping process, leading them to find online shopping frustrating, annoying and less enjoyable[65]. Conversely, when chatbots can effectively handle and resolve customers' issues or queries, they contribute to a smoother

shopping experience. This can enhance customers' perception of enjoyment during online shopping. Therefore, we propose the following hypothesis:

H4b The extent of problem resolution offered by chatbots is positively related to perceived shopping enjoyment.

Mediator

Perceived shopping enjoyment

The value of chatbot services in enhancing customers' online shopping experience goes beyond utilitarian aspects such as efficiency and convenience[3], encompassing the enjoyment derived from the shopping process. This is because chatbots are perceived to have less agency (i.e., the ability to act purposefully, form opinions and make judgments) than human service employees, which can reduce potential customer embarrassment during awkward service encounters, such as purchasing sensitive products (e.g., contraceptives and personal hygiene items) or behaving inappropriately (e.g., intrusive questioning or failing to respond to received messages)[66]. Moreover, since customers can freely decide when to initiate, pause and stop conversations with chatbots without concern for their reactions, being chased or feeling obliged to buy products, their perception of freedom, control and fun over online shopping will also increase[67]. When chatbots provide customers with a relaxed, free and undisturbed shopping experience, they are more likely to choose chatbots. Hence, we propose the following hypothesis:

H5 Perceived enjoyment of the online shopping served by chatbots is positively related to customers' willingness to switch from human services to chatbot services.

Moderator

Active control

The extent to which chatbot service quality influences customers' intentions to choose chatbot services is also affected by their ability to manipulate interactions with chatbots. This is because, although customers view chatbots as service employees, their responses are not as flexible as those of real humans. Customers with a higher level of active control can guide the chatbot to provide more accurate responses by rephrasing their questions, correcting the chatbot's misunderstandings or offering additional context, leading to an enhanced perception of the chatbot's ability to understand. In such scenarios, customers are more likely to experience smooth interactions, increasing their willingness to switch from human services to chatbot services. Therefore, we propose the following hypothesis:

H6a Active control positively moderates the relationship between a chatbot's ability to understand and customers' willingness to switch from human services to chatbot services.

A customer who can actively control the flow of interactions with an information system is able to obtain information based on their needs[42]. In the case of chatbot services, customers with a high level of active control can guide the chatbot to resolve their problems effectively by providing relevant information, which increases their willingness to switch from human services to chatbot services. Therefore, we propose the following hypothesis:

H6b Active control positively moderates the relationship between problem resolution and customers' willingness to switch from human services to chatbot services.

However, active control does not influence the synchronicity of chatbot services or the perceived humanness of chatbots; as a result, it does not moderate the relationship between these two factors and customers' willingness to switch from human services to chatbot services.

Figure 1 below illustrates the theoretical framework containing all the hypotheses.

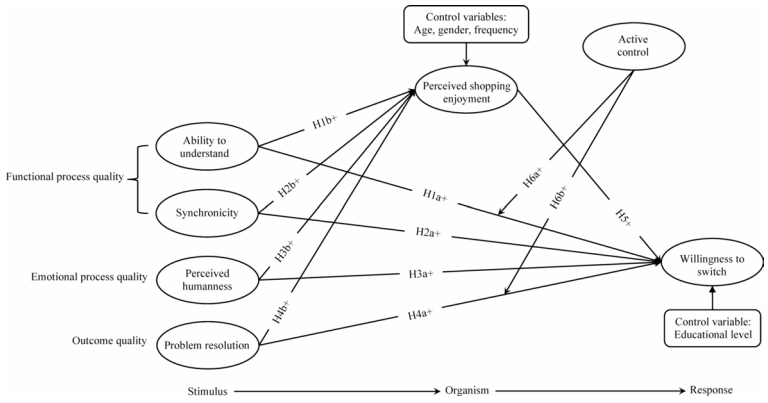

Fig. 1. Research framework.

Methodology

Questionnaire design

The online questionnaire was developed in English, translated into Chinese by one of the authors, and then checked by another author, both native Chinese speakers. The survey underwent a pilot test and was revised to avoid confusion, ambiguity and inaccurate interpretation. The survey consisted of three sections. The first section gauges customers' preferences for chatbot services versus human services in different service scenarios associated with varying levels of task complexity. These service scenarios encompass two dimensions, namely high- and low-involvement product purchase scenarios and nine purchase sub-stages. Respondents were provided with four options to choose from: chatbot service, human service, either or neither. The second section consisted of questions related to ability to understand, synchronicity, perceived humanness, problem resolution, perceived shopping enjoyment, active control and willingness to switch from human services to chatbot services. The third section collected the demographic and behavioral information of the respondents, including gender, age, educational background, income, location, employment status and online shopping frequency. All respondents are required to complete three sections.

Sample and recruitment

This study employed a non-probabilistic purposive sampling strategy by targeting Chinese adults who had used chatbot services when shopping online. Therefore, the survey includes a screening question to select respondents with prior chatbot interaction experience. Questionnaires were distributed to the panel of a reliable research platform, Credamo (www.credamo.com). Credamo has over 1.5 million registered panel members with a diverse sociodemographic range and provides researchers with multiple data-filtering measures to recruit eligible respondents[68]. During the period from August to December 2022, a total of 648 adult participants were recruited through Credamo for a nominal fee. To avoid the problems associated with mischievous responders, which refers to responders who deliberately falsify information[69], surveys were checked for random reporting and fake responses by analyzing the average duration time. After removing the invalid responses, 575 usable responses remained in the final analysis. Notably, all participants have interacted with both human services and chatbot services in the past. The respondents come from 29 out of 34 provinces, autonomous regions, municipalities and special administrative regions in China. Table 3 reports their demographic information.

		Number	Percentage (%)
Gender	Male	237	41.2
	Female	338	58.8
Age	18–25	129	22.4
	26–35	241	41.9
	36–45	129	22.4
	46–55	54	9.4
	56–65	22	3.8
Diploma	Junior high school and below	9	1.6
	Senior high school and Vocational high school	9	1.6
	Junior college	60	10.4
	Undergraduate degree	424	73.7
	Graduate degree	73	12.7
Income	0–1,999	39	6.8
	2,000–4,999	84	14.6
	5,000–9,999	257	44.7
	10,000–19,999	153	26.6
	20,000–49,999	39	6.8
	50,000	3	0.5
Employment	Student	70	12.2
	Homemaker	1	0.2
	Retiree	7	1.2
	Out of work	1	0.2
	Full-time employed	486	84.5
	Part-time job	0	0.0
	Freelancer	3	0.5
	Self-employed	7	1.2
Online shopping Frequency	1–3 times per month	129	22.4
	1–2 times per week	255	44.3
	More than 2 times per week	191	33.2

Table 3. Sample distribution.

Ethical approval

All methods of this research project were carried out in accordance with relevant guidelines and regulations according to the Australia's National Statement on Ethical Conduct in Human Research (2023). Informed consent was obtained from all subjects and/or their legal guardian(s) before the start of the study. Participants were asked to fill in a questionnaire and no biological samples were taken. Collection of personal data entailed only minimal risks and burdens. The Human Research Ethics Executive Review Committee of James Cook University reviewed and approved this project.

Measurement

The constructs of active control, ability to understand, synchronicity, perceived humanness, perceived shopping enjoyment, problem resolution and willingness to switch were adapted from previous studies, as indicated in Table 4, column 1. Seven-point Likert scales that were anchored by 1 = strongly disagree and 7 = strongly agree were used. The scale items are reported in Table 4.

Validity test

To assess the convergent validity of the constructs, we first examined their Cronbach's alpha values. As shown in Table 4, all of the constructs demonstrated Cronbach's alpha values ranging from 0.601 to 0.817, which are higher than the acceptable threshold of 0.60[74,75]. The composite reliability indicators are higher than the recommended threshold of 0.7[76]. The AVE of each construct is also greater than the threshold value of 0.5 suggested by Fornell and Larcker[77]. These results indicate that the constructs have sufficient convergent validity.

To assess the discriminant validity, we first investigated the cross-loading results in SmartPLS. All the cross-loadings are less than the loading on the main construct. We then assessed two criteria, the Fornell and Larcker and the Heterotrait-Monotrait Ratio of Correlations (HTMT ratio) reported in the SmartPLS, as shown in Table 5. Regarding Fornel-Lacker's criteria, the square root of the AVE on each construct must exceed the estimated correlations between the construct and other constructs in the model[77]. In this study, the square root of AVE for each construct (indicated by the diagonal elements) is greater than the correlations of the construct with other constructs (indicated by the off-diagonal elements). To supplement Fornel-Lacker's criteria, Henseler et al.[78] imposed a more stringent assessment of the variables' discriminant validity by observing the HTMT ratio and suggested that all variables are distinctively different with a cutoff point of 0.90 on the HTMT ratio. As shown in Table 5, the HTMT ratio for all variables is below 0.9, confirming the discriminant validity.

Common method variance assessment

Given that the data collected in this study is from a single source, common method variance (CMV) is possible. To reduce the CMV, this study opts for both procedural and statistical remedies before and after data collection. Firstly, referring to Zhou et al.[79], this study hid the names of constructs and assigned the question items randomly to prevent CMV. Furthermore, the Harman one-factor analysis method was used to test for CMV. The explained variance in one factor was 46.123%, which is smaller than the recommended threshold of 50%[80]. Finally, the CMV was also assessed through variance inflation factor (VIF) values of the inner and outer models. All VIF values are lower than the threshold of 3.33[79,81,82], as shown in Tables 4 and 6, and the model can be considered free from CMV.

Construct	Indicator	Loading	Out VIF	Cronbach's α	CR	AVE
Active control[29,70]	I felt like I knew exactly what questions I should ask the chatbot to get the information I wanted	0.894	1.507	0.734	0.883	0.790
	When I consulted a chatbot, I had no idea how I should describe the questions to get the information I wanted. (r)	0.883	1.507			
Ability to understand[17,19]	The information provided by the chatbot was relevant to the questions I asked	0.811	1.637	0.811	0.888	0.726
	The chatbot can understand the questions I asked very well	0.886	2.014			
	It was quite difficult to ask further questions to the chatbot. (r)	0.858	1.812			
Synchronicity[29,70]	The chatbot was very efficient in responding to my inquiries	0.893	1.186	0.601	0.764	0.529
	Getting responses from the chatbot was very fast	0.691	1.295			
	The chatbot was very slow in responding to my inquiries. (r)	0.558	1.182			
Perceived humanness[10,23]	The chatbot was friendly, polite and respectful to me	0.809	1.229	0.603	0.833	0.714
	The chatbot made me feel like it was willing to help me with my questions	0.880	1.229			
Problem resolution[63]	I was able to obtain the information I wanted from the chatbot without any delay	0.865	1.459	0.719	0.876	0.780
	When I sent an inquiry to the chatbot, I felt like my question was resolved efficiently	0.900	1.459			
Perceived shopping enjoyment[71,72]	I found it freer to consult a chatbot than a human when shopping online	0.846	1.852	0.817	0.891	0.733
	I found consulting the chatbot was a good approach to shopping without disturbance	0.832	1.674			
	The chatbot provided me with a relaxed shopping experience	0.889	2.032			
Willingness to switch[73]	I would consider consulting the chatbot in more situations in the future	0.916	1.574	0.753	0.889	0.801
	In the future, I would probably try to switch from the chatbot to human services as much as possible (r)	0.873	1.574			

Table 4. Factor loading and validity measures.

			1	2	3	4	5	6	7
Fornell–Larcker Criterion									
	1	Active control	0.889						
	2	Ability to understand	0.661	0.852					
	3	Synchronicity	0.551	0.575	0.727				
	4	Perceived humanness	0.446	0.477	0.496	0.845			
	5	Problem resolution	0.529	0.679	0.567	0.445	0.883		
	6	Perceived shopping enjoyment	0.548	0.694	0.572	0.545	0.693	0.856	
	7	Willingness to switch	0.530	0.710	0.501	0.428	0.644	0.710	0.895
Heterotrait–monotrait Ratio of Correlations (HTMT ratio)									
	1	Active control							
	2	Ability to understand	0.856						
	3	Synchronicity	0.797	0.713					
	4	Perceived humanness	0.666	0.673	0.787				
	5	Problem resolution	0.727	0.881	0.743	0.663			
	6	Perceived shopping enjoyment	0.704	0.847	0.718	0.765	0.898		
	8	Willingness to switch	0.710	0.896	0.615	0.622	0.861	0.895	

Table 5. Results of the discriminant validity test.

Hypotheses		Inner VIF	Coefficients	SD	Hypothesis support	Specific indirect effects	Coefficients	SD
H1a	Ability to understand—> Willingness to switch	2.393	0.354***	0.046	Yes	Ability to understand—> Perceived shopping enjoyment—> Willingness to switch	0.112***	0.020
H1b	Ability to understand—> Perceived shopping enjoyment	2.198	0.314***	0.044	Yes			
H2a	Synchronicity—> Willingness to switch	1.793	0.012	0.036	No	Synchronicity—> Perceived shopping enjoyment—> Willingness to switch	0.037**	0.014
H2b	Synchronicity—> Perceived shopping enjoyment	1.776	0.105**	0.038	Yes			
H3a	Perceived humanness—> Willingness to switch	1.546	−0.010	0.033	No	Perceived humanness—> Perceived shopping enjoyment—> Willingness to switch	0.067***	0.015
H3b	Perceived humanness—> Perceived shopping enjoyment	1.458	0.187***	0.036	Yes			
H4a	Problem resolution—> Willingness to switch	2.352	0.155***	0.041	Yes	Problem resolution—> Perceived shopping enjoyment—> Willingness to switch	0.116***	0.025
H4b	Problem resolution—> Perceived shopping enjoyment	2.077	0.325***	0.045	Yes			
H5	Perceived shopping enjoyment—> Willingness to switch	2.600	0.357***	0.049	Yes			
H6a	Active control*Ability to understand—> Willingness to switch	1.533	0.051*	0.020	Yes			
H6b	Active control *Problem resolution—> Willingness to switch	1.398	0.025	0.020	No			

Table 6. Hypothesis testing results. SRMR for the saturated model is 0.059. ***$p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

Results

Descriptive statistics: customers' service preferences

According to the results from the first section of the questionnaire, as shown in Table 7, customers prefer interacting with human services when purchasing high-involvement products, particularly in the post-purchase stages. For low-involvement products, they show a slight preference for chatbot services in the pre-purchase stage. However, in the post-purchase stage, they also favor human services. In summary, the findings indicate a general customer preference for human services over chatbot services, which confirms the significance of this study's focus on customers' intentions to switch from human services to chatbot services.

PLS-SEM analysis: hypothesis testing

We employed SmartPLS for partial least squares structural equation modelling (PLS-SEM) to test the hypotheses. The approximate fit index SRMRs for the saturated models is 0.059, well within the acceptable range between 0 and 0.08[83], indicating the model is robust. The results are presented in Table 6,showing that chatbot service quality plays a significant role in customers' choices between chatbot services and human services, either directly or through the mediation of perceived shopping enjoyment, and is moderated by customers' active control over their interactions with chatbots.

Purchase stage	Sub-stages of online shopping		Low-involvement product purchase (1)	High-involvement product purchase (2)
Pre-purchase stage	Product information browsing and consulting	(1)	2	120
	Retailer choice	(2)	−73	12
	Delivery time and logistics issues	(3)	−91	−61
During purchase stage	Add to shopping cart	(4)	−9	18
	Order and pay	(5)	−19	−61
Post-purchase stage	Product quality check and feedback	(6)	303	330
	Product use consultation and guidance	(7)	−34	132
	Exchange and return goods	(8)	275	289
	Product maintenance and other after-sales services	(9)	375	401

Table 7. Customers' service preferences in 18 different service scenarios. This table shows customers' relative preferences for human services over chatbot services, calculated as the number of participants choosing human services minus those choosing chatbot services in each service scenario.

Firstly, in terms of functional process quality dimensions, ability to understand is positively and significantly related to willingness to switch ($\beta = 0.354$, $p < 0.001$) and perceived shopping enjoyment ($\beta = 0.314$, $p < 0.001$), supporting H1a and H1b. Synchronicity positively and significantly influences perceived shopping enjoyment ($\beta = 0.105$, $p < 0.01$), but it does not significantly influence willingness to switch. Thus, H2b is supported, but H2a is unsupported. Secondly, regarding the emotional process quality, perceived humanness positively and significantly influences perceived shopping enjoyment ($\beta = 0.187$, $p < 0.001$), but it does not significantly influence willingness to switch. Hence, H3b is supported but H3a is unsupported. Finally, as for the outcome quality, problem resolution is positively and significantly related to willingness to switch ($\beta = 0.155$, $p < 0.001$) and perceived shopping enjoyment ($\beta = 0.325$, $p < 0.001$), supporting H4a and H4b.

With regard to perceived shopping enjoyment, it positively and significantly influences willingness to switch ($\beta = 0.357$, $p < 0.001$), supporting H5. Moreover, perceived shopping enjoyment partially mediates the relationships between ability to understand and willingness to switch ($\beta = 0.112$, $p < 0.001$), as well as the relationships between problem resolution and willingness to switch ($\beta = 0.116$, $p < 0.001$). In contrast, it fully mediates the relationships between synchronicity and willingness to switch ($\beta = 0.037$, $p < 0.01$), as well as the relationships between perceived humanness and willingness to switch ($\beta = 0.067$, $p < 0.001$).

With regard to active control, it positively moderates the effect of the ability to understand ($\beta = 0.051$, $p < 0.05$) on customers' willingness to switch from human services to chatbot services, as we predicted, supporting H6a. However, it does not moderate the effect of problem resolution on customers' willingness to switch, thus H6b is unsupported.

Finally, the control variables age ($\beta = -0.063$, $p < 0.05$) and gender ($\beta = -0.052$, $p < 0.1$) negatively and significantly influence perceived shopping enjoyment, while online shopping frequency ($\beta = 0.064$, $p < 0.05$) positively and significantly influence perceived shopping enjoyment. Moreover, the indirect effects of age, gender and online purchase frequency on their willingness to switch from human services to chatbot services through perceived shopping enjoyment are all significant. These findings suggest that younger individuals, males and those who shop more frequently will perceive more enjoyment in online shopping when served by chatbots, which further enhances their intentions to choose chatbot services. In addition, educational level negatively and significantly influences customers' willingness to switch from human services to chatbot services ($\beta = -0.039$, $p < 0.1$), suggesting that individuals with a high educational level are less likely to choose chatbot services.

Discussion

Interpretation of findings

Finding 1 Ability to understand and problem resolution directly and indirectly influence customers' willingness to switch from human services to chatbot services.

On the one hand, in line with the findings of Li et al.[17] and Chen et al.[19], we found that among the four dimensions of chatbot service quality, ability to understand and problem resolution directly and significantly influence customers' willingness to switch from human services to chatbot services. This also explains why, in complex service scenarios, customers' preference for chatbot services is lower than their preference for human services[63]. This is likely because customers perceive chatbots' ability to understand their inquiries and resolve their problems to be limited. Specifically, chatbots are more ineffective in dealing with topic-led conversations than task-led ones[62]. However, our study extends their findings by revealing that ability to understand and problem resolution significantly influence customers' perceived shopping enjoyment, while perceived shopping enjoyment further enhances their willingness to switch from human services to chatbot services.

Moreover, when comparing the magnitude of the coefficients, we found that the combined impact (direct + indirect) of ability to understand (0.354 + 0.112) on customers' willingness to switch from human services to chatbot services is greater than that of problem resolution (0.155 + 0.116), indicating that customers place more emphasis on the process quality of chatbot services. This is possibly because if the chatbot demonstrates sufficient ability to understand the customer's questions and the interaction process is smooth, then the failure to obtain the desired information or resolve their problems becomes relatively acceptable, as customers can turn to human services for assistance.

Finding 2 Synchronicity and perceived humanness solely indirectly influence customers' willingness to switch from human services to chatbot services.

Synchronicity has no direct effect on customers' willingness to switch from human services to chatbot services, which align with Yun and Park[39] and Li et al.[17]. This could be because customers are generally aware that synchronicity is an inherent advantage of chatbot services, regardless of whether they choose to use them or not. This is evidenced in our survey by the high mean scores of three indicators of synchronicity, which are 5.9, 6.2, and 5.9. However, both Yun and Park[39] and Li et al.[17] did not examine the mediating role of perceived shopping enjoyment in these relationships. Our study extends their findings by confirming the significant positive impact of synchronicity on customers' perception of shopping enjoyment, while perceived shopping enjoyment further enhances their willingness to switch from human services to chatbot services.

Perceived humanness has no significant effects on customers' willingness to switch from human services to chatbot services, which contradicts the findings of Chen et al.[19]. The reasons could be found in studies by Fu et al.[23] and Song and Shin[84]. Specifically, Fu et al.[23] found that anthropomorphism has a negative influence on customers' trust in using chatbots, since it enhances consumers' expectations of their service performance, causing them to feel more dissatisfied with irrelevant or inaccurate responses. Song and Shin (2024) found that enhancing the humanness of chatbots will significantly increase customers' feelings of eeriness due to the uncanny valley effect, which refers to a phenomenon where exposure to an almost authentic, yet imperfect representation of real humans is assumed to evoke eeriness in users, thereby reducing their trust in chatbots and their intentions to reuse them[84]. However, Fu et al.[23] and Song and Shin[84] did not examine the mediating role of perceived shopping enjoyment in this relationship. We found that, as we predicted, the perceived humanness of chatbots has a significant effect on customers' perceived shopping enjoyment, while perceived shopping enjoyment further enhances their willingness to switch from human services to chatbot services.

In addition, when comparing the magnitude of the coefficients, we found that the impact of synchronicity and perceived humanness on perceived shopping enjoyment is much weaker compared to that of ability to understand and problem resolution. This could be attributed to the fact that synchronicity only adds value to the shopping experience when chatbots' responses are relevant. In addition, while chatbots exhibit human-like characteristics, these traits are quite limited.

Finding 3 Active control positively moderates the effect of the ability to understand on willingness to switch

Active control positively moderates the effect of the ability to understand on customers' willingness to switch from human services to chatbot services, which suggests that this relationship becomes stronger with high active control compared to low active control. However, it does not moderate the effect of problem resolution on customers' willingness to switch. This may be because, even if customers have a high level of active control over their interactions with chatbots, as reflected in their ability to guide chatbots to provide relevant responses by adjusting the way they ask questions, it does not guarantee that these responses will solve their problems.

Contributions

Unlike the prevailing perspectives in most existing chatbot studies, which consider chatbots to be pure information delivery technologies, this study treats chatbots as service employees, making several significant theoretical and practical contributions.

Theoretical contributions

From a theoretical perspective, this study makes the following contributions to the research field of chatbot service quality. First, unlike previous technology acceptance-related theories, such as TAM and UTAUT, which focus on customers' experience of using and interacting with chatbots[2,8], this study adopts a service quality perspective and empirically demonstrates that the four service quality dimensions identified from existing literature across various industry contexts—functional process quality (ability to understand and synchronicity), emotional process quality (perceived humanness) and outcome quality (problem resolution)—significantly influence customers' willingness to switch from human services to chatbot services, indicating that these dimensions are suitable for evaluating chatbot service performance in the context of the retail e-commerce industry. By validating these dimensions in a new context, the study not only contributes to the theoretical framework of chatbot service quality but also enriches the broader research on e-service quality, providing a more nuanced understanding of how different service aspects shape customers' service preferences.

Second, this study reveals that the four dimensions of chatbot service quality influence customers' willingness to switch from human services to chatbot services both directly and indirectly. On the one hand, the ability to understand and problem resolution directly influence customers' service-switching intentions. This is likely because chatbots help customers complete online shopping with minimal effort by understanding their inquiries and resolving their problems, thereby catering to customers' task-oriented shopping motivations, i.e., visiting online stores for the purpose of product acquisition[24]. On the other hand, the four dimensions all exert an indirect influence on customers' service-switching intentions through perceived shopping enjoyment. This is likely because chatbots enhance customers' perception of shopping enjoyment by providing highly intelligent, responsive, humane and effective problem-resolution services, thereby catering to customers' recreation-oriented shopping motivations, i.e., viewing online shopping more as a relaxing and recreational experience[24]. These findings contribute to existing theories by revealing that the way the four dimensions of chatbot service quality influence customers' willingness to switch from human services to chatbot services aligns with their shopping motivations. This validates the viewpoint that service quality research should consider specific industry contexts

in which the services are delivered[20], emphasizing the value customers seek within those contexts. Specifically, the industry-specific context in this study is online shopping.

Third, this study introduces the moderator "active control", which refers to customers' ability to manipulate their interactions with chatbots, confirming that chatbot service quality is also co-created by customers. Service experience co-creation is a key area of research, but the majority of studies in this area have focused on human-to-human interactions[85]. This study extends the research in this area to chatbot-to-human interactions, thus making a notable contribution. Moreover, this moderator reflects customers' perceptions of the technical ease of interacting with chatbots, which aligns with the concept of perceived ease of use in TAM and effort expectancy in UTAUT. Thus, this study considers the technical attributes of chatbots while treating them as service employees, distinguishing it from previous studies that rely solely on service quality theories or technology acceptance-related theories.

Practical implications

From a practical perspective, to make chatbots a more attractive service option to customers, online retailers could work on the following three service quality dimensions. (1) Enhancing perceived humanness. Online retailers are suggested to anthropomorphize chatbots by incorporating visual (e.g., human figures), identity (e.g., human names) and conversational cues (i.e., mimicking human language)[51]. (2) Improving the ability of chatbots to understand. Online retail platforms could continuously improve natural language processing algorithms to enhance the chatbot's ability to understand and process natural language inquiries from customers, thus improving two-way communication. (3) Upgrading the problem-solving ability of chatbots. Online retailers could regularly review and analyze customer inquiries to prepare and refine automated responses, thereby reducing the probability of unresolved customer problems. In addition, online retail platforms can enhance chatbots' capacity to detect customers' active control ability, for instance, by tracking how frequently customers rephrase their queries or the frequency of requesting human services**.** If the store's customers have weaker active control ability, more human support should be provided to address their service-switching needs.

Limitations and future research

Although this study provides new insights and creates valuable theoretical contributions and practical implications, we also acknowledge several limitations. First, while this study examined four dimensions of chatbot service quality, it is important to note that chatbot technology constantly evolves. As chatbots become more intelligent[86], the significance of different service quality dimensions may change, and some new dimensions may emerge. Future research could employ a more qualitative approach, such as conducting interviews with customers, to verify and identify the dimensions of chatbot service quality that customers value, while considering the intelligent level of chatbot technology at that time. Second, this study is limited to exploring the impact of chatbot service quality dimensions on customers' willingness to switch from human services to chatbot services. Future research could consider exploring the factors from the perspective of human services that hinder customers' switching behavior. Third, this study only examined the moderating effect of customers' active control ability on the relationship between chatbot service quality dimensions and their service-switching intentions. Future research could explore whether other factors, such as technology anxiety and the need for human interaction, also serve as moderators. Finally, this study focuses solely on the Taobao retail platform, where human services and chatbot services share the same interface and interaction methods. Future research could extend across multiple retail platforms and incorporate the dimensions of ease of use and visual design.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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