Chatbot Anthropomorphism and Its Influence on Trust and Satisfaction via Perceived Value

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This study explores how chatbot user's perceptions about it's competence, ease of use, and usefulness contribute to the value they assign to the interaction and how this value shapes trust and, ultimately, satisfaction. It also considers whether anthropomorphic design features, that make a chatbot seem more human, can strengthen the link between value and trust. A survey of university students (n = 233), all with previous chatbot experience, was analyzed using Partial Least Squares Structural Equation Modeling. The findings suggest that the three antecedents meaningfully influence perceived value, which then predicts both trust and satisfaction. Notably, anthropomorphism enhances the effect of perceived value on trust. The model shows acceptable explanatory strength for all endogenous constructs. By blending the Technology Acceptance Model with psychological insights and design elements such as anthropomorphism, the study contributes to a more layered understanding of chatbot evaluation. The research extends both Self-Determination Theory and Social Response Theory into chatbot contexts. Practically, the results imply that building chatbots that are not only functional and easy to use but also subtly human-like can improve user trust and satisfaction over time.

1. Introduction

The growing presence of chatbots has significantly altered how people engage with digital systems and it offers both greater efficiency and interactive potential. However, despite their ubiquity, the psychological dynamics that shape user interactions with chatbots are still not fully understood. This paper puts forward a framework in which users' overall evaluation of a system (experience with chatbot) influences how much they value it. This perceived value then shapes their trust, making it a decisive factor in determining their satisfaction with the experience. Additionally, the model considers Anthropomorphism as a moderating factor, suggesting that the presence of human-like traits can shape the strength of the relationship between value and trust (Rahim et al. 2022; Wilczewski et al. 2023).

Perceived competence, in this context, refers to the extent to which users believe the chatbot can perform tasks reliably and effectively. When chatbots offer timely and relevant responses, users are more inclined to view them as capable, which positively influences how much value they place on the interaction (Rahim et al. 2022). This perspective is reinforced by findings showing that older users often report high levels of satisfaction and usability when interacting with chatbots designed to offer human-like support (Wilczewski et al. 2023). These outcomes point toward the importance of functionality that also feels supportive and capable.

Alongside competence, perceived ease of use and perceived usefulness—two central constructs of the Technology Acceptance Model (TAM)—further shape how users respond to chatbots. When users experience minimal effort in navigating or using the chatbot, they are more likely to view it as useful (Goli et al. 2023). The logic here is relatively straightforward: when interaction feels easy, the chatbot's functionality becomes more accessible, and users are more likely to engage meaningfully. Research supports this view, indicating that perceived usefulness often works as elemental concept in determining whether users continue to engage with such systems (Aslam et al. 2022).

These dimensions—competence, ease of use, and usefulness—combine to create a perception of value, which becomes a foundation for trust. Trust, in this setting, involves a readiness to rely on the chatbot's integrity, accuracy, and helpfulness. As shown in earlier work, trust is one of the strongest predictors of whether users feel satisfied and whether they are willing to continue using the system (Følstad et al. 2018). A chatbot that earns a user's trust may not only cater for user retention but also encourage perpetual deeper engagement.

At the same time, Anthropomorphism which is defined as the tendency to attribute human traits to non-human agents, can moderate the nature of this interaction. When chatbots include features that mimic human behavior, such as conversational tone, subtle emotional cues, or names and avatars, users often begin to interpret them through a more social lens. This response may increase emotional involvement and deepen perceived trust, thereby strengthening the effect of perceived value (Lee and Park 2022).

This study presents a model that links perceived competence, ease of use, and usefulness to users' perceived value of chatbots, which in turn shapes trust and satisfaction. By introducing Anthropomorphism as a moderating factor, the research draws attention to how design choices—particularly those that simulate human qualities—can influence user trust and satisfaction in meaningful ways. These findings are expected to contribute to more effective and psychologically attuned chatbot design strategies across applied contexts.

The following section set out the guiding question of this study and outline its specific aims. Together, they frame the conceptual focus and analytical path taken in exploring how users evaluate and respond to chatbot interactions.

1.1. Research Question

How do chatbot's perceived competence, perceived ease of use, and usefulness shape user trust and satisfaction through perceived value by virtue of moderation effect of anthropomorphism between perceived value and trust?

1.2. Objectives

- To examine how perceived competence, ease of use, and usefulness influence users' perceived value of chatbot interactions.
- To investigate the role of perceived value in shaping user trust and subsequent satisfaction.
- To assess the moderating effect of anthropomorphism on the relationship between perceived value and trust in chatbot interactions.

2 Literature Review

2.1. Self-Determination Theory: Chatbot Motivation via Psychological Needs

Self-determination theory (SDT) is known as a widely used framework for explaining human motivation and well-being, explicating the role of three basic psychological needs which are autonomy, competence, and relatedness (Deci and Ryan 2012; Ryan and Deci 2000). Albeit rooted in psychology, SDT has influenced a broad-spectrum including technology use and educational engagement, offering a lens through which motivation can be assessed across varied contexts.

The core conceptual idea of SDT is that individuals experience greater well-being and self-regulation when their intrinsic needs are met. The theory proposes that environments which are supportive of autonomy offer challenges for competence and enable connection with others are more likely to enhance intrinsic motivation. These conditions have become central to studies investigating both formal and informal learning behaviors, especially when assessing user engagement in systems that rely heavily on interaction.

More recently, SDT has been applied to digital learning contexts, particularly those involving AI tools and virtual agents. In a recent study, the framework was used to examine how perceptions of AI competence, chatbot interaction, and user autonomy shaped digital engagement in informal learning spaces (Hidayat-ur-Rehman 2024). One of the key findings was the significance of perceived autonomy, a central SDT construct, in enhancing motivation to engage with digital tools. These insights point toward the need for technology design to move beyond technical performance alone and to focus on promoting user agency and psychological comfort (Hidayat-ur-Rehman 2024).

The integration of SDT into models of technology acceptance has also been explored in workplace and academic environments. For instance, Roca and Gagné (2008) examined e-learning continuance in professional settings and found that support for autonomous motivation led to stronger long-term engagement. Their study demonstrated that even when platforms are

functionally sound, sustained use often depends on whether the environment encourages autonomy and competence (Roca and Gagné 2008).

Similarly, in the context of mobile-based assessments, Nikou and Economides (2017) introduced a combined model that incorporated SDT constructs alongside traditional technology acceptance variables. Their findings showed that motivational aspects such as intrinsic interest and perceived autonomy could reinforce, and in some cases better explain, user engagement than utility-based models alone. By integrating psychological needs with constructs like usefulness and ease of use, their work highlighted the dual importance of cognitive evaluation and motivational satisfaction in user-centered system design (Nikou and Economides 2017).

Altogether, these research strands emphasize that SDT offers a compelling foundation for understanding how digital technologies can be designed to support not only performance but also user well-being. As digital environments continue to evolve, there is strong value in further exploring how SDT-based insights can inform interface development, particularly with respect to supporting autonomy, fostering competence, and enhancing connection. Such work holds potential not just for improving user satisfaction, but also for aligning technology with deeper human motivational structures.

2.2. Social Response Theory: Chatbot Design and Human-like Social Behaviors

Social response theory (SRT) suggests that individuals interacting with non-human agents, such as chatbots, often apply the same social frameworks and expectations that typically guide human-to-human communication (Adam et al. 2020). This theoretical approach rests on the idea that when digital systems present human-like cues—whether linguistic, behavioral, or visual—people tend to treat them as social entities. These responses are not necessarily conscious but appear to stem from an underlying predisposition to anthropomorphize interactive technologies when they simulate familiar aspects of human behavior. Supporting this notion, prior work has shown that the inclusion of verbal anthropomorphic cues, especially when combined with persuasive techniques, can lead users to comply with chatbot-initiated requests. For example, empirical findings demonstrate that when such design elements are present, users are more inclined to follow through with suggested actions, indicating the activation of social influence processes such as commitment and consistency (Adam et al. 2020). These findings reinforce the argument that even artificial agents are capable of triggering relational dynamics typically observed in interpersonal settings.

Further support for this theory is found in studies exploring anthropomorphism and perceived social presence. In particular, research has highlighted how conversational agents designed with features such as natural language, emotional tone, and adaptive dialogue tend to foster a stronger sense of presence and engagement. These design elements prompt users to perceive the interaction as more personal and socially meaningful, thereby encouraging behaviors aligned with social norms (Seeger et al. 2021). The implication here is that even subtle adjustments in how a chatbot communicates can meaningfully shift how users evaluate and respond to it.

Qualitative work has also added depth to these findings by examining how users interpret social cues in chatbot interactions. In one such study, anthropomorphic design elements were shown to influence users' interpretations of the agent's credibility and intent,

leading to more favorable perceptions of the interaction overall (Goot 2022). This aligns with the broader view that when chatbots exhibit social signals, users respond not merely functionally but socially, assigning motives and trustworthiness in ways consistent with human-human exchanges.

Taken together, these strands of research highlight the utility of SRT in explaining how individuals relate to chatbots. While some studies highlight behavioral outcomes such as compliance and trust (Adam et al. 2020), others emphasize the role of human-like cues in fostering presence and connection (Seeger et al. 2021; Goot 2022). Moving forward, there is a need for deeper inquiry into the situational and emotional variables that shape how people interpret and respond to socially designed digital agents. Such work may not only clarify underlying psychological mechanisms but also guide the development of conversational systems that better reflect and adapt to human expectations in technologically mediated environments.

2.3. SDT and SRT Combined: Understanding Chatbot Engagement

Understanding how users interact with chatbots isn't just about technology, it's also about psychology. Two theories that underpin and explicate to make sense of this are SDT and SRT. SDT, for instance, is based on the idea that people are motivated when three key needs are met viz. autonomy, competence, and relatedness (Deci and Ryan 2012; Ryan and Deci 2000). These aren't just abstract terms. They refer to things like feeling in control, feeling capable, and feeling connected to others. In chatbot settings, this might translate into features like personalized replies or feedback that responds to what the user is doing. These can help users feel more competent and engaged (Hidayat-ur-Rehman 2024). Even small touches like giving users choices or including friendly language can go a long way in supporting these needs. Now, if SDT looks at motivation, SRT brings in the social angle. According to this theory, people often treat machines (chatbots) as if they were other people (Adam et al. 2020). It sounds odd, but the brain doesn't always differentiate. So, if a chatbot talks like a person, uses humor, or has a face that looks vaguely human, users might start responding socially as though it's more than just code (Seeger et al. 2021). That means they might trust it more, feel more at ease, or even feel emotionally connected. When users see the chatbot as "someone" rather than "something," it can affect how open and comfortable they feel during the interaction.

When these theories are placed side by side, they actually work really well together. SDT helps explain how people's inner motivation is affected by the chatbot's features (Deci and Ryan 2012; Hidayat-ur-Rehman 2024). At the same time, SRT explains why human-like design cues (things like tone of voice or visual design) can make a chatbot feel trustworthy or even likable (Adam et al. 2020; Seeger et al. 2021). Together, they show that it's not just functionality that matters it's also how the system makes the user feel. In fact, recent studies have shown that both technical usefulness and emotional connection influence whether people are satisfied with chatbots or not. Nicolescu and Tudorache (2022), for example, found that both factors play a role in shaping the overall experience. Research might want to dig deeper into how motivation and social cues interact, especially if the intent is to design chatbots that aren't just smart but also satisfying to use.

2.4 Conceptual model and hypothesis development

2.5 Perceived competence

Perceived competence refers to the degree to which users believe a chatbot can perform its tasks accurately and effectively. It is an evaluation that plays a key role in shaping trust. When users sense that a system consistently delivers on expectations, their confidence in the interaction tends to grow. Research suggests that both warmth and competence contribute to user expectations in digital environments, and together they form a basis for overall satisfaction (Li et al. 2024). While warmth often guides how human the chatbot feels, competence has a more direct influence on users' behavioral intentions, highlighting a dual pathway through which these characteristics affect outcomes.

In the broader context of human-robot interaction, perceived competence has similarly been identified as essential for promoting trust. Study has emphasized that the psychological principles underlying interpersonal trust can, to a significant extent, be applied to human-technology relationships as well (Christoforakos et al. 2021). Findings indicate that warmth and competence should not be treated as orthogonal; rather, their interaction contributes to shaping users' expectations and emotional responses during chatbot interactions.

The way a chatbot is designed, visually and linguistically, greatly influences how competent users perceive it to be. Design elements such as conversational tone, personality cues, and interface features that resemble human characteristics can strengthen users' perception of the chatbot's capability. As noted in prior work, when anthropomorphic cues such as language style or avatar design are embedded into the system, users are more likely to view the chatbot as relatable and functionally sound (Araujo 2018). These elements help transform the chatbot from a tool into something closer to a social agent, which in turn supports trust and satisfaction.

The quality of communication also plays an integral role in shaping users' evaluations of competence. For instance, the manner in which a chatbot communicates such as tone, pacing, and emotional expression can strongly influence how users feel about the interaction. In a study examining emotional attachment and service expectations, it was found that a socially oriented communication style significantly enhanced user satisfaction, particularly among users prone to anxiety in relational contexts (Xu et al. 2022). This indicates that emotional responsiveness can help position the chatbot as not only competent but also attuned to user needs.

Anthropomorphism also serves as a mechanism through which perceived competence can be enhanced. When chatbots simulate human-like behavior convincingly, users tend to attribute greater skill and trustworthiness to them. Some studies show that anthropomorphic features, especially those linked to personality and emotional expression, can strengthen the bond between the user and the system (Pizzi et al. 2023). This effect is further supported by evidence suggesting that users respond more favorably to systems that balance warmth and competence in a coherent design (Christoforakos et al. 2021).

Interestingly, chatbots have sometimes outperformed human agents in contexts where sensitive communication is required. One study found that users actually evaluated chatbots more positively than human agents when their requests were denied, pointing to the protective buffer that perceived competence can provide in difficult interactions (Yu et al. 2022). In these

cases, competence seems to serve as a stabilizing force, maintaining user satisfaction even in the face of service limitations.

However, expectations around competence can also backfire. When anthropomorphism elevates user expectations but the system fails to meet them, negative emotions such as disappointment or frustration may intensify. For example, in service settings where chatbots are presented as highly human-like, their failure to deliver on user needs can lead to more severe dissatisfaction than if those same expectations were not established in the first place (Park et al. 2024). This highlights not only the importance of initial trust but also the need for competence to be consistently demonstrated across the user experience. Hence,

H1: Perceived competence of a chatbot has a significant positive influence on user's perceived value

2.5 Perceived ease of use

Perceived ease of use (PEOU) as a significant construct, helps in understanding users' acceptance of chatbots. PEOU is defined as the degree to which an individual believes that using a particular system will be free of effort (Venkatesh et al. 2003). In the context of chatbots, this concept is directly linked to interface design, interaction simplicity, and overall usability. This construct informs user satisfaction thereby influencing the adoption and continued use of chatbot technology.

Systematic reviews have highlighted that chatbot-related factors, including operational simplicity and intuitive design, are key determinants of user experience. Nicolescu and Tudorache (2022) conducted a systematic literature review categorizing customer experience factors in chatbot interactions. Their analysis emphasizes the importance of PEOU as part of the design attributes that contribute to customer satisfaction and efficiency. Similarly, Følstad and Brandtzæg (2020) found that for chatbots to be broadly adopted, they must be perceived as useful and pleasurable, with ease of use serving as a prerequisite for positive user experiences. These studies collectively provide evidence that the perceived effortlessness of interacting with chatbots significantly influences user attitudes and acceptance.

In applied settings such as hospitality and tourism, empirical research further reinforces the significance of PEOU. This, alongside perceived usefulness and trust, is a strong predictor of consumers' willingness to interact with chatbots (Pillai and Sivathanu 2020). This finding supports the original propositions of TAM, indicating that a system that minimizes cognitive and operational demands is more likely to be embraced by users. PEOU positively influences adoption intentions, emphasizing the need for chatbots to deliver seamless and intuitive user experiences (Alboqami 2023). Further evidence comes from comparative studies evaluating interaction modalities. Simpler and more intuitive designs that enhance perceived ease of use lead to significantly improved user experiences (Nguyen et al. 2022). Such research indicates that reducing interaction complexity not only increases user satisfaction but also promotes broader acceptance of chatbot technology within digital service platforms. PEOU is a pivotal factor in adopting and sustaining the use of chatbots. By minimizing complexities of interaction and enhancing the intuitiveness of chatbot interfaces, designers can significantly capitalize on users' willingness to engage with these systems. Therefore it is hypothesized:

H2: Perceived ease of use of chatbot has a significant positive influence on user's perceived value

2.6 Perceived usefulness

Perceived usefulness is defined as the degree to which an individual perceives using a system will make them more productive. The construct has been instrumental in explaining technology adoption across various contexts. It continues to offer a critical lens through which the effectiveness of chatbot systems can be evaluated. In the context of chatbots, this construct encapsulates users' judgments regarding the ability of these systems to deliver effective customer service, streamline decision-making, and enhance overall interaction quality (Følstad and Brandtzæg 2020).

An examination of chatbot literature reveals that perceived usefulness is frequently influenced by design attributes and technical functionalities that enhance user experience. Chatbot-related factors such as natural language processing, reliability, and response accuracy significantly contribute to building users' perceptions of usefulness (Nicolescu and Tudorache 2022). Research indicates that when chatbots are perceived as useful, they not only increase user satisfaction but also foster positive behavioral intentions in diverse service contexts (Følstad and Brandtzæg 2020).

Empirical investigations in the service quality domain further support the centrality of perceived usefulness in influencing chatbot acceptance. Reliability and perceived usefulness are key determinants driving customer re-engagement with chatbot systems and users seek tangible benefits when evaluating conversational agents (Meyer-Waarden et al. 2020). Higher level of perceived usefulness leads to stronger behavioral intentions for chatbot adoption.

In essence it is indicated in the literature that perceived usefulness is a decisive factor influencing the acceptance and continued usage of chatbots. The integration of functional design elements and technological sophistication directly enhances users' evaluations of a chatbot's utility, thereby driving its adoption across varied service contexts. Accordingly, the study hypothesizes that:

H3: Perceived usefulness of chatbot has a significant positive influence on user's perceived value

2.7 Perceived value

Perceived value in the context of chatbots captures consumers' overall evaluation of the benefits received relative to the costs incurred during interactions with these systems (Nicolescu and Tudorache, 2022). This construct encapsulates not only functional utility but also hedonic, experiential, and social dimensions. Researchers studying what makes chatbots useful conclude that key factors include interaction quality and anthropomorphic features that mimic humans (Nicolescu and Tudorache 2022; Følstad and Brandtzæg 2020).

Nicolescu and Tudorache (2022) reviewed studies on AI chatbots and customer experience. They found that good design, language skills, and quick, relevant responses create better user experiences. When chatbots work smoothly, people see them as more valuable. Complementing these findings, Følstad and Brandtzæg (2020) conducted questionnaire-based research that highlights the importance of usability and pleasure in driving positive evaluations.

Their study found that perceived effectiveness and enjoyable interactions are critical antecedents of overall perceived value in digital customer service settings.

Research in domain-specific contexts further elucidates the role of perceived value in shaping customer attitudes and behavioral intentions. For instance, features such as streamlined decision-making and engaging service interactions enhance the overall perceived value of the service (Yoon and Yu 2022). Variations in communication style and consumer attachment anxiety affect satisfaction levels in chatbot interactions (Xu et al. 2022). This finding implies a broader linkage wherein effective and empathetic communication styles directly elevate the perceived value of chatbot services, thereby influencing long-term customer engagement.

Interaction with chatbots engenders not only tangible benefits, such as efficiency and convenience, but also intangible benefits, including emotional satisfaction and social connectivity (Lalicic and Weismayer 2021). Successful chatbots work on two levels: solving problems and building connections. Their worth isn't just about efficiency but about creating satisfying and natural conversations. Research shows the most effective bots blend good design, conversational skills, and adaptability to user needs. This leads to the hypothesis:

H4:   Perceived value of a chatbot's user has a significant positive influence on trust

2.8 Trust

Trust in chatbots is a key factor in whether users accept, enjoy, and keep using them (McKnight et al. 2011). Early research on trust in technology focusing on reliability, competence, and integrity helps explain how people trust chatbots. As chatbots have become more common in business and customer service, studies now explore how trust grows or breaks down in human-chatbot interactions (Cheng et al. 2021).

Research shows several factors that build trust in chatbots. Human-like design features and personalized responses, for example, make users trust chatbots more (Jiang et al. 2023). A balance of competence and warmth in chatbot behavior also strengthens trust (Christoforakos et al. 2021). Other studies reveal that task complexity and clear chatbot identity disclosures affect trust in e-commerce settings (Cheng et al. 2021). Privacy concerns also play a role where users share less personal data when they distrust a chatbot (Lappeman et al. 2022). These findings suggest trust depends not just on the chatbot's abilities, but also on how it's designed and used.

Comparing chatbots to human agents highlights the importance of trust. Features like rich media and social presence help chatbots earn trust similar to human agents, increasing reuse intentions (Lei et al. 2021). Reviews of chatbot research confirm that design, natural language use, and error handling shape trust (Nicolescu and Tudorache, 2022). Some researchers even argue that trust should be a key metric for chatbot success (Przegalińska et al. 2019). Together, these studies show trust in chatbots involves both technical performance and user psychology.

Overall, chatbot trust stems from design, interaction quality, and situational factors. Human-like cues, transparency, and privacy protection boost trust, which then affects long-term use and user openness (Cheng et al. 2021; Lappeman et al. 2022). Future research should

improve trust measurement and explore new factors as chatbots evolve. So the following hypothesis is proposed:

H5:   *User's Trust has a significant positive influence on chatbot satisfaction*

2.9 Chatbot satisfaction

Chatbot satisfaction has emerged as a pivotal construct in understanding user experiences in digital customer service. It is predominantly defined as the degree to which users are pleased with and contented by the interactions they have with automated conversational agents. Researchers generally consider satisfaction to be a multidimensional construct encompassing aspects such as system responsiveness, communication style, perceived reliability, and emotional engagement (Nicolescu and Tudorache 2022; Xu et al. 2022). This recent literature emphasizes that chatbot satisfaction hinges not only on the technical performance of the system but also on the human-like qualities embedded into its design.

Empirical studies have demonstrated that communication style plays a crucial role in heightening customer satisfaction. Subtle variations in communicative approaches employed by chatbots significantly influence satisfaction levels by catering to users' attachment anxieties and expectations during online interactions (Xu et al. 2022). This observation is supported by broader research that suggests integrated customer service can enhance the human-computer interaction experience, where smooth, contextually adaptive dialogues contribute to positive affective responses (Nicolescu and Tudorache 2022; Følstad and Brandtzæg 2020). Additionally, questionnaire-based investigations further corroborate that response relevance and problem resolution are key determinants of satisfaction in chatbot interactions (Følstad and Brandtzæg 2020).

Another line of inquiry has focused on the impact of anthropomorphic design elements on satisfaction. While anthropomorphism can humanize the digital experience and facilitate trust, its influence on satisfaction is nuanced. Klein and Martinez (2022) demonstrated that anthropomorphic cues, when effectively implemented, positively correlate with customer satisfaction in chatbot interactions by enhancing enjoyment and attitude. Conversely, Crolic et al. (2021) found that excessive or poorly calibrated anthropomorphic features can lead to negative emotional responses such as anger, which adversely affect satisfaction. Thus, designers must carefully balance human-like attributes to avoid diminishing satisfaction.

Domain-specific studies further enrich this understanding. In the banking sector, Eren's (2021) research indicates that perceived trust in the service provided by chatbots, alongside the banks' reputation, is a critical antecedent of overall customer satisfaction. Similarly, Park et al. (2024) have illustrated that specific characteristic of AI-based chatbots, such as their operational efficiency and user interface design, are closely linked to the overall satisfaction experienced by users in various service settings. These studies collectively stress that factors intrinsic to the chatbot and external in terms of service contribute to customer satisfaction.

The body of literature suggests that achieving high levels of chatbot satisfaction requires an integrative approach that considers technical competence, strategic communicative design, and nuanced anthropomorphic cues. By ensuring that chatbots are not only operationally efficient but also contextually adaptive and emotionally resonant, organizations can adopt higher satisfaction levels, which can lead to greater customer loyalty and advocacy.

2.10   Anthropomorphism

Anthropomorphism refers to assigning human-like traits to non-human entities. It has become a central theme in research on digital assistants and chatbots which fundamentally changes how users perceive and interact with service technologies (Adyantari 2022; Goot 2022). Initial research established that incorporating human characteristics into chatbots does more than simply increase their perceived social presence. It also shapes user attitudes regarding privacy and advertising by creating a sense of interpersonal connection (Seeger et al. 2021). The fundamental value of anthropomorphism stems from its ability to soften the mechanical nature of digital interfaces, helping to align user expectations with technological capabilities (Goot 2022; Blut et al. 2021).

Recent studies have systematically examined the specific design components that create effective anthropomorphic systems. Scholars have demonstrated that visual elements, linguistic patterns, and behavioral characteristics all play crucial roles in triggering anthropomorphic perceptions among users (Seeger et al. 2021; Araujo 2018). For example, carefully implemented visual and conversational elements have been shown to significantly enhance perceptions of human-like qualities, which in turn improves user engagement (Araujo 2018; Go and Sundar 2019). Additional research confirms that customized anthropomorphic features, including personalized greetings and context-aware responses, can strengthen users' emotional bonds with chatbots while simultaneously increasing the system's perceived credibility (Li et al. 2024; Alboqami 2023).

The effects of anthropomorphism extend significantly into consumer decision-making and technology adoption processes. Within service industries, empirical evidence from online travel platforms demonstrates that anthropomorphic characteristics substantially increase users' willingness to adopt chatbot services by enhancing both perceived social presence and emotional connection (Cai et al. 2022; Yang et al. 2021). Research has also identified the important mediating role of psychological distance. Anthropomorphic design elements help reduce the perceived gap between users and AI systems, thereby increasing trust and engagement willingness (Li and Sung, 2021; Cheng et al. 2022). Supporting studies reveal that when consumers encounter well-designed anthropomorphic features, they consistently attribute greater levels of both competence and warmth to chatbots, further strengthening their intention to use the technology (Alboqami 2023; Pizzi et al. 2023).

However, current literature also documents important limitations and potential drawbacks of anthropomorphic design. Some studies caution that while human-like features can improve user rapport, they may simultaneously create unrealistic expectations that, when unfulfilled, lead to greater dissatisfaction or disproportionate blame during service failures (Ketron and Naletelich 2020; Song et al. 2023). Furthermore, research indicates that the effectiveness of anthropomorphic elements depends heavily on situational factors including user confidence and task complexity. In certain scenarios, stronger human-like cues might actually increase perceived risk or decrease operational efficiency (Fan et al. 2019; Kim and Im 2023). These findings collectively suggest that implementing anthropomorphic design requires careful calibration to ensure improvements in social presence don't compromise functional reliability or erode user trust.

Comprehensive research on this subject establishes anthropomorphism as a complex, multidimensional concept that intersects design principles, psychological factors, and consumer behavior patterns. While the literature confirms that human-like features offer significant potential for improving user engagement and perceived trustworthiness, it equally emphasizes that their impact depends heavily on contextual variables and individual user characteristics.

2.11   Anthropomorphism as moderator

Anthropomorphism's ability to influence relationships between key variables in technology-mediated environments has become a significant research focus. Studies show that human-like characteristics in non-human agents can either weaken or strengthen effects that would normally occur without such features. For instance, research demonstrates that anthropomorphic cues systematically affect risk perceptions, with these effects depending on an individual's sense of social power. People with lower power perceive greater risk when using anthropomorphized systems (Kim and McGill 2011). This finding reveals how anthropomorphism's moderating role varies by user characteristics, ultimately shaping how people process risk and uncertainty in technology interactions.

In AI and chatbot research, anthropomorphism's moderating function has been particularly well-documented. A study on AI chatbot adoption found that anthropomorphism not only directly predicts consumer adoption but also changes how traditional factors like perceived ease of use and usefulness influence adoption decisions (Alboqami 2023). This suggests anthropomorphism gives designers and marketers an additional tool to shape consumer perceptions and behaviors beyond conventional technology acceptance factors.

Trust development in human-robot interactions similarly reveals anthropomorphism's moderating effects. Systematic research shows that perceived human-like qualities alter how competence and warmth contribute to trust formation in robots (Christoforakos et al. 2021). Rather than simply adding to these effects, anthropomorphic features interact with other social-cognitive dimensions, fundamentally changing how trust develops in automated systems which is a crucial insight for designing interfaces that balance technical capability with human-like qualities.

Research on service failures provides another perspective on this moderating role. Studies indicate anthropomorphism can reduce dissatisfaction after service failures, but only for certain users - specifically those with higher technology self-efficacy and interdependent self-construal (Fan et al. 2019). These findings position anthropomorphism as a potential buffer against negative experiences, though its effectiveness depends on individual user characteristics. Additional studies examining consumer mindset found that people with competitive orientations respond less positively to anthropomorphic features compared to those with collaborative orientations (Han et al. 2023). This demonstrates how the success of human-like design elements depends on the psychological framework users bring to AI interactions. It is therefore posited:

H6: *Chatbot anthropomorphism moderates the relationship between perceived value and trust, such that the relationship is stronger when anthropomorphism is high*

In light of the above discussion and hypotheses a conceptual model is developed (Figure 1) proposing users' perceptions of chatbot competence, ease of use, and usefulness influence their perceived value of interactions. The model offers that perceived value plays a central role in shaping user trust and satisfaction, while anthropomorphism strengthens the relationship between perceived value and trust in chatbot interactions.

Figure No 1: Conceptual model
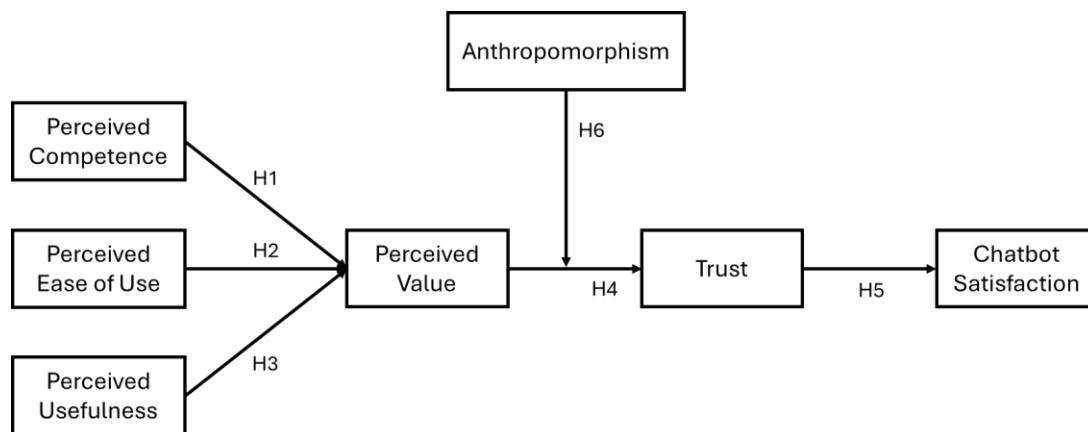
Sources(s): Authors' own work

3 Methodology

3.4 Measures

To measure the key constructs of this study, previously validated items were adapted from established literature and reworded slightly to align with the context of chatbot use (Table 1). All items were measured on a seven-point Likert scale anchored as 1 being "strongly disagree" to 7 as "strongly agree". Perceived Competence was measured using four items adapted from prior work (Meyer-Waarden et al. 2020), which reflected users' perceptions of the chatbot's intelligence, skill, and ability to manage tasks as expected. Perceived Usefulness and Perceived Ease of Use were each assessed with four items derived from foundational studies in technology acceptance (Davis, 1989; Oh et al. 2013; Kim et al. 2009; Kaushik et al. 2015), capturing the chatbot's contribution to user efficiency and how intuitively it could be navigated.

Five items for Perceived Value were taken from earlier work (McKnight et al. 2002), with a focus on technical reliability, professional affiliation, and visual familiarity. Anthropomorphism was measured through four items based on prior scales (Lu et al. 2019; Bartneck et al. 2009; Gursoy et al. 2019), assessing the degree to which the chatbot was perceived as lifelike or emotionally expressive. The construct of Trust was evaluated using five indicators adapted from the same foundational source as value (McKnight et al. 2002), gauging whether users believed the chatbot was dependable, honest, and had their best interests in mind. Finally, Chatbot Satisfaction was measured with four items from an

established satisfaction scale (Wixom and Todd 2005), addressing users' overall experience and contentment with the system. Table 1 provides a complete overview of all constructs, items, and their respective sources. Minor rewordings were applied where needed to improve readability and contextual clarity while retaining the conceptual core of each scale.

Table No 1: Measures and items

Construct	Item	Code	Adapted from
Perceived Competence	I think the chatbot I use is intelligent.	PC1	(Meyer-Waarden et al. 2020)
	I think the chatbot I use is proficient.	PC2	
	I believe the chatbot I use will perform as I expected.	PC3	
	I believe the chatbot I use can competently handle my request.	PC4	
Perceived Usefulness	The chatbot I use is useful.	PU1	(Oh et al. 2013; Davis 1989; Kim et al. 2009)
	The chatbot I use improves efficiency.	PU2	
	The chatbot I use improves my performance (save time).	PU3	
	Overall, I feel that the chatbot I use is very useful.	PU4	
Perceived Ease of Use	The chatbot I use requires little mental effort.	PEU1	(Oh et al. 2013; Davis 1989; Kaushik et al. 2015; Kim et al. 2009)
	It is easy to use the chatbot I use.	PEU2	
	My interaction with the chatbot I use is clear and understandable.	PEU3	
	The chatbot I use is simple to use.	PEU4	
Perceived Value	The chatbot I use is well respected by professionals.	PV1	(McKnight et al. 2002)
	The chatbot I use belongs to a reputable firm of the AI industry.	PV2	
	Overall, my chatbot site works very well technically.	PV3	
	On my chatbot site, it is easy to find the information I wanted.	PV4	
	Visually, my chatbot resembles other sites I think highly of.	PV5	
Anthropomorphism	The chatbot I use has its own mind.	ANTHR1	(Lu et al. 2019; Bartneck et al. 2009; Gursoy et al. 2019)
	The chatbot I use can experience emotions.	ANTHR2	
	I feel that the chatbot I use is – inanimate: living.	ANTHR3	
	I feel the chatbot I use is computer-animated: real	ANTHR4	
Trust	I believe that the chatbot I use would act in my best interest.	TR1	(McKnight et al. 2002)
	The chatbot I use is truthful in its dealings with me.	TR2	
	The chatbot I use is competent and effective.	TR3	
	When an important issue or problem arises, I feel comfortable depending on the information provided by the chatbot I use.	TR4	
	I can always rely on the chatbot I use in a critical situation.	TR5	
Chatbot Satisfaction	Overall, the information I get from the chatbot I use is very satisfying.	CS1	(Wixom and Todd 2005)
	I am very satisfied with the information I receive from the chatbot I use.	CS2	
	All things considered; I am very satisfied with the chatbot I use.	CS3	
	Overall, my interaction with the chatbot I use is very satisfying.	CS4	

3.5 Data collection

Data was collected through an online survey administered to the students of 4 universities from Quetta, Pakistan. Participants were invited to respond only after confirming their familiarity with chatbot usage. The minimum required sample size suggested was 98 by using G*Power software (Faul et al. 2009). To ensure robustness, the target was set at 250 responses. A total of 233 complete responses were received, with 17 incomplete surveys excluded. This resulted in a response rate of approximately 93%. The demographic details of the sample are presented in Table 2.

Table No 2: Demographic variables

Category	Description	Frequency	Percentage
Gender	Male	142	61
	Female	91	39
Age Group	18-20 years	82	35
	21-23 years	68	29
	24-26 years	51	22
	27 years or older	33	14
Educational Level	Undergraduate	117	50
	Graduate (Master's)	93	40
	Postgraduate (PhD)	23	10
Field of Study	STEM	47	20
	Business and Management	75	32
	Social Sciences and Humanities	49	21
	Arts and Design	37	13
	Health Sciences	37	14
Experience with Chatbots	Regular user (several times a week)	126	54
	Occasional user (few times per month)	70	30
	Rarely use (used once or twice a month)	33	14
	Never used before this study	5	2

Source(s): Authors' own work

3.6 Structural Equation Modeling Approach

To analyze the structural relationships among latent constructs, Partial Least Squares Structural Equation Modeling (PLS-SEM) technique was employed. SmartPLS version 4 software was used for analysis. It is capable of handling problematic modeling issues such as non-normal data distributions (Hair et al. 2014) and small sample sizes (Gefen et al. 2011). In this study, a PLS-SEM model with seven latent constructs and six hypothesized causal relationships were conceptualized. The analysis followed a two-step approach: first, assessing the measurement model to evaluate the reliability and validity of the constructs; and second, examining the structural model to test the proposed hypotheses.

4   Results and findings

The reliability and validity of the measurement model were evaluated prior to structural analysis. Table 3 includes the primary statistics. All item loadings were greater than 0.70

highlighting indicator reliability was achieved. Cronbach's alpha values ranged from 0.758 to 0.864 which emphasized internal consistency. Construct reliability was confirmed too as both composite reliability and ρ_A values remained above the 0.70 criterion. For convergent validity, the average variance extracted (AVE) across constructs, each surpassed the 0.50 benchmark. To check for discriminant validity, the heterotrait-monotrait (HTMT) ratio was examined. All HTMT values (Table 4) remained below 0.85 (Henseler et al. 2015). The highest observed value was 0.849, between Perceived Usefulness and Anthropomorphism.

Table No 3: Reliability and convergent validity

Construct	Item	Loading (≥ 0.70)	CA (≥ 0.70)	ρ_A (≥ 0.70)	ρ_C (≥ 0.70)	AVE (≥ 0.50)
Anthropomorphism	ANTHR1	0.828	0.828	0.844	0.885	0.658
	ANTHR2	0.759				
	ANTHR3	0.804				
	ANTHR4	0.850				
Chatbot Satisfaction	CS1	0.818	0.864	0.876	0.907	0.709
	CS2	0.897				
	CS3	0.804				
	CS4	0.846				
Perceived Competence	PC1	0.831	0.843	0.844	0.906	0.763
	PC3	0.837				
	PC4	0.948				
Perceived Ease of Use	PEU1	0.843	0.832	0.833	0.888	0.666
	PEU2	0.844				
	PEU3	0.756				
	PEU4	0.817				
Perceived Usefulness	PU1	0.801	0.823	0.831	0.882	0.652
	PU2	0.766				
	PU3	0.840				
	PU4	0.821				
Perceived Value	PV1	0.840	0.758	0.781	0.846	0.579
	PV2	0.756				
	PV4	0.752				
	PV5	0.688				
Trust	TR1	0.793	0.813	0.824	0.877	0.640
	TR3	0.847				
	TR4	0.741				
	TR5	0.817				

Loading, outer loading coefficients; CA, Cronbach's α; ρ_A, construct reliability measure (true reliability); ρ_C (CR), composite reliability; AVE, average variance extracted.

Source(s): Authors' own work

Table No 4: HTMT ratios

	ANTHR	CS	PC	PEU	PU	PV	TR
ANTHR							
CS	0.563						
PC	0.826	0.540					
PEU	0.822	0.784	0.783				
PU	0.849	0.627	0.784	0.847			
PV	0.821	0.647	0.826	0.836	0.833		
TR	0.800	0.579	0.683	0.844	0.841	0.818	

Source(s): Authors' own work

In the structural model, significant path relationships were observed. Perceived Competence ($\beta = 0.263$, $p < .001$), Perceived Ease of Use ($\beta = 0.263$, $p < .001$), and Perceived Usefulness ($\beta = 0.355$, $p < .001$) all three were associated positively with Perceived Value. Consequently, it showed a significant effect on Trust ($\beta = 0.342$, $p < .001$), which was found to predict Chatbot Satisfaction ($\beta = 0.497$, $p < .001$). Indirect effects were also examined. Perceived Competence, Ease of Use, and Usefulness influenced both Trust and Satisfaction indirectly via Perceived Value. For example, Perceived Usefulness was associated with an indirect effect on Trust ($\beta = 0.122$, $p < .001$) and on Chatbot Satisfaction ($\beta = 0.060$, $p = .001$). These findings indicate path effects across the proposed pathways. Moderation analysis was also conducted. Anthropomorphism moderated the effect of Perceived Value on Trust ($\beta = 0.091$, $p = .010$) (Table 5). This interaction is visualized in Figure 2. At higher levels of perceived anthropomorphism (+1 SD), the impact of Value on Trust was stronger. When anthropomorphism was lower (−1 SD), the relationship weakened. This suggests that more humanlike chatbots enhance trust-building mechanisms rooted in perceived value (Hair et al. 2022).

Table No 5: Direct, indirect, and moderation effects

Hypothesis	Effect	Path	Path Coefficients	t Values	p Values	5% CI	95% CI	Sig. (p<0.05)
H1	Direct Effect	PC -> PV	0.263	4.165	0.000	0.158	0.365	Supported
H2		PEU -> PV	0.263	3.945	0.000	0.156	0.375	Supported
H3		PU -> PV	0.355	5.502	0.000	0.249	0.462	Supported
H4		PV -> TR	0.342	4.588	0.000	0.212	0.461	Supported
H5		TR -> CS	0.497	10.275	0.000	0.418	0.577	Supported
	Indirect Effect	PC -> CS	0.045	2.925	0.002	0.021	0.071	
		PC -> TR	0.090	3.261	0.001	0.046	0.136	
		PEU -> CS	0.045	2.532	0.006	0.020	0.077	
		PEU -> TR	0.090	2.783	0.003	0.041	0.148	
		PU -> CS	0.060	3.115	0.001	0.031	0.094	
		PU -> TR	0.122	3.499	0.000	0.066	0.179	
		PV -> CS	0.170	3.857	0.000	0.098	0.244	
H6	Moderation	ANTHR x PV -> TR	0.091	2.316	0.010	0.032	0.158	Supported

Statistically significant at P-value <0.05; t-value (statistics) thresholds: ±1.96. CI = confidence interval
Source(s): Authors' own work

Figure No 2: Interaction of moderation
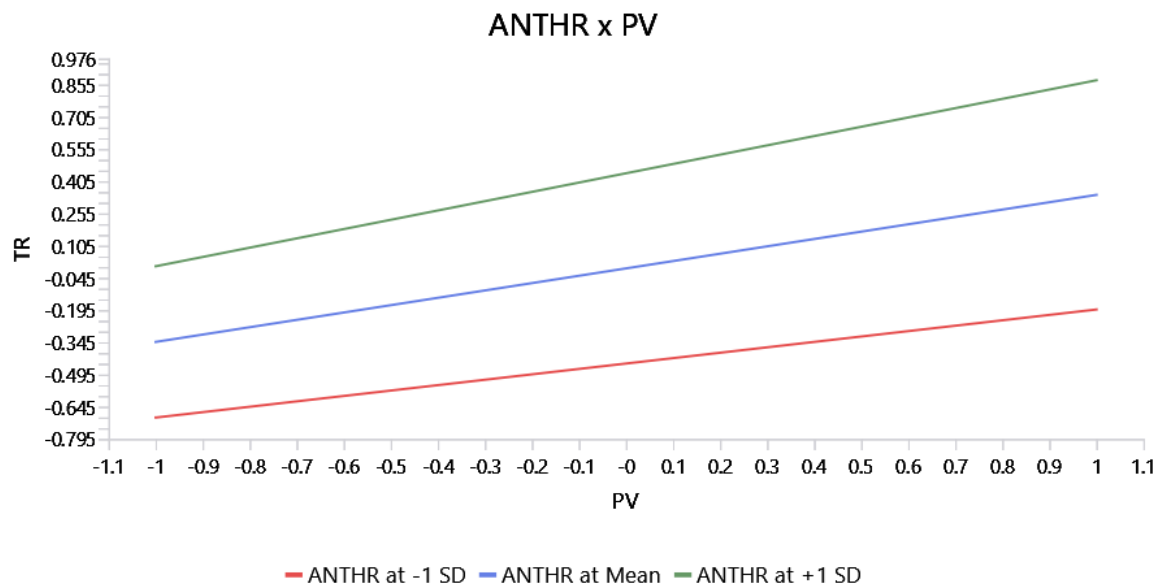
Sources(s): Authors' own work

The model's explanatory and predictive power was assessed using R², f², and Q² estimates (Table 6). The R² values indicated that Perceived Value explained 61.4% of its variance, Trust accounted for 51.5%, and Chatbot Satisfaction for 24.7%. These are typically interpreted as moderate explanatory levels (Hair et al. 2022). Small-to-medium effect sizes were observed, such as Usefulness on Perceived Value (f² = 0.134), and the interaction between Anthropomorphism and Value on Trust (f² = 0.023). Predictive relevance was also confirmed, as Q² values for all endogenous constructs exceeded zero.

Table No 6: Explanatory power and predictive relevance

Exogenous	Endogenous	R-square	f-square	Q-square
PC	PV	0.614	0.089	0.597
PEU			0.074	
PU			0.134	
ANTHR	TR	0.515	0.156	0.534
PV			0.097	
ANTHR x PV			0.023	
TR	CS	0.247	0.328	0.258

Source(s): Authors' own work

4.1 Discussion

This study set out to examine how users' perceptions of chatbot competence, ease of use, and usefulness contribute to their overall evaluation of value, and how this perceived value subsequently shapes trust and satisfaction. The empirical results offer consistent support for the proposed model, thereby advancing current understanding of how cognitive appraisals and design perceptions jointly influence user responses to conversational agents.

Perceived competence was found to significantly predict perceived value, affirming prior claims that users are more inclined to find chatbot interactions worthwhile when the system is seen as reliable and skillful (Li et al. 2024; Christoforakos et al. 2021). This finding supports the argument that competence as a systemic characteristic function shaping both instrumental and affective responses. Moreover, the indirect effects of competence on trust and satisfaction suggest that it reinforces the psychological foundations of long-term user engagement.

Perceived ease of use also demonstrated a positive effect on perceived value. This result aligns with the core tenets of the TAM, which posits that systems requiring less cognitive or physical effort are more adopted and positively evaluated (Venkatesh et al. 2003). In line with earlier research (Følstad and Brandtzæg 2020; Nicolescu and Tudorache 2022), perceived ease of use was associated with a smoother interaction, resulting in enhanced users' evaluation of the overall experience. These findings reaffirm the centrality of usability in human–AI interaction.

Among the antecedents examined, perceived usefulness emerged as the most robust predictor of perceived value. Users who believed that chatbot served practical and goal-oriented functions were also more likely to regard the interaction as valuable. This supports prior research that emphasizes the instrumental basis of technology evaluations (Davis 1989; Meyer-Waarden et al. 2020), highlighting that functional adequacy remains a critical driver of favorable user assessments. Notably, the strength of this relationship was echoed in the observed indirect effects on trust and satisfaction, accentuating the broad reach of usefulness across affective and behavioral outcomes.

Perceived value itself played a pivotal role, bridging the cognitive appraisals of competence, ease, and usefulness with more relational constructs such as trust. The findings suggest that when users see tangible benefits in using the chatbot, they are more inclined to place trust in the system. This outcome corroborates earlier frameworks proposing that value perceptions serve as a conduit between design features and relational responses (Følstad et al. 2018; Xu et al. 2022). The sequential pathway from value to trust, and then to satisfaction, provides empirical validation for a layered model of user evaluation.

Importantly, the moderating role of anthropomorphism revealed that the strength of the value–trust relationship was contingent on the perceived human-likeness of the chatbot. This is consistent with prior literature indicating that anthropomorphic cues can activate social interpretive frameworks, thereby intensifying affective responses (Jiang et al. 2023; Seeger et al. 2021). In this study, human-like design features appeared to augment the relational salience of perceived value, effectively amplifying the likelihood of trust. While these findings support the social response perspective, they also signal the importance of calibration—designers must balance anthropomorphic cues to avoid overstated expectations or unintended discomfort (Crolic et al. 2021).

4.2 Theoretical implications

Theoretically, this study makes several contributions. First, it integrates constructs from the TAM with design-oriented and psychological perspectives such as perceived competence and anthropomorphism, enriching our understanding of chatbot evaluation. Second, the findings extend both SDT and SRT by demonstrating that perceived value is not only a cognitive judgment but also a socially shaped construct. Third, by establishing the conditional effect of anthropomorphism, the research offers nuanced insights into how design features can modulate the psychological effects of perceived value.

4.3 Practical implications

From a practical standpoint, these results suggest specific strategies for chatbot developers. Prioritizing technical performance that promotes competence and usefulness remains essential. At the same time, ensuring that the system is easy to use can further enhance users' appraisal of its value. Developers might also consider incorporating moderate anthropomorphic features such as name personalization, emotionally expressive language, and turn-taking styles that increase engagement without compromising system credibility. Such refinements can be especially effective in domains where user trust and satisfaction are critical.

5. Conclusion

This study aimed to improve understanding of how users engage with chatbots by examining the interplay of chatbot-relevant constructs. The proposed model was strongly supported by the data, validating the significance of these interrelated constructs. By integrating foundational TAM constructs with psychological and socially grounded dimensions. The study offers a multi-theoretical explanation of chatbot evaluation and satisfaction.

A key insight emerging from the findings is the role of perceived value, which effectively links cognitive appraisals to trust and satisfaction. Moreover, the analysis revealed that anthropomorphism moderates the strength of the value–trust pathway, suggesting that social design cues can meaningfully enhance the relational outcomes of chatbot interactions. This not only lends empirical support to SRT but also highlights the value of human-like cues in the development of more trustworthy and emotionally resonant AI interfaces.

From a theoretical standpoint, the study confirms that both task-related perceptions (competence, usefulness, ease of use) and socially embedded design elements (anthropomorphism) jointly inform users' evaluations of value and trust. The research also demonstrates that chatbot satisfaction emerges not solely from system performance but also through design factors that facilitate psychological connection and emotional comfort.

From a practical perspective, the findings inform chatbot design strategies by indicating constructs that are most likely to influence user satisfaction. Developers are encouraged to prioritize not only functionality and usability, but also affective dimensions such as human-like responsiveness and conversational tone. When well-calibrated, such features appear to strengthen users' trust by enhancing the perceived value of interaction. Importantly, these enhancements should be applied judiciously, as prior literature warns against the overuse of anthropomorphic cues.

The study is not without limitations. The sample, composed of university students in a single geographic region, may constrain generalizability. While efforts were made to address common method bias, reliance on self-reported data presents a constraint. Future research could adopt multi-method approaches or longitudinal designs to better capture behavioral outcomes and temporal patterns. Moreover, future research might benefit from integrating individual-level moderators such as prior experience, personality traits, or sociocultural orientation.

Additional work may be proposed in the direction of exploring how anthropomorphic design interacts with contextual variables such as culture, emotion, and system transparency. Future models could also incorporate emerging constructs such as ethical alignment or personalization capacity, which may further illuminate the evolving dynamics of human–chatbot interaction. Finally, studies involving adaptive and emotionally intelligent chatbots might uncover richer insights into how user expectations evolve over time.

Overall, this study contributes to the ongoing discourse on human–AI interaction by highlighting perceived value as a central pathway and anthropomorphism as a dynamic contextual amplifier. Through its empirically supported framework, the research provides a comprehensive lens through which chatbot satisfaction can be understood not only as a function of design logic, but also of psychological resonance and social interpretability.

5.1 Authors' contribution and statement of conflict of interest

This research paper reflects a collaborative effort among all authors. Author 1 initiated the research topic, guided the study design, and supervised the overall research process. Author 2 undertook the detailed literature review and developed the conceptual framework central to the study's argument. Author 3 performed the data gathering, managed the analytical processes, and was actively involved in preparing the manuscript. Each author contributed significantly to manuscript revisions, ensuring the integrity and coherence of the final paper.

The authors confirm there is no conflict of interest to declare in relation to this research.

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