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Research Article

Usability, Humanization, and Perceived Service are Predictors of Customer Satisfaction in Chatbot Interactions

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Abstract: Companies' online presence has driven the use of chatbots in digital channels as a solution to expand customer service. These systems make it possible to offer satisfying experiences and handle requests on a large scale. Even when adopting this technology, companies must regularly assess whether these solutions increase or maintain customer satisfaction levels. This study analyzed the factors of humanization H, usability US, and perceived service quality QS in customer satisfaction when interacting with chatbots. Causal research is used to evaluate the relationships between the aforementioned factors and customer satisfaction using structural equation modeling (SEM). To this end, 423 people aged between 25 and 40 years were surveyed. The results confirm the five study hypotheses, establishing that H, US, and QS strongly, positively, and significantly influence user satisfaction when interacting with AI-driven chatbots. The study concludes that these factors are important in predicting customer satisfaction with online chatbots and that chatbot systems must be designed to generate satisfaction in terms of service quality and interaction. This study contributes a new understanding of the combined effect of the three factors by integrating them into a single model to explain satisfaction with online chatbot services.

Keywords: AI-Driven chatbot; Anthropomorphism; Customer satisfaction; Chatbot usability; Perceived service quality

1. Introduction

The online presence of businesses has allowed for the creation of online customer service spaces, as physical contact points and customer service phone lines are sometimes insufficient to meet customer convenience needs. Digital ecosystems drive digital transformation (Masrianto et al., 2024), and online chat has given way to the implementation of automation of complex customer service tasks through artificial intelligence by implementing chatbots in their digital channels. Organizations seek to ensure that, as with other contact channels, customers will have a satisfactory and adequate experience, address requirements, and reduce the costs involved in personal service.

Over the last decade, the use of artificial intelligence (AI) in everyday life has intensified, with chatbots being one of its most common tools in customer service environments (de Sa Siqueira et al., 2023; Sanny et al., 2020). These tools, powered by natural language processing, have transformed business-to-consumer (B2C) interactions by offering quick, standardized responses that aim to optimize customer service (Ltifi, 2023; Cheng and Jiang, 2020) and AI systems that emulate the human brain can analyze and adjust to information in real time, similar to the human mind (Whulanza et al., 2024). However, despite their operational efficiency,

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chatbots face limitations in personalization and adaptation to complex needs, which affects the perception of usability, user experience, and overall satisfaction with the service received (Aslam, 2023; Cheng and Jiang, 2020). Failing to address these experience limitations results in user frustration and service abandonment, undermining the technology's cost-saving and availability goals.

Several studies have documented the potential of these technologies in service management (Huang et al., 2024; Taule et al., 2022; Sands et al., 2021), but they have also highlighted theoretical gaps regarding how optimal usability and interaction experience are critical mechanisms that determine consumer satisfaction (Folstad and Brandtzaeg, 2020; Trivedi, 2019). This gap prevents organizations from transitioning chatbots from mere cost-saving tools to genuine drivers of customer loyalty and retention. This situation is particularly relevant for younger generations, such as Millennials, who regularly interact with digital assistants in purchasing, support, and entertainment processes (Ren et al., 2022).

Studies often investigate the variables evaluated in isolation. While some research integrates up to two of these factors—specifically those referring to service quality and usability or chatbot anthropomorphization and satisfaction—the interplay among all three has not been systematically examined within the context of chatbot technology (Lubbe and Ngoma, 2021). Klein and Martinez, 2023 found that the humanization of the agent (anthropomorphism) is positively associated with customer satisfaction and that this relationship is mediated by variables such as trust. Ltifi, 2023 describes how human traits such as empathy and friendliness present in chatbots and the tool's usability strongly influence trust in the system. Both studies do not mention the quality of service as meeting user requirements.

Understanding this synergy is vital, as the combined effect of all three factors is expected to be greater than the sum of their individual parts, creating a truly satisfactory service encounter. Furthermore, quantitative evidence regarding user satisfaction in these interactions remains limited (El Bakkouri et al., 2022). Consequently, the factors that influence user satisfaction with chatbots should be investigated, considering the synergistic effect of usability design, perceived service quality, and interaction humanization. Delving deeper into these relationships will allow us to understand whether chatbots can establish themselves as a strategic tool for increasing user satisfaction and loyalty in digital environments.

Customer satisfaction is a psychological response that emerges when prior expectations are compared with the perceived performance of a product or service (Ramasamy et al., 2024). This evaluation process generates both cognitive and emotional reactions that lead to subsequent consumption attitudes (Oliver, 2014; Moliner et al., 2014). In the service sector, perceived quality—whether functional, technical, or relational—is a determining factor in satisfaction and, in many cases, loyalty (Silva-Trevino et al., 2021; Chavez and Revolledo, 2018; Nunez-Tobias and Juarez-Mancilla, 2018). Chatbots have been implemented in sales, technical support, banking, and digital marketing due to their ability to handle queries immediately and simultaneously (Smutny and Schreiberova, 2020). Their effectiveness depends largely on users' trust in their responsiveness (Davila-Moran and Aguero-Corzo, 2023). However, limitations in personalization and the occurrence of errors negatively affect the perception of usefulness and, therefore, customer satisfaction (de Sa Siqueira et al., 2023).

Usability, defined as the degree to which an interface allows objectives to be achieved efficiently, effectively, and satisfactorily (ISO/IEC, 2010; Petre et al., 2006), is a factor in the acceptance of interactive systems. Recent research confirms that usability has a positive impact on satisfaction and intention to use, especially among younger generations accustomed to interacting with digital interfaces (Esmaeili et al., 2021; Parera and Susanti, 2021; Thakur, 2014).

In the case of chatbots, features such as conversation clarity, accurate interpretation of requests, and anthropomorphic appearance can increase the perception of quality and, consequently, improve customer satisfaction (Davila-Moran and Aguero-Corzo, 2023). Recent studies have argued that user experience is a key mediator in the relationship between usability and

satisfaction (J. S. Chen et al., 2021; Knuvers and van Miltenburg, 2021).

The role of humanizing chatbots, understood as incorporating conversational or anthropomorphic features that bring the interaction closer to human interaction, has been highlighted in the emerging literature (Smestad and Volden, 2019; Araujo, 2018). This attribute not only improves the perceived experience but also contributes to the user's trust and emotional connection with the service provider (Hsu and Lin, 2023; Eren, 2021).

According to Eren, 2021, satisfaction is affected by perceived performance and trust. Thus, the experience and interaction with the elements, systems, programming, and training exhibited by a chatbot as an online customer service assistant are the means by which customers determine their degree of satisfaction with their requirements. Customer satisfaction is the central dependent variable that is directly affected by users' online assessment of service quality and is interdependently explained by the direct and indirect effects of humanization and usability of chatbots. Thus, these three elements reinforce final customer satisfaction, and the following model hypotheses are proposed (Figure 1):

- h1. The humanization of chatbots has a positive influence on service quality perception.
- h2. The perceived service quality in chatbots is positively related to customer satisfaction.
- h3. Chatbot humanization has a direct positive effect on customer satisfaction.
- h4. Chatbot usability has a positive impact on the perception of service quality.
- h5. Chatbot usability has a positive influence on customer satisfaction.

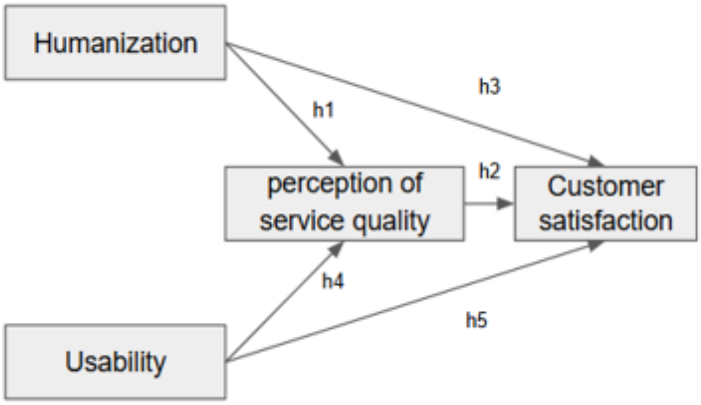

Figure 1 The research model is proposed

2. Methods

This study adopts a quantitative approach with a causal scope and cross-sectional design to analyze the influence of perceived service quality, humanization, and the usability of chatbots on customer satisfaction. The quantitative approach is relevant because it allows the measurement and analysis of the relationships between the variables of interest using numerical data and statistical techniques, ensuring objectivity and accuracy in the results (Creswell and Creswell, 2018). Likewise, the choice of a causal design is justified by the need to identify the magnitude and direction of the effect that the independent variables have on customer satisfaction, which is consistent with the findings of Hernandez Sampieri and Mendoza, 2018, who highlight the value of causal studies in establishing explanatory relationships beyond mere description.

The study's cross-sectional nature responds to the interest in collecting information at a single point in time, which is appropriate for research that seeks to explore patterns and

relationships in specific contexts, such as the use of chatbots in online customer service (Kerlinger and Lee, 2002). Simple probability sampling is adopted to ensure that all elements of the population have the same probability of being selected, which increases the representativeness of the results and reduces bias in statistical inference (Lohr, 2019).

To analyze customer satisfaction with the use of artificial intelligence-based digital assistants in online customer service, a causal study targeting the Millennial population was designed. This age group, ranging from 25 to 40 years old, is characterized by its status as digital natives and the frequency with which they interact with information technologies through mobile devices, applications, and online platforms. In this context, chatbots are a recurring tool for purchasing, marketing, technical support, and training processes (Smutny and Schreiberova, 2020).

The sample was determined from an infinite population of 18-year-olds in Colombia, with a 95% confidence level and a 5% margin of error, which corresponds to 384 people. However, the final sample consisted of 423 individuals, corresponding to a 4.76% error, a sample size that falls within the required range. This sample consisted of 52.2% women and 47.3% men, aged between 25 and 40, with a medium socioeconomic level (86%), low socioeconomic level (18.7%), and high socioeconomic level (3.3%), and 98.1% were economically active. The majority (87.3%) had a higher education level, and only 12.3% had a basic education.

A structured questionnaire with closed-ended questions was designed to evaluate the hypotheses and measure the constructs of interest: chatbot usability, service perception, and customer satisfaction. The instrument included scales previously validated in the literature, such as those proposed by Rajaobelina et al. (2020) for usability and Duijst (2017) for experience and satisfaction. The variables were selected based on their coherence with the theoretical framework, the strength of the available empirical evidence, and their methodological relevance to the study objectives.

The items were measured using a five-point Likert scale, with values ranging from 1 (strongly disagree) to 5 (strongly agree). In addition to the central dimensions, sociodemographic variables (gender, age, educational level, and socioeconomic status) were incorporated, most of which were categorical, except age, which was treated as a discrete variable. The questionnaire was administered through digital channels, such as email, social media, and instant messaging, which allowed the target population to be efficiently reached.

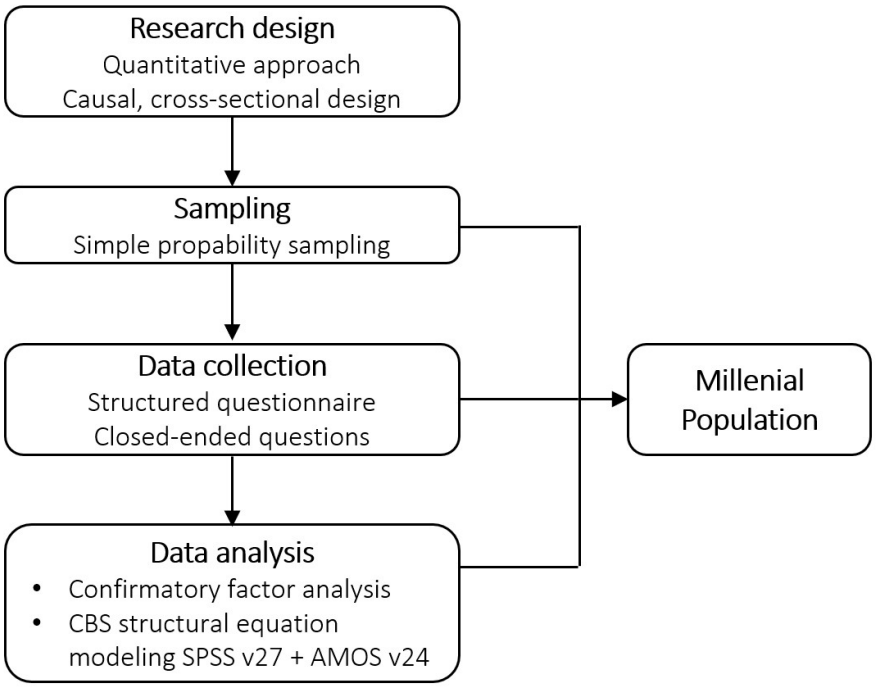

Figure 2 The research method proposed

The collected data were processed using SPSS v27 and AMOS v24 software. First, CFA was performed to validate the internal consistency and convergent and discriminant validity of the constructs. Subsequently, covariance-based structural equation modeling (CB-SEM) was employed because of its suitability for validating theoretical models that explain the intention and use of technologies in the business context. This approach allows testing hypotheses derived from established theories and assessing the correspondence between the theoretical model and the empirical data (Hair et al., 2021; Kline, 2016; Henseler et al., 2014).

3. Results and Discussion

CFA was performed (Table 1) to evaluate the validity and reliability of the four latent factors (Brown, 2015; Perez-Gil et al., 2000): usability (US), perception of service quality (SQ), Customer satisfaction (CS) and Humanization (HU).

Table 1 Construct validity and reliability for each factor

Factor	Variable	Item description	E.E.	C.R.	α
Usability (US)	US1	The chatbot is well designed	0.879	0.919	0.908
	US2	The chatbot is useful	0.837		
	US3	The chatbot is intuitive	0.826		
	US4	The chatbot optimizes my time	0.806		
	US5	Responds to my expectations	0.789		
Perception of service quality (SQ)	SC1	The chatbot generates trust	0.547	0.704	0.723
	SC2	The chatbot is well trained	0.667		
	SC3	The chatbot correctly interprets the queries	0.774		
Customer satisfaction (CS)	ST1	I am satisfied with the chatbot service	0.720	0.809	0.811
	ST2	I'm pleased with the chatbot's service	0.827		
	ST3	The chatbot did what I expected	0.746		
Humanization (HU)	HU1	The chatbot is empathetic	0.765	0.731	0.600
	HU3	Had a satisfying experience interacting with the chatbot	0.816		
	HU2	The chatbot exhibits human-like traits	0.461		

Note: E.E. = estimate standardized; C.R. = composite reliability; α = Cronbach's alpha.

In the Usability (US) construct, the standardized factor loadings for items US1 to US5 ranged between 0.789 and 0.879, indicating a significant contribution for all indicators. Cronbach's alpha coefficient ($\alpha = 0.919$) and Composite Reliability (CR = 0.908) reflect an excellent level of internal consistency. In the case of, service quality perception (SQ), the factor loadings (0.547 and 0.774) for items SC1 to SC3 indicate moderate to solid contributions. Cronbach's alpha ($\alpha = 0.704$) and CR (0.723) indicate the construct's acceptable reliability. Regarding Customer Satisfaction (CS), items ST1, ST2, and ST3 presented factor loadings between 0.720

and 0.827, confirming their relevance for the model. Cronbach's alpha ($\alpha = 0.809$) and CR (0.811) indicate an adequate level of internal consistency. The humanization (HU) construct has acceptable variable factor loadings (0.461 and 0.816), although item HU2 demonstrated a low contribution (0.461), which is acceptable. HU1 and HU3 presented satisfactory loadings (0.765 and 0.816, respectively). Cronbach's alpha ($\alpha = 0.731$) and CR (0.6) reflect moderate internal consistency, which is accepted, although the established umbral is greater than 0.7; values between 0.6 and 0.7 are recognized as acceptable in exploratory studies (Bagozzi et al., 1998; Fornell and Larcker, 1981).

The model proposes that three factors determine customer satisfaction in interactions with chatbots: humanization, usability, and perceived service quality. These variables are linked by causal relationships that explain how users evaluate their digital assistant experience. A structural equation analysis was run using the bootstrapping technique with 3000 subsamples at a 95% confidence level to test the model. Although the fit indices achieved are adequate, although the p-value is significant, the X^2/df index obtained (3.347) is below the threshold of 5.0, indicating an acceptable fit (Bentler and Bonett, 1980).

Table 2 Model fit indices

Fit index	Minimum acceptable value	Reference	Model results	Model results
Chi-square (χ^2)	< 5, $p > 0.05$	Bentler and Bonett, 1980	3347, $p = 0.001$	Accepted
RMSEA	≤ 0.08	Browne et al., 1993	0.075	Excellent
CFI	≥ 0.90	Bentler and Bonett, 1980)	0.952	Excellent
TLI	≥ 0.90	Tucker and Lewis, 1973	0.931	Excellent
NFI	≥ 0.90	Tucker and Lewis, 1973	0.933	Excellent
PNFI	≥ 0.50	Bentler and Bonett, 1980	0.656	Excellent

Note: CFI = Comparative Fit Index, TLI = Tucker–Lewis Index, NFI = Normed Fit Index, RMSEA = Root Mean Square Error of Approximation, PNFI = Parsimonious Normed Fit Index.

The fit indices obtained are acceptable or excellent (Table 2), indicating good fit measures. The values of CFI (0.952), TLI (0.931), and NFI (0.933) exceed the threshold of 0.9. The RMSEA are excellent (0.075) and below the 0.08 threshold, and the PNFI is above the 0.5 threshold (0.656). Finally, the determination index R2 indicates that the model explains 86.1% of the variance in customer satisfaction when a chatbot is used.

Table 3 Hypothesis testing

Hypothesis	Path	Estimate	Standard error	Critical ratio	P-value	Result
h1	SQ ← H	0.254	0.052	4.884	0.001	Accepted
h2	ST ← SQ	0.673	0.158	4.251	0.001	Accepted
h3	ST ← H	0.153	0.055	2.781	0.005	Accepted
h4	SQ ← US	0.293	0.039	7.547	0.001	Accepted
h5	ST ← US	0.169	0.049	3.415	0.001	Accepted

Since the Critical Ratio (CR) exceeds the ±1.96 threshold and the p-value is less than 0.05 (Table 3), there is sufficient evidence to reject the null hypothesis (H_0). Therefore, the relationships proposed in the tested hypotheses are statistically significant (Hair et al., 2019; Kline, 2016; Henseler et al., 2014). The results support that the humanization of the chatbot, which is understood as the ability to be empathetic and exhibit anthropomorphic features,

directly influences the perception of service quality (H1 $\beta = 0.254$). Likewise, humanization also has a direct effect on customer satisfaction (H3 $\beta = 0.153$), since it contributes to generating trust and closeness in the interaction. The perceived quality of a chatbot service, which is related to dimensions such as trust, interpretation accuracy, and training, has a positive influence on customer satisfaction (h2 $\beta = 0.673$). This finding reinforces similar research results, as performance expectations positively influence users' intention to use a particular technology (C. F. Y. Chen et al., 2023). Usability is recognized as a determining factor in the perceived quality of service (H4 $\beta = 0.293$) and customer satisfaction (H5 $\beta = 0.169$) by fulfilling client expectations, designing useful, intuitive, and reducing time expenditure.

As in other studies (Rapp et al., 2021; Jain et al., 2018), the results confirm that chatbot humanization is an influential factor in the perception of service quality and perceived experience (Hsu and Lin, 2023). This is because the user's attitude is affected by human similarity during interaction (Go and Sundar, 2019), and although the effect of H on SQ is moderate, it indicates that the quality of service experienced by users with the assistance of an online chatbot is better perceived when the machine can express empathy and human traits during interaction. Therefore, in addition to being a transactional medium where customers get answers to their needs, these systems require that their design provide a human-friendly or warm treatment. This approach can reduce the barriers that users face due to dissatisfaction generated by "fake humanity" (Zhang et al., 2024) when they perceive this system as a machine, and not a human (Chih et al., 2025).

A chatbot with an intuitive design that provides quick and accurate responses was observed to promote a positive perception of the online service. The usability of the chatbot is an exogenous variable (J. S. Chen et al., 2021) considered to be a factor that improves both the perceived quality of the service and overall customer satisfaction, which is consistent with Davila-Moran and Aguero-Corzo, 2023, who indicated that the implementation of chatbots improves the perceived quality of service and customer care, as well as positively affecting satisfaction and willingness to interact with these systems (Esmaeili et al., 2021). Although Mulyono and Sfenrianto, 2022 argued that there is no relationship between quality and customer satisfaction, some previous research has described the chatbot's perceived quality of service as a factor that directly and indirectly affects satisfaction with these systems (Davila-Moran and Aguero-Corzo, 2023; Eren, 2021) that can even improve customer retention (Gul et al., 2025). These results confirm previous research in which service quality is an aspect that delivers value to the customer when a user interacts with an organization through a chatbot.

This research delves into human-computer interaction through a chatbot to respond to customer needs. The findings point toward a better user experience in automated communication systems. In addition to intuitive design, sensitivity, and human-like social interaction, these elements enhance service quality and user satisfaction. It is not just about operational efficiency, but also about how the machine communicates with the user; achieving this is a way for companies to obtain a good return on investment in these technologies.

4. Conclusions

This research contributes to the field by simultaneously verifying the influence of usability, humanization, and perceived service on customer satisfaction in chatbots, something that previous research had studied in isolation. A joint model of structural relationships was established to explain customer satisfaction when interacting with online chatbots, integrating the factors of humanization, usability, and perceived service quality as predictors of satisfaction. Although progress has been made in researching the factors that influence customer satisfaction when using chatbots, no quantitative empirical research has been identified that integrates the constructs of usability, humanization, and customer satisfaction into a single model that explains customer satisfaction when these technologies are used.

The perceived usability of chatbot systems predicts customer satisfaction. Therefore, companies should use intuitive interfaces, agile interaction, and quick and appropriate responses

when designing these systems to avoid user frustration. This also implies empathetic communication that exhibits human traits, since the rules of social interaction determine the interaction between user and machine. Although these aspects demonstrate an increase in the perceived quality of service through chatbots, designing systems that are geared toward providing relevant service quality is necessary, as this is the factor with the greatest impact on user satisfaction when interacting with a chatbot.

As an assistance tool and online communication system, AI-driven chatbots have transformed people's experience of online interaction, delivering value through usability design that optimizes both time and user responses. The results strengthen the literature on Human-Computer Interaction, showing that design factors and service perception have a measurable effect on customer experience and not just on operational efficiency. The validated model can serve as a reference for further studies in different sectors, regions, and types of chatbots, allowing for comparison of results and the development of more generalizable theories about customer satisfaction in automated services.

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Author Contributions

Yezid Alfonso Cancino-Gómez: Introduction, methodology, data collect, data analysis Lugo Manuel Barbosa-Guerrero: Introduction, data analysis, conclusions Jairo Jamith Palacios-Rozo: Methodology, Data analysis, conclusions

Conflict of Interest

The authors declare no conflicts of interest.

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