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Avoiding Excessive AI Service Agent Anthropomorphism: Examining its Role in Delivering Bad News

Abstract:

Purpose: The aim of this paper is twofold. First, it seeks to understand how different forms of anthropomorphism, namely verbal and visual, can enhance or detract from the subjective well-being of consumers and their co-creation behaviors whilst collaborating with artificial intelligence (AI) service agents. Second, it seeks to understand if AI anxiety and trust in message, function as primary and secondary consumer appraisals of collaborating with AI service agents.

Method: A conceptual model is developed using the theories of the uncanny valley and Cognitive Appraisal Theory, with three hypotheses identified to guide the experimental work. The hypotheses are tested across three experimental studies which manipulate the level of anthropomorphism of AI.

Findings: Results demonstrate that verbal and visual anthropomorphism can assist consumer well-being and likelihood of co-creation. Further, this relationship is explained by the mediators of anxiety and trust.

Originality: The empirical results and theorizing suggest verbal anthropomorphism should be present (absent) and paired with low (high) visual anthropomorphism, which supports the "uncanny valley" effect. A moderated mediation relationship is established, which confirms AI anxiety and trust in a message as mediators of the AI service agent anthropomorphism-consumer subjective well-being/co-creation relationship. This supports the theorizing of the conceptual model based on the "uncanny valley" and Cognitive Appraisal Theory.

INTRODUCTION

Artificial Intelligence (AI) can enhance collaboration between consumers and service providers by improving communication, decision-making, productivity, and well-being (Makridis & Mishra, 2022). This is particularly the case in financial services, whereby banks and other financial service providers can enhance collaboration with consumers via AI, allowing for greater customized financial advice, recommendations, proactive fraud detection, and shorter support wait times (Kreger, 2023). However, there are challenges to effective collaboration between consumers and AI (Le, Sajtos & Fernandez, 2023). One such example is consumers' scepticism towards AI service provision, with industry reports suggesting that only 27% of consumers believe that AI can deliver similar or better customer service than humans (Todorov, 2021). Thus, it is essential to understand how to shift consumers' mindsets and perceptions of working with AI in services to achieve greater collaboration and well-being benefits (Noble et al., 2022), particularly given that more and more organizations are integrating AI into their service delivery (Pavone, Meyer-Waarden & Munzel, 2023). Collaborating, as proposed by Gauri and Van Eerden (2019) captures humans and machines metaphorically “dancing together”, whereby humans and technology work together to enhance each other’s strengths (Noble et al., 2022). As such, in the current study, collaboration refers to the sharing of information between both the AI and the consumer with the purpose of achieving a goal through working together. By addressing the marketplace’s need to enhance collaboration between AI and consumers, this research will provide important insights relating to Service Research Priority 2 (SRP2), technology and customer experience, as well as SRP6 regarding how service practitioners should design AI to create a greater sense of trust.

It has been argued that consumers may be reluctant to collaborate with AI due to their preference for the human element in service delivery (Keating, McColl-Kennedy & Solnet,

2018; Xu, Shieh, van Esch & Ling, 2020). Indeed, research has shown that when providing banking services such as loan advice or investment advice, there is a preference for dealing with a human instead of an AI service agent (Riedel, Mulcahy & Northey, 2022). Therefore, finding ways to balance the human element in AI could be key to enhancing collaboration between consumers and AI (Huang & Rust, 2022). The growing research interest on collaboration between consumers and AI speaks to the limitations in understanding about how to guide these collaborations and maximize value co-creation for all parties (Le et al., 2023; Huang & Rust, 2022). In response, there is a growing body of literature relating to the anthropomorphism of AI with the focus on how to balance collaboration with positive outcomes for all (Baek, Bakpayev, Yoon & Kim, 2022; Crolic, Thomaz, Hadi & Stephen, 2022; Huang & Rust, 2022; Okazaki & Li, 2022).

Popular cues used to support the anthropomorphism of AI include focusing on natural language use (Crolic et al., 2022) and the incorporation of avatars and visuals (Letheren et al., 2021; Keating & Aslan, 2023). Given the need for human touch, one could argue "the more human the better," suggesting the need to use multiple human cues. Indeed, there is already tentative support in the literature to suggest it may be better to anthropomorphize multiple aspects of AI (Letheren et al., 2021). However, arguments against increasing humanness of AI also exist in the literature, particularly from the "uncanny valley" perspective, which describes the phenomenon where an AI becomes increasingly unsettling as it becomes more human-like (Mori, 1970; Kim, Schmitt & Thalmann, 2019).

Irrespective of the arguments and counterarguments in relation to the anthropomorphism of AI, research has tended to only focus on one anthropomorphism cue at a time, thereby neglecting how different anthropomorphic cues might interact to encourage or discourage greater consumer acceptance and collaboration. The current study seeks to address this ambiguity in the literature by considering the "uncanny valley" effect (Kim et al., 2019;

Shin et al., 2019; Wang et al., 2015), which theorizes that making an AI agent appear too human may have adverse effects. Thus, the first aim of the current research is to understand how different types and combinations of anthropomorphism and AI impact upon consumer willingness to collaborate with AI.

Another important consideration when examining a combination of different anthropomorphism cues in AI is considering how such cues impact consumer appraisals. For instance, a reason consumers may be concerned with collaborating with AI in services may be due to their unfamiliarity with how the technology works, leading to uncertainty or even fear of interacting with the technology (Li & Huang, 2020; Rohden & Zeferino, 2022). Indeed, research appears to support such claims, demonstrating that AI anxiety is a key mechanism that explains a consumer's willingness (or not) to collaborate with AI. To this end, research also suggests that trust is a key appraisal undertaken by consumers when collaborating with AI (Riedel et al., 2022). For instance, ensuring the information provided by AI when collaborating with consumers is trusted could be key in ensuring a successful service outcome. The current study uses Cognitive Appraisal Theory and in particular the perspective of the Transactional Model of Stress (Lazarus & Folkman, 1984) to bring these two appraisals together and examine how different combinations of anthropomorphism cues elicit or mitigate primary and secondary appraisals of AI anxiety and trust, respectively.

Building on the previously mentioned areas of AI, anthropomorphism, and services, this study develops and tests a conceptual model of AI and consumer collaboration underpinned by the uncanny valley effect and the Transactional Model of Stress. The remainder of this article is organized as follows. First, the AI and anthropomorphism literature is reviewed, followed by the development and justification of the hypotheses depicted in the conceptual model. The method and results for the different studies are then

presented prior to a more general discussion of the research findings, implications for theory and practice, as well as opportunities for future research.

LITERATURE REVIEW

Co-Creation with AI

Understanding consumers' willingness to engage in co-creation behavior is crucial when examining the likelihood of collaborating with AI service agents. However, most research focuses on consumers' co-creation behavior with other human actors (Laud & Karpen, 2017), and studies that do consider co-creation with AI often overlook the potential impact of anthropomorphism in encouraging greater collaboration with consumers (Čaić et al., 2018; Leone et al., 2021; Lalicic & Weismayer, 2021). For example, Leone et al. (2021) investigate how healthcare organizations can co-create with AI to enhance patient outcomes, while Čaić et al. (2018) study social robots as AI-enabled agents that facilitate co-creation and co-destruction but do not specifically address the role of anthropomorphic features. In a study by Lalicic and Weismayer (2021), considerations and explanations of the impact of general psychological perceptions of AI and the impact on value co-creation with AI-enabled travel service agents are provided. However, like previous studies, they do not consider how AI can be designed or altered to enhance the likelihood of collaboration.

In the current research, it is posited that the incorporation of specific anthropomorphic features into an AI agent can potentially boost consumers' inclination to engage in co-creation with it. This is rooted in the idea that when AI systems exhibit human-like traits to a certain level, consumers may find them more relatable and approachable, thus fostering a greater willingness to collaborate in the co-creation process. Furthermore, this perspective draws from previous studies in the services field, such as the meta-analysis of Blut et al. (2021),

which provides evidence humanising AI agents can lead to increased trust between consumers and these virtual counterparts. Therefore, by investigating the impact of anthropomorphism on consumers' willingness to co-create with AI, our research aims to contribute valuable insights into the design and customization of AI for more effective and productive interactions with consumers.

Consumer Well-being

Another important outcome to consider when consumers collaborate with AI is their subjective well-being, which from a psychological and transformative service research (TSR) perspective, refers to a state of optimal psychological functioning and positive mental health (Rahman, 2021). Consumer interaction with AI has been reported to have both negative and positive impacts on subjective well-being (Henkel et al., 2020; Uysal, et al., 2022). It is therefore crucial for service organizations to ensure that consumers' well-being is consistent or improved through using AI service agents. Calls have been made to explore the conditions where consumers and AI can collaborate to enhance well-being (Noble et al., 2022). Understanding how anthropomorphism may mitigate negative emotional responses from consumers, such as frustration, anger, or anxiety, is important for achieving this goal. As such, this research aims to understand how services can balance encouraging consumer co-creation behavior with AI whilst also promoting consumers' subjective well-being using anthropomorphism and in turn, achieve both positive organizational and consumer outcomes.

Enhancing Co-Creation with AI and Consumer Well-being

While prior research has predominantly concentrated on the impact of AI-human interactions on single organizational outcomes, such as the division of labour (Le et al., 2023), this research underscores the significance of exploring the interdependence of consumers collaborating with AI and its broader effects on multiple stakeholders (Noble et al., 2022).

This shift in focus is essential as AI's influence extends beyond individual or isolated organizational realms, impacting various stakeholders. Given the centrality of exchange in services, where value is sought by two or more actors, the current research seeks to investigate whether AI interactions can be structured to yield mutually beneficial outcomes for both consumers and service organizations.

In this specific context, the present research delves into the potential for consumers to engage in co-creation with AI, which represents a promising avenue for service organizations. Co-creation behavior refers to consumers actively participating in value creation through collaboration with an AI service agent (Yi & Gong, 2013). This collaboration can yield benefits for the organization by facilitating resource allocation and streamlining processes. For instance, research shows that AI will deliver up to $1 trillion of additional value for global banking in which customer services accounts for a significant portion (Das, et al., 2023). However, if consumers are hesitant to engage and co-create with AI, these potential benefits and cost-savings for service organisations may remain unrealized.

Furthermore, the current research places a specific emphasis on outcomes that prioritize the consumer's experience, specifically their subjective well-being, capturing the consumer’s ideal psychological functioning with their positive mental health (Rahman, 2021) and in turn, identifies the impact of AI collaboration on the individual. The current research seeks to determine whether designing AI systems in a particular manner can enhance the overall sense of well-being for consumers when interacting with these agents, while simultaneously minimizing adverse effects. This inquiry is particularly relevant, given instances in the existing literature suggest that there are optimal times and situations in which AI delivers “good” or “bad” news to consumers as well as potential negative responses to the technology in general (Garvey, et al. 2023; Sands et al. 2021). By centring the current research on consumer experience and outcomes that hold significance for service

organizations, the aim is to provide valuable insights into the optimal integration of AI, thus creating a win-win scenario for all stakeholders involved.

In summary, the current investigation seeks to assess the influence of AI anthropomorphism on both co-creation behaviour and subjective well-being. This analysis aims to provide insights into how AI can be customized to optimize outcomes for both service organizations and consumers, ultimately fostering a mutually beneficial dynamic in these exchanges.

How Anthropomorphism Can Be Utilized

Now that the outcomes of the study have been defined and considered, one may ask, how can anthropomorphism be used to ensure consumers' collaboration with AI achieves outcomes for co-creation behavior and consumer well-being? A review of the literature on AI reveals that two main approaches have been taken to examine anthropomorphism and how this may assist consumers' co-creation with AI service agents as well as consumers' subjective well-being (see Table 1). The first approach focuses on consumers' self-report evaluations of the level of anthropomorphism experienced when interacting with AI service agents (Blut et al., 2021; Sheehan et al., 2020). For example, Sheehan et al. (2020) examined how the level of errors a consumer experienced with a chatbot impacted their evaluation of anthropomorphism and subsequent adoption intentions. Another example is the study conducted by Blut et al. (2021), which used meta-analysis to consider how perceived anthropomorphism mediates the impact of robot design features (excluding anthropomorphism), consumer traits, and sociodemographic features of consumers on their intentions to use the technology.

The second approach considers how design features can be altered to make AI agents appear more human. For instance, Konya-Baumbach et al. (2023) investigated how anthropomorphizing the verbal style of a chatbot could enhance perceptions of social

presence and improve desired marketing outcomes. It is this second stream of AI anthropomorphism research that the current study seeks to contribute to. As shown in Table 1, the current research is among the few to consider multiple ways of integrating anthropomorphism into the design of AI service agents. Moreover, this research is one of the first to use Cognitive Appraisal Theory to examine how different forms of anthropomorphism may interact to trigger primary and secondary appraisals, which in turn influence consumers' perceptions of subjective well-being and the co-creation of value.

As shown in Table 1, AI research of anthropomorphism tends to consider only one way in which this can be operationalized, particularly those which are based upon communication (e.g., Roy & Naidoo, 2021; Konya-Baumbach et al., 2023). Whereas a more limited body of literature has considered how multiple ways to operationalize anthropomorphism may enhance consumers' experiences when collaborating with AI agents (Letheren et al., 2021; Tsai et al., 2021). However, even within this literature there appears to be conflicting evidence at present. For example, Letheren et al. (2021) show that in medium and high social interaction situations where human interaction is more likely, participants prefer humanoids (robots that bare close human likeness) than robots. Whereas Tsai et al. (2021) demonstrate non-significant interactions between visual and communication anthropomorphism. The current research will therefore contribute to this limited body of literature to examine multiple aspects (cues) of anthropomorphism and aims to contribute insight into the debate as to whether utilizing multiple anthropomorphic cues do (or do not) interact and impact consumer responses to collaborating with AI, and how this impacts consumers' appraisals and subjective well-being as illustrated in Figure 1.

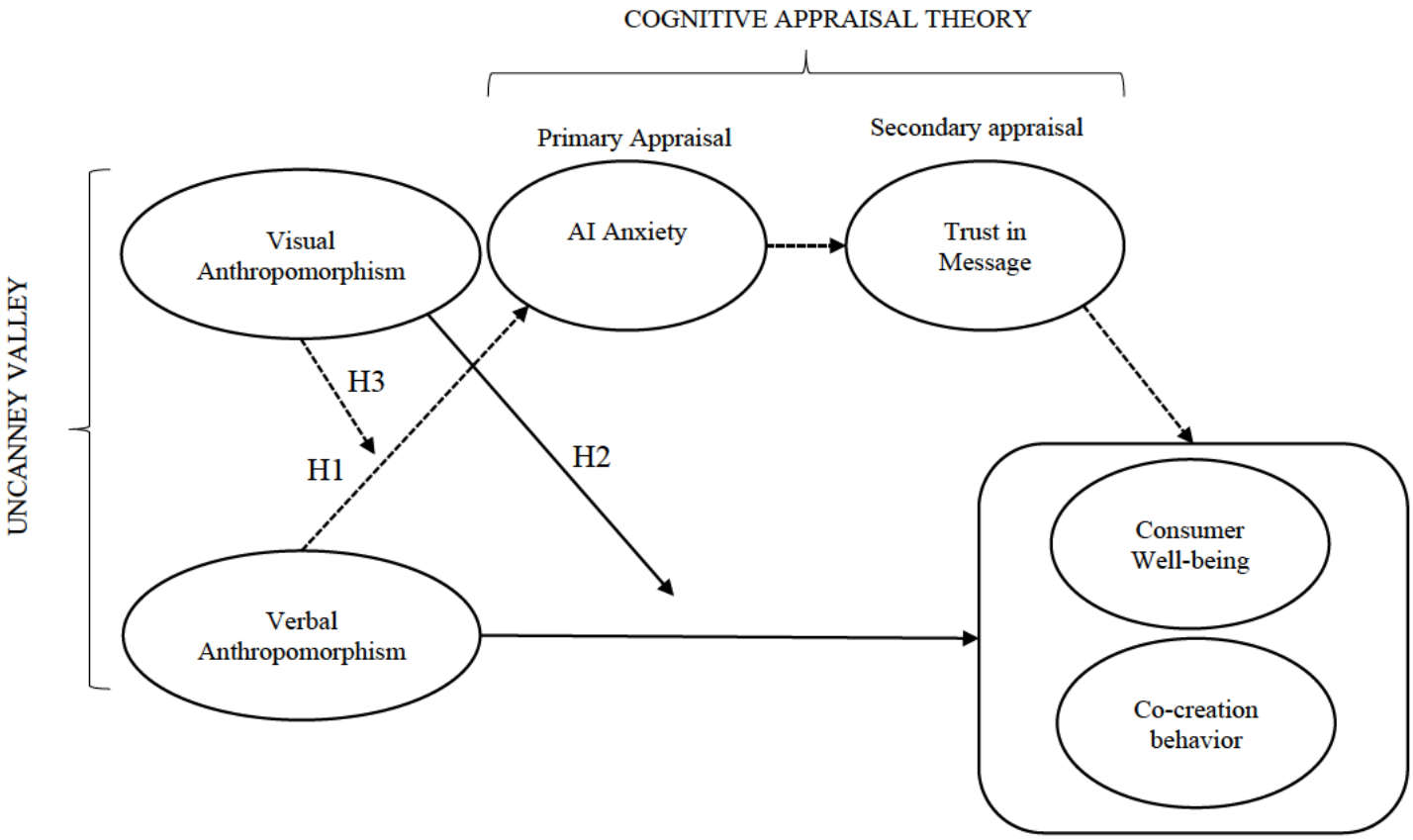
Table 1. Literature review overview

Author(s)/Year	AI	Anthropomorphism	AI Anxiety	Trust	WB	Co-creation	Theory	Findings
Čaić, et al. (2018)	Robot					Y		Robots support value co-creation for elderly care by safeguarding, social contact, and cognitive support
Sangle-Ferriere & Voyer (2019)	Chatbot	-	-	-	-		Social presence theory and media richness theory	Customers perceive live chat as mainly beneficial in a customer service context, alleviating embarrassment, perceived threats elusive nature of a chat conversation interlocutor (human or artificial) adversely affects how customers interpret assistance from companies.
Chung et al., (2020)	Chatbot	-	-	Communication quality (accuracy, credibility, communication competence)	-		-	Chatbot efforts on consumer satisfaction are mediated by their communication quality
Sheehan et al., (2020)	Chatbot	Anthropomorphism (measured)	-	-	-		Elicited agent knowledge	Chatbot's level of error or seeking clarification effect on adoption intention is mediated by perceived levels of Anthropomorphism This effect is also moderated by need for human interaction
Blut et al., (2021)	Multiple	Anthropomorphism (measured)	Computer anxiety	-	-		Task–technology fit (TTF) theory	Customer traits and predispositions (e.g., computer anxiety) and robot design features (e.g., physical, nonphysical) are identified as triggers of anthropomorphism.
Lalicic, et al., (2021)	Chatbot		Technology anxiety			Y	Behavioral reasoning theory	Reasons against adoption such as technology anxiety decreased likelihood of co-creation
Leone, et al., (2021)	Machine learning					Y		Increase AI co-creation improves consumer healthcare
Letheren et al., (2021)	Robot	Visual, Social Interaction (manipulated)	-	-	-		Anthropomorphism theory	Consumers prefer higher levels of humanness and moderate-to-high levels of social interaction opportunity, only some

Author(s)/Year	AI	Anthropomorphism	AI Anxiety	Trust	WB	Co-creation	Theory	Findings
								participants liked robots more when dialogue (high-interaction opportunity) was offered
Roy & Naidoo (2021)	Chatbot	Conversation/Verbal (warm/competent) (manipulated)	-	-	-		-	Social perceptions of brand mediate the impact of chatbot conversational style on marketing outcomes Findings demonstrate that consumers with a present-orientated mindset prefer a warm versus competent chatbot and the opposite exists for future-orientated consumers.
Sands et al., (2021)	Chatbot	-	Positive Emotion, Negative Emotion	Rapport			Social impact theory	When employing an education service script, a significant positive effect occurs for human service agents (compared to chatbots) in terms of both satisfaction and purchase intention.
Riedel et al., (2022)	Chatbot	-	Positive Emotions	Y	-		Affect as information theory	Consumers feel greater levels of affection when served by humans as opposed to AI.
Tsai et al., (2021)	Chatbot	Communication and Visual (manipulated)	-	-	-		-	Non-significant interaction between communication and visual anthropomorphism. Visual anthropomorphism has a main effect on parasocial interaction.
Cai et al., (2022)	Chatbot	Verbal, Visual		Trustworthiness			Social presence theory	Trustworthiness mediates effect of anthropomorphism on adoption Visual anthropomorphism alone may not be sufficient to encourage adoption of Chabots.
Konya-Baumbach et al., (2023)	Chatbot	Conversation (manipulated)	-	Y	-		Social presence theory	Equipping chatbots with human-like verbal cues enhances social presence and desired marketing outcomes
Current study	Chatbot	Verbal and Visual	Y	Y	Y		The uncanny valley effect, cognitive appraisal theory	See Discussion section

Table created by authors.

Figure 1. Conceptual Model



Note: Dashed line indirect effect of verbal and visual anthropomorphism via mediators
Figure credited by authors.

Anthropomorphism Cues and AI

In the literature, there are many ways anthropomorphism can be integrated into AI service agents to give them human-like qualities, including visual and verbal cues. The first form/type of anthropomorphic cue, verbal, refers to humanized communication behaviors (Cohen et al., 2021) such as using a first-person pronoun (e.g., Lee & Oh, 2021), which we use in this study to describe the humanized ways that an AI service agent may use when collaborating with a consumer. The literature provides support that human-like qualities such as emotive expression of AI enhances consumers' perceptions and that this should be a key predictor of consumer subjective well-being and co-creation behavior when collaborating

with AI (Roy & Naidoo, 2021). For instance, Roy and Naidoo (2021) evidence consumers can have varying preferences of chatbots' warmth or competence linguistics depending upon their mindset. Further, research by Konya-Baumbach et al., (2023) suggest equipping chatbots with human-like verbal cues enhances social presence and desired marketing outcomes.

Beyond verbal anthropomorphism, literature also evidences the importance of related constructs for consumer well-being and co-creation. For instance, Parkinson et al., (2019) demonstrate the importance of esteem support and emotional support in online communities for generating transformative value co-creation, which also benefits the well-being of the consumer. Yao and colleagues (2015) demonstrate that emotional support has a greater effect on psychological quality of life of consumers than informational support, which lends further evidence to suggest verbal anthropomorphism may be more influential than non-verbal anthropomorphism for consumer well-being as predicted in the current study. Alternatively, when considering how verbal anthropomorphism language used by AI may enhance co-creation, support can be drawn from the study of Quach and Thaicon (2017), who demonstrate in online communities that when affective language is used consumers are more willing to seek help and consultation and engage in value co-creation. Thus, based upon the findings discussed in the AI literature, as well as the broader service literature, it is therefore plausible to suggest that the presence of verbal anthropomorphism will enhance consumers' perception of consumer subjective well-being and their co-creation behaviors. Stated formally as:

> H1. Verbal anthropomorphism of an AI will lead to significantly higher levels of (a) consumer subjective well-being and (b) co-creation behavior.

The second form of anthropomorphism, visual, refers to how design features of the AI agent emulate human-like imagery including body shape and facial expressions (Kim & McGill,

2011). Letheren et al. (2021) demonstrate how consumers prefer collaborating with humanoids as opposed to robots particularly in high or moderate social situations. In further support, Mull et al. (2015) demonstrate that human avatars were found to be the most credible and attractive in comparison to other less human avatar types. Cai et al. (2022) also consider the difference between human or robot avatars for chatbot adoption. They however suggest that the use of human (as opposed to robot) avatars for chatbots may not be sufficient. It is from this suggestion by Cai et al. (2022) as well as the limited studies that investigate how visual anthropomorphism may combine with other types of anthropomorphism cues, that the current research investigates how visual anthropomorphism may be integrated with verbal anthropomorphism to influence outcomes. Theorizing as to provide justification of why these two forms of anthropomorphism, verbal and visual, should not be combined due to them leading to decreased collaboration with AI service agents is considered next through the uncanny valley effect.

The Uncanny Valley Effect and Excessive AI Anthropomorphism

While limited literature exists on the combination of multiple forms of anthropomorphism, the uncanny valley effect (Kim et al., 2019) provides support for service managers to avoid this phenomenon. According to the uncanny valley effect (Mori, 1970), as AI agents become more human-like in appearance and behavior, they can evoke feelings of eeriness or unease in humans (Kim et al., 2019; Shin et al., 2019; Wang et al., 2015). This discomfort arises due to a subtle mismatch between the AI's almost-human attributes and its inherent non-human nature (Wang et al., 2015). To prevent triggering this unsettling response, literature and empirical evidence suggest maintaining a balanced level of anthropomorphism in AI agents that strikes a harmony between relatability and the acceptance of their artificial nature (Kim et al., 2019). The study by Kim et al. (2019) indicates that appearances and behaviors of robots should not be overly human-like to avoid negative attitudes. Similarly, the study by

Song and Shin (2022) suggests that as the human likeness of a chatbot agent increases, users' feelings of eeriness also rise, leading to lower levels of trust in the chatbot agent.

Interestingly, there are competing theories, such as the dual-coding theory and related literature, proposing that consumers process and remember information more effectively when there is congruency between how senses are stimulated, such as those presented in visual and verbal formats (Filieri et al., 2021; Pagani, Racat & Hofacker, 2019; Yang et al., 2017). Liu-Thompkins et al. (2022) support this assertion, suggesting that empathy expressed by AI may be perceived as more congruent with a human-like AI agent. Consequently, there appear to be somewhat conflicting theories or ideas regarding how AI should embody anthropomorphism and its level of humanness.

For the current study, the theoretical position of the "uncanny valley" effect guides the research along with the findings of Kim et al. (2019) and Song and Shin (2022), leading to the following specific hypothesis:

H2: When high levels of verbal anthropomorphism are paired with high levels of visual anthropomorphism, they will lead to lower levels of (a) consumer subjective well-being and (b) co-creation behavior.

Cognitive Appraisal Theory and Consumer Responses to AI

Cognitive Appraisal Theory (CAT) is a psychological framework that suggests that people's emotional experiences are shaped by their perceptions of events, rather than the events themselves (Lazarus & Folkman, 1984) and has been demonstrated to be useful for theorizing in services scholarship (Christ-Brendemuhl & Schaarschmidt, 2019; Tsarenko & Rooslani, 2011). This research specifically uses the Transactional Model of Stress[1] (Lazarus &

[1] Other CAT frameworks include that of Roseman's appraisal theory of emotions (1996). Roseman's theory highlights the causal link between cognitive appraisals and emotions, while the transactional model views emotions as both influenced by and influencing the stress appraisal process.

Folkman, 1984), a particular conceptual framework of Cognitive Appraisal Theory (Biggs, Brough & Drummond, 2017). The Transactional Model of Stress is a psychological framework that explains how people respond to stressful events, which in the context of the current research relates to consumers' collaborating with AI when being delivered "bad news" such as a service failure or service obstacle (Keating & Aslan, 2023). In particular, the transactional model of stress perspective suggests that stress (or in the case of the current research, well-being, or the need to co-create to experience value), is a result of an individual's assessment or appraisal of a situation and their ability to cope with it. In particular, the Transactional Model of Stress suggests that a primary appraisal and secondary appraisal occur, which in this research is suggested to be AI anxiety and trust in message respectively, which are considered next.

AI anxiety as a primary appraisal. In accordance with the Transactional Model of Stress (Lazarus & Folkman, 1984), a consumer interprets whether the event is dangerous (challenging, at risk of harm or threat) or positive, as the primary appraisal. For the purpose of the current research, it is theorized that AI anxiety will function as the primary appraisal in relation to evaluating whether collaborating with the AI will be dangerous. AI anxiety is defined as "excessive fear arising from problems originating from changes formed by AI technologies in personal or social life" (Kaya et al., 2022, pg. 3).

Indeed, anxiety with technology has been shown to significantly influence attitudinal perceptions as well as technology and service usage (Hsu et al., 2021; Kwarteng et al., 2023). For instance, research has considered computer anxiety (Beckers & Schmidt, 2001) and robot anxiety (Erebak & Turgut, 2022). In the broader existing body of literature on technology anxiety, there is evidence suggesting that anxiety related to technologies is not a uni-dimensional construct centred around a single source or experience. Instead, technology anxiety, inclusive of AI, is often recognized as a multi-dimensional phenomenon in the

literature (Beckers & Schmidt, 2001; Erebak & Turgut, 2022; Wang & Wang, 2022). For instance, Wang and Wang (2022) conceptualize and empirically validate a scale of AI anxiety represented by learning (anxiety of learning how AI works), job replacement (anxiety that AI will replace humans), sociotechnical blindness (anxiety of an AI malfunctioning/not providing correct service) and configuration (anxiety of the humanness of AI). When considering these dimensions within a service setting, all dimensions of AI anxiety can arguably be relevant. This is because consumers may experience anxiety related to learning how the chatbot functions, concerns about service employees being replaced by the chatbot, worries about the chatbot's accuracy and security in delivering the service. Addressing or capturing the multi-faceted nature of AI anxiety therefore becomes crucial for service providers in ensuring that consumers trust the technology and also that the benefits of AI automation is not at the percieved expense of human expertise.

However, whilst literature has demonstrated the importance of anxiety with technology on service outcomes (Hsu et al., 2021; Kwarteng et al., 2023), there is currently a lack of understanding in the AI literature as to how anxiety with technology may play an explanatory role in how consumers respond to the design of AI, and in particular approaches which fully capture the multi-dimensionality of such anxiety and its role as a potential explanatory mechanism (mediator). Thus, to overcome this limitation in the AI literature, support is drawn from the wider anxiety literature.

In the wider literature, anxiety, has been demonstrated as a key mediator for relationships pertaining to coping and well-being (Akram, Ellis & Barclay, 2015; Kushner et al., 2001). For instance, Akram and colleagues (2015) demonstrate that anxiety mediates the relationship between individuals' perfectionism and insomnia symptoms. Whereas Kushner et al. (2001) demonstrate anxiety mediates the association between sensitivity and coping-related drinking. Thus, whilst AI anxiety has not yet been shown as a key mediating

mechanism of AI technology use, based upon theorizing that it will function as a primary appraisal in accordance with CAT and prior wider anxiety literature, it is suggested anxiety with technology should play a key mediating role in the AI anthropomorphism and well-being/co-creation relationship.

Trust in message as a secondary appraisal. Next and consistent with the conceptual model and theorizing based upon the transactional model of stress, trust in message is considered as the secondary appraisal. From the perspective of the transactional model of stress, a secondary appraisal refers to the individual's evaluation of their availability of resources to cope with a specific situation. For the purpose of this research, this theorizing is extended beyond evaluation of personal resources, to an evaluation of the resources provided by the AI in collaboration with the consumer. It is suggested that a consumer will make an evaluation of their trust in the resource (information) provided by the AI.

In support of trust in AI's inclusion as the second mediator in the current study, related AI literature is consulted (Cai et al., 2022; Kim et al., 2021; Riedel et al., 2022). Riedel et al. (2022) demonstrate that trust functions as a secondary mediator proceeding after emotions, in consumers' evaluation of banking services provided by AI, which bares similarities to the conceptualized AI anxiety-trust in message sequence in the current study. Kim et al. (2021) also show trust to mediate the relationship between preciseness of information provided by AI, and behavioral intention. In further support, Cai et al. (2022) demonstrate trustworthiness to mediate the impact of anthropomorphism of AI on adoption of chatbots. Thus, based on prior literature, there is evidence supporting trust as a mediator for consumer collaborations with AI, inclusive of when anthropomorphism is present.

In sum of the prior discussion, there is strong support that both AI anxiety and trust in message, could be potential mediators in the relationship between AI anthropomorphism and well-being/co-creation, yet there is little to no research which considers both within the same

study. To overcome this limitation in the current literature and supported by the transactional model of stress theoretically linking these two concepts as primary and secondary appraisals, the following is hypothesized:

> H3. AI anxiety and trust in message will function as primary and secondary appraisals by serially mediating the relationship between AI anthropomorphism and (a) consumer subjective well-being and (b) co-creation behavior.

STUDY OVERVIEW

To test the hypothesized relationships, this research conducted three experimental studies (see Table 2 for an overview). Study 1 examines how the use of verbal anthropomorphism integrated into AI could assist consumers' subjective well-being when collaborating. AI anxiety and trust in messages are then studied as the underlying consumer appraisals (mediators). Study 2 builds upon Study 1 by examining the effects of visual anthropomorphism paired with verbal anthropomorphism, and their combined influence on subjective consumer well-being. Study 3 then replicates Study 2 but considers consumer collaboration in the form of co-creation behavior as the outcome, instead of subjective consumer well-being.

The context for all three studies is banking and in particular the delivery of "bad news" such as service failure or service obstacles (a loan application being rejected). The grounding of the studies in financial services was deemed appropriate given the prevalence of AI use in this industry and the extent of prior AI research in this domain (see for example, Cao, 2022). As a utilitarian service, banking and in particular loans, has been suggested as an appropriate context for AI service delivery (Huang & Rust, 2021) due to the focus on instrumental and functional benefits, thus providing a good environment to replace human interactions (Le et al., 2023). According to industry reports, the utilization of chatbots has

experienced significant growth. In the beginning of 2020, approximately 4% of mid-sized banks and credit unions in the United States had implemented chatbot technology. However, by the end of that year, the adoption rate had tripled to reach 13% (Shelvin, 2021). Given the literature support regarding banking as a utilitarian service and the increasing prevalence of AI within the industry, it was considered suitable to situate the study within this domain. Further, the selection of considering service failure situations is consistent and extends upon the work of Garvey et al. (2023) who find AI should be used when delivering bad news to customers, as well as the work of Keating et al. (2023) who show the importance of considering the use of human and non-human service agents following a service obstacle, a situation where a customer is hindered from completing a desired task.

Table 2: Empirical Overview

Study	**Sample size**	**Anthropomorphism** *Verbal*	*Visual*	**AI Anxiety**	**Trust in Message**	**Consumer well-being**	**Co-creation Behavior**
1	242	Y		Y	Y	Y	
2	211	Y	Y	Y	Y	Y	
3	194	Y	Y	Y	Y		Y

Table created by authors.

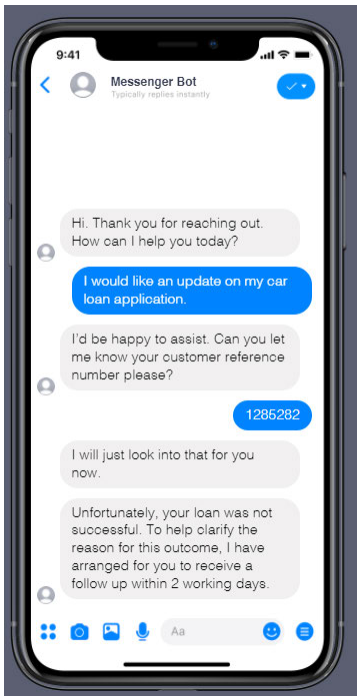
STUDY 1

Study 1 involved a one factorial, two level (verbal anthropomorphism: present vs. absent) design. Participants were randomly assigned to one of the two conditions through a function within Qualtrics. First, participants were provided with ethics information for the study. Participants then completed demographic information including age, gender, and previous AI use. Following this, participants were instructed: “Imagine you have applied for a car loan. You want an update on the loan process, so you contact your bank through their online service. The following conversation results with a chatbot”, which was followed by exposure to the stimuli. Participants then completed the mediating (AI anxiety and trust in message) and outcome variable (consumer well-being) measures.

Stimulus development and pretest. Prior to hypothesis testing, the stimuli were developed and assessed. The stimuli involved a written chatbot correspondence between a customer and an AI service agent with manipulations based upon whether a verbal anthropomorphism cue was present or not. We used a between-subjects experimental design in which we manipulated verbal anthropomorphism (present or not) and assigned participants randomly to the two conditions. First, participants read a description of the service delivery. According to the description, a consumer was asking for an update on their car loan application. In the first condition, the consumer was presented with verbal anthropomorphism cues such as first-person pronouns, "I" (Lee & Oh, 2021), and affective language such as "happy to assist" and "unfortunately" (Quach & Thaicon, 2017) when they interacted with the AI service agent. Further, as identified in the literature, additional human-like qualities can be added to AI through empathetic (affective) language, and thus consistent with this, the AI chatbot was designed to incorporate reflected emotions (Lewis et al., 2018). This verbal anthropomorphism was lacking with the second condition. The complete verbal stimuli can be seen in Figure 2.

Figure 2. Study 1 stimuli

Verbal anthropomorphism present



Verbal anthropomorphism absent

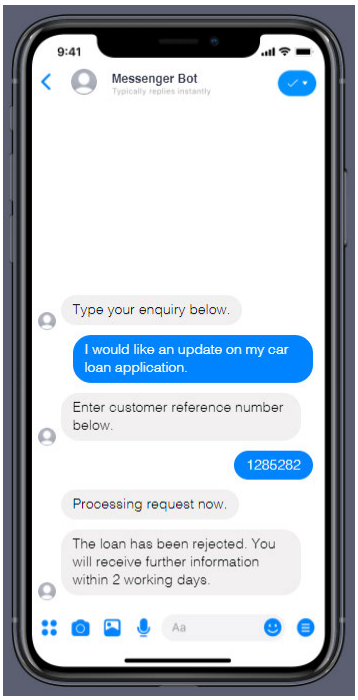


Figure created by authors.

To ensure the experimental manipulation was designed as intended, a pre-test was conducted to establish the verbal anthropomorphized manipulation, as well as to establish the realism of the AI interaction. Forty participants were randomly assigned to the verbal anthropomorphized absent and present stimuli conditions. To establish the success of the verbal anthropomorphism manipulation, participants were asked to indicate the level of emotion that the AI used (Septianto & Pratiwi, 2016). The utilization of anthropomorphism in language manipulation was deemed appropriate for several reasons. The literature provides evidence that the incorporation of positive emotional language, a key component of the language manipulation in this anthropomorphic context, is indicative of empathy (Nguyen, et al. 2023). Additionally, the literature highlights the existence of affective approaches to empathy, even within robot-human interactions (Leite et al., 2013).

From an affective perspective on empathy, empathy can be defined as "an observer's emotional response triggered by their perception that another individual is currently experiencing or is on the verge of experiencing an emotion" (Stotland, 1969, p. 272). In the context of the present research, this definition aligns with the AI's role as an observer. The AI responds emotionally through language based on its interpretation that a service-related situation may elicit an emotional response from the consumer, indicating a heightened level of intelligence that approaches humanistic characteristics. It was for this reason and given that other anthropomorphic scales do not isolate this aspect, we employed the integration of emotion into communication or specifically written text, as identified in the manipulation check by Septianto and Pratiwi (2016), which is consistent with other studies which use the expression of integration of emotion in communication as a proxy for anthropomorphism in AI (Nguyen, et al. 2023). This check helps us determine the extent to which emotion is integrated into the AI's responses and aligning with the way in which the current study manipulates linguistic anthropomorphism.

The results of the manipulation check confirmed the manipulation, $t(38) = -4.041$, $p = <.001$, with the verbal anthropomorphism present condition ($M= 3.90$) producing higher perceived levels of emotion than the verbal anthropomorphism absent condition ($M= 1.75$). Thus, the manipulations were taken forward into the main study.

Participants and experimental design. A total of 242 participants (64.5% male, $M_{age}= 37.42$, $SD=9.69$), were recruited for Study 1. To measure AI anxiety, 21 items were adapted from the study of Wang and Wang (2022) (loadings: .66-.86, $\alpha = .97$) measured on a 1-5 Likert scale (strongly disagree-strongly agree). Further, consistent with the original work of Wang and Wang (2022) we considered and confirmed AI anxiety as a higher order construct represented by the dimensions of learning, AI configuration, job replacement, and sociotechnical blindness (please refer to Appendix A for items). To measure trust in message,

12 items were adopted from Wu and Lin (2017; loadings: .58-.84, α =.93). Well-being was measured using Cao et al.'s (2021) scale (loadings: .84-.91, α =.92) with two items dropped due to poor factor loadings (see Appendix A). Further, participants' experience with AI was measured to be used as a covariate (control variable) within the analysis with participants indicating their familiarity with using AI systems on a scale of 1 (not familiar at all) to 5 (extremely familiar).

Results. The data were analyzed using PROCESS Model 6 with 5,000 bootstrap resamples and a 95% confidence interval. For the purpose of the analysis, verbal anthropomorphism present was coded as a 1 and verbal anthropomorphism absent was coded as a 2. The results demonstrated that AI anxiety was significantly reduced in the verbal anthropomorphism condition (B= -.37, SE=.14, t=2.61, p=.009). Next, the results demonstrated that AI anxiety had a negative effect on trust in message (B= -.14, SE=.03, t= -2.46, p=.014). Trust in message was then shown to have a significant direct effect on positive well-being (B= .41, SE=.05, t=7.61, p=.000). The indirect effect of verbal anthropomorphism was shown to be significant and directed towards verbal anthropomorphism present (2) as opposed to verbal anthropomorphism absent (1) (B=.01, SE=.01, LCI=.001, UCI=.03). The model produced an R^2 of .61 for well-being. The covariate of prior AI use was found to have a significant impact upon trust with message (B=.14, SE=.07, t= 2.02, p=.04) and well-being (B=.17, SE=.08, t=2.19, p=.02).

Discussion. The results of Study 1 provide evidence that verbal anthropomorphism enhances consumers' perceptions of well-being when interacting with an AI service agent. Further, support and explanation as to why this relationship was evident was provided by the serial mediating roles of AI anxiety and trust in message. Specifically, the results were able to demonstrate that verbal anthropomorphism use by AI service agents reduces anxiety,

subsequently increasing trust in the message from the AI service agent and cumulates in a greater sense of well-being.

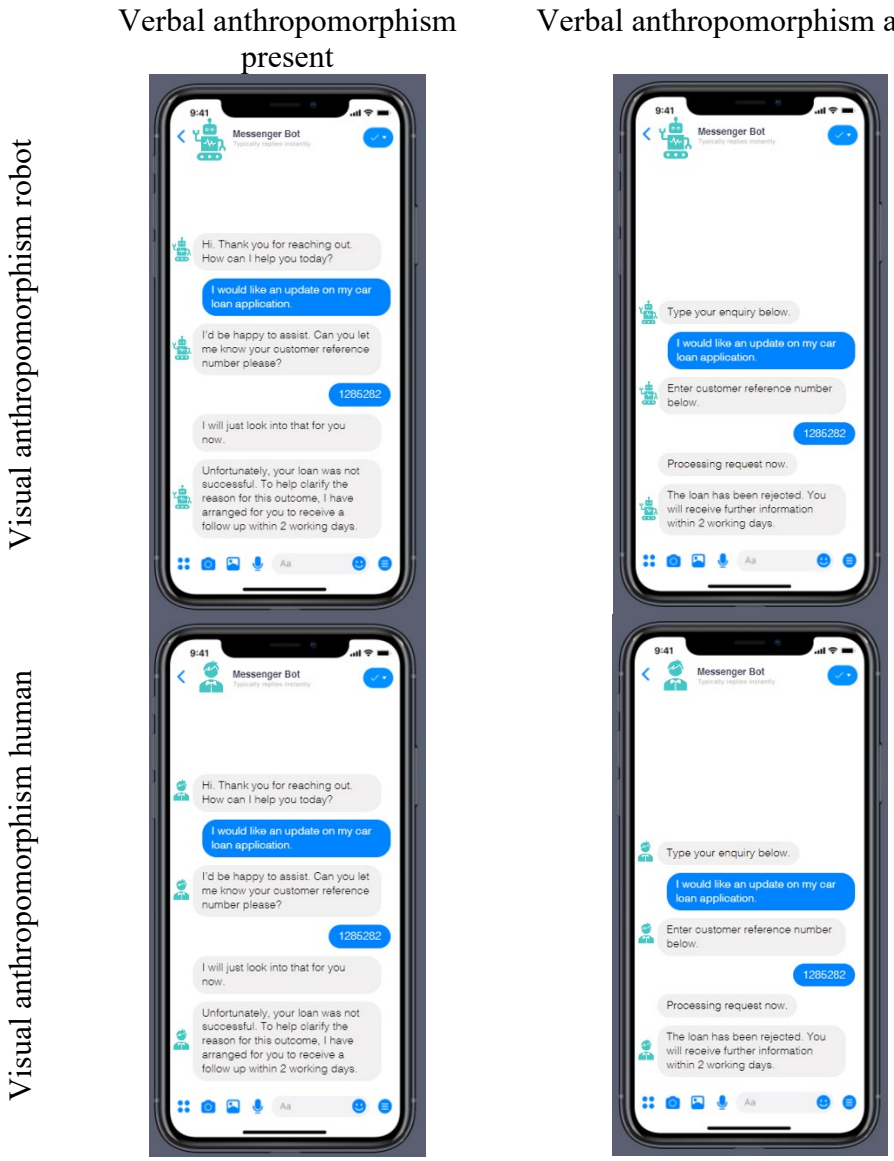
STUDY 2

In Study 2, the serial mediating roles of AI anxiety and trust in message were again assessed. However, an extension on Study 1 was also incorporated by examining how visual anthropomorphism interacts with verbal anthropomorphism and thus testing whether an AI agent may become "too human" and thus triggering the uncanny valley effect.

Design and Sample. Study 2 involved a 2 (verbal anthropomorphism: present vs. absent) x 2 (visual anthropomorphism: robot vs. human) design. Participants were randomly assigned to one of the four conditions through a randomization link. The experiment was consistent with Study 1 with the same measures and instructions for participants utilized, however, the stimuli were updated to reflect the new conditions. The participants for Study 2 were 211 U.S. consumers (64.5% male, Mage= 30.00, SD=8.64).

Stimuli development and pre-test. The verbal anthropomorphized AI service agent conversations were consistent with Study 1 however, AI service agent anthropomorphism was instantiated in Study 2 by also displaying either a human-like or robot-like avatar in the chat window, which is consistent with other literature investigating the anthropomorphism of AI (Kim et al., 2023; Letheren et al., 2021). These visual anthropomorphic cues (Aggarwal & McGill, 2007) can reproduce different levels of perceived humanness within text-based chatbots (Rapp et al., 2021) The stimuli can be seen in Figure 3 below.

Figure 3. Study 2 Stimuli



Figures created by authors.

To ensure the introduced visual anthropomorphism manipulation was interpreted by participants as intended, a pre-test was undertaken. Sixty-six participants were randomly assigned to the anthropomorphized human and robot stimuli conditions. Participants were asked the extent to which the bot "looks like a person", "seemed almost as if it has free will", and "seemed almost as if it had intentions" (Kim & McGill, 2011). A significant difference was identified between the conditions, $t(64) = 2.269$, $p = .027$ with the human avatar anthropomorphism condition ($M = 6.33$) producing higher perceived levels of

anthropomorphized traits than the robot anthropomorphism condition (M= 5.71). Thus, the stimuli were taken forward for testing in the main study.

Results. To test the entirety of the conceptual model, the data were analyzed using PROCESS Macro Model 85 with 5,000 bootstrap samples. The results demonstrated that the interaction of visual anthropomorphism (1=Robot, 2=Human) and verbal anthropomorphism (1= not present, 2=present) had a significant impact on AI anxiety (B= .57, SE=.28, t=2.04, p=.04). The conditional effects demonstrated that when human visual anthoromoprhism was paired with present verbal anthropomorphism that this leads to significantly higher levels of AI anxiety (B= .43, SE=.20, t=2.17, p=.03). Whereas, in the robot visual anthropomorphism condition, the effect was in the opposite direction towards absence of verbal anthropomorphism condition but was non-significant (B= -.14, SE=.19, t= -.71, p=.47). In sum, these results demonstrate indeed "too human" an AI service agent can lead to potentially adverse effects.

For the human condition, the indirect effect was significant on well-being when verbal anthropomorphism was not present (B= -.01, SE=.01, LCI= -.02, UCI= -.001), whereas for the robot condition the effect was significant but directed towards presence of verbal anthropomorphism (B=.002, SE=.01, LCI=.001, UCI=.03). Further, the index of moderated mediation was significant (index= -.01, SE=.02, LCI= -.01, UCI= -.08). The model produced an R^2= .71 for consumer well-being. The covariate of prior AI use was found to have a significant impact upon trust in message (B= .16 SE=.06, t=2.43, p=.01) and AI anxiety (B=.29, SE=.07, t=4.25, p=.000).

Discussion. The results of Study 2 provide evidence to suggest that high anthropomorphic cues paired together, such as verbal anthropomorphism and human avatars, can have adverse effects on consumers' well-being whilst interacting with AI. Consistent with the results of Study 1, the relationship between AI anthropomorphic cues and consumer

well-being was explained via the mediators of AI anxiety and trust in message, providing further support for the theorizing on the basis of the theoretical model of stress and its suggested primary and secondary appraisal pathway. What is yet to be explained is whether these sets of relationships are able to extend to predict a greater likelihood of consumer collaboration in the form of co-creation behavior, which is considered next in Study 3.

STUDY 3

Procedure Design and Sample. For Study 3, 194 consumers (64.5% male, Mage= 33.50, SD=11.26) were recruited through a third-party online survey panel. The stimuli and measures with the exception of co-creation behavior were consistent with Study 2. Co-creation behavior was measured using the scale of Yi and Gong (2013), which was adapted to align with consumers' co-creating with an AI service agent as opposed to a human employee. Consistent with the original work of Yi and Gong (2013), prior to hypothesis testing, we assessed co-creation behavior as a hierarchical third-order reflective construct using a confirmatory factor analysis. The confirmatory factor analysis demonstrated adequate levels of reliability and validity at the third order (first level loadings: 60-945, $\alpha \geq .70$). A computed score was then generated for co-creation behavior for analysis.

Results. As per Study 2, the analysis was undertaken using Model 85 in PROCESS with 5,000 bootstrapping samples with two models assessed considering both co-creation and consumer well-being as the outcomes.

Co-creation model. The results demonstrated for the co-creation model that there was a significant interaction between the anthropomorphic cues (verbal and visual) on AI anxiety (B= .37, SE=.12, t=3.05, p=.002). The conditional effects demonstrated that a congruent pairing of the anthropomorphic cues of human avatar with present verbal anthropomorphism was more likely to increase AI anxiety (B=.20, SE=.08, t=2.38, p=.02). Whereas, when the

pairing of robot avatar with absent verbal anthropomorphism was used, this increased AI anxiety (B= -.18, SE=.08, t=2.08, p=.03).

The covariate of prior AI use was found to have a significant effect on co-creation (B=.10, SE=.04, t=2.35, p=.01). The index of moderated mediation was significant (index=-.01, SE=.01, LCI=-.03, UCI=-.002). Specifically, the indirect effect when the human avatar and verbal anthropomorphism was present this was found to be non-significant on co-creation via anxiety and trust in message (B= -.006, SE=.006, LCI= -.02, UCI= .001). Whereas, in the robot avatar, when verbal anthropomorphism was present, this was found to increase the likelihood of co-creation (B=.005, SE=.00, LCI= .001, UCI=.01). This therefore suggests that if co-creation behavior is a desired outcome with an AI agent, a robot using affective language should be utilized. The model produced an R^2 of .18 for co-creation.

Well-being model. The results replicated with a significant index of moderated mediation observed (index= -.03, SE=.02, LCI=-.10, UCI=-.001). The conditional effects demonstrated that incongruent pairing of the anthropomorphic cues of human avatar when verbal anthropomorphism was not present were more likely to increase well-being (B= - .02, SE=.01, LCI=-.06, UCI= -.01). Whereas, when the pairing of robot avatar with verbal anthropomorphism was used, this increased well-being but was non-significant (B= .01, SE=.01, LCI= -.0009, UCI=.05). The model produced an R^2 of .07 for well-being.

Post-hoc model: A post-hoc model was also conducted, where well-being and co-creation were included within the same model, incorporating the prior ordering of relationships. In this configuration, well-being was introduced as an additional mediator, with the sequence of relationships as follows: anthropomorphism verbal x visual → AI anxiety → trust in message → well-being → co-creation. The index of moderated mediation did not reach statistical significance (index= -.00, SE= .00, LCI= -.006, UCI= .00). It is worth noting

that the relationship between well-being and co-creation (B= -.00, SE= .03, p= .89) was also non-significant, indicating that the two dependent variables do not predict each other.

Discussion. The results of Study 3 provide further evidence that when pairing high anthropomorphic cues of verbal anthropomorphism and visual anthropomorphism, this increases the likelihood of AI anxiety consistent with the "uncanny valley" effect. Whereas, when verbal anthropomorphism was present and paired with a robot, this effect likely to increase the likelihood of co-creation due to lower AI anxiety and greater trust in the message provided by AI service agent. Thus, the relationship between AI service agent anthormoporhic cues and co-creation behavior, and well-being was again explained by the mediators of AI anxiety and trust in message, which is consistent with the results of Study 1 and 2, and also provides additional support for the theoretical foundation on the basis of CAT. Thus, overall, the results suggest that if wanting to protect consumer well-being, "too human" avatars should be avoided, and if wishing for co-creation to occur, robots using affective language is preferred.

GENERAL DISCUSSION

Across three experimental studies, this research provides empirical evidence as to how anthropomorphism impacts consumers' responses to collobrating with AI and their subjective well-being and willingness to engage in collaborative co-creation behavior, contributing to the limitations in current knowledge (Le et al., 2023). Across the experimental studies concrete evidence is provided as to how different forms and combinations of anthropomorphism elicit and or mitigate consumer appraisals of AI anxiety and trust in message. Overall, evidence is shown that carefully considered combined anthropomorphism cues can enhance consumer well-being and likelihood of co-creation behavior when consumers interact with AI service agents. The theoretical and practical implications of these findings will now be discussed.

Theoretical implications

By integrating the "uncanny valley" effect and the transactional model of stress, this research was able to theorize and empirically validate a model which explains how different combinations of verbal and visual anthropomorphism elicit primary and secondary appraisals, which subsequently impact consumer subjective well-being and co-creation. Three key theoretical implications of this theorizing will now be outlined.

The first implication for service theory relates to how anthropomorphism can be used to mitigate barriers to consumers' collaboration and co-creation with AI and hence, contributes towards SRP6 in relation to how service practitioners can design technology for a greater sense of trust. While prior research has investigated anthropomorphism of AI, the majority of the literature has focused on one sole way in which this can be operationalized (e.g. Roy & Naidoo, 2021; Konya-Baumbach et al., 2023). To overcome this limitation in the current AI and service literature, the current study theorized on the basis the "uncanny valley" effect that incorporating multiple forms of anthropomorphism would likely lead to can hinder maintaining or improving consumer well-being when interacting with AI and decreased the likelihood of co-creation behaviors . Indeed, the results support the theorizing of the "uncanny valley" effect and other related AI literature which has been underpinned by its tentants (Mori, 1970; Kim et al., 2019), showing the verbal anthropomorphism in isolation can contribute to positive results but once combined with additional forms of visual anthropomorphism, this addition of "humanness" may work against the likelihood of detrimental impact on consumers' collaborating with AI. Thus, a key implication of this research for future service scholarship is considering theorizing, developing, and empirically testing conceptual models underpinned by the uncanny valley effect detailing the boundaries of how different humanistic features of AI should be used.

Using Cognitive Appraisal Theory and in particular, the Lazarus Transactional Model of Stress (Lazarus & Folkman, 1984), this research was able to demonstrate the psychological process by which consumers evaluate their collaborative experiences with AI, and by doing so provides important insights into SRP2, technology and customer experience. As noted previously, the service literature has often considered singular mechanisms (psychological processes) which explain consumer responses to AI (See Table 1). This research however theorized, that a primary appraisal, the evaluation of whether collaborating with AI would be positive or dangerous, followed by a secondary appraisal of the resources provided by the AI, would occur. This theorizing was supported by the empirical results demonstrating that AI anxiety as the primary appraisal, and trust in message as the secondary appraisal, serially mediate the effect of AI anthropomorphism and consumer subjective well-being and co-creation. In doing so, this research not only unifies AI and the technology literature which has considered anxiety (Hsu et al., 2021; Kaya et al., 2022; Kwarteng et al., 2023) and trust (Cai et al., 2022; Kim et al., 2021; Riedel et al., 2022) separately, but also demonstrates how consumer evaluations of collaborating with AI include two appraisals as opposed to one. A key implication of this finding for future service scholars' theorizing and conceptual development, in relation to consumers' collaboration and experience with AI, is to consider how to integrate primary and secondary appraisals, which evaluate consumers' perceptions of danger/safety followed by evaluations of resources provided by AI to the consumer.

A third contribution of this research is the integration of well-being and the likelihood of consumer co-creation with AI service agents. While previous studies have separately examined co-creation (Čaić et al. 2018; Leone et al., 2021; Lalicic & Weismayer, 2021) and consumer well-being (Henkel, et al., 2020; Uysal, et al. 2022) when interacting with AI, very few, if any, have considered both within the same study, or how the design of AI can contribute to these outcomes. Therefore, this research is among the first to propose and

demonstrate a theoretical model based on the uncanny valley effect and Cognitive Appraisal Theory, predicting how the design of AI can enhance both co-creation and consumer well-being, thereby delivering outcomes for both the organization and the consumer (Noble et al., 2022). The key implication of this for future service scholarship and investigations of AI is the potential for theoretical integration, whereby using multiple theories can provide opportunities for a more comprehensive understanding of how AI can facilitate multiple outcomes, such as enhanced collaboration through co-creation and well-being, thus contributing to the advancement of theory and the generation of new knowledge.

Practical Implications

The findings of this research have important practical implications. First, the findings demonstrate how the design of AI service agents needs to be carefully considered by service organizations. In instances where textual (e.g. email, text message) or verbal exhanges are the sole way a consumer collobrates with an AI service agent, this research suggests service managers should ensure the AI service agent utilizes verbal anthropomorphism language. Depending upon how the verbal anthropomorphism of the AI service agent is operationalized, expression of emotions through words and tone of voice should be considered. One way service managers can achieve this is through using natural language processing (NLP) algorithms to assist chatbots to recognize emotional cues by consumers and respond with empathetic and affective responses. By using NLP algorithms, service organizations can also ensure that the use of affective language is potentially more authentic as it is using the cues and input from the consumer, as opposed to using affective language as a default.

Another important managerial implication for service managers' consideration, is whether AI service agents are required to be "the face" of the service interaction. While previous research has tended to explore how consumers react to service failure when an AI

service agent delivers the service (Pavone et al., 2023), this current research explores how organizations can deliver 'bad news' to consumers using AI within utilitarian services. The current research shows that organizations can still achieve somewhat favorable outcomes with consumers when they carefully consider what human-like features should be used when delivering "bad" news in relation to service results within utilitarian contexts which offers opportunities for service managers within these industries. As demonstrated in the results of Study 2 and 3, if AI service agents it is best to avoid being "too human" when attempting to improve or maintain consumer well-being and their likelihood of engaging in co-creation behaviors.

Beyond the design of AI service agents, there are managerial implications about the importance of AI anxiety. AI anxiety was the first key mechanism identified in the current study and on the basis of this finding it is suggested that service providers should consider ways in which they can help manage anxiety and ensure greater collaboration with their AI. For instance, service providers could provide information to consumers about the capabilities and limitations of the AI prior to collobration taking place. This can help consumers understand what to expect from their collobration with the AI and mitigate feelings of anxiety. Extending beyond this, service providers could provide counter arguments to the potential anxieties of consumers, such as providing comparative benefits of being served by an AI service agent. This could include benefits on the basis of efficiency, ease of use and accuracy. Other alternatives could include transparency in relation to how the AI service agent has been developed and trained. Clearly communicating the rigour and development process of the AI service agent may provide consumers' reassurance as to the quality of the AI service agent.

Limitations and future research directions

While this study has several strengths, including its experimental manipulation of two types of anthropomorphism, there are also opportunities for future research to address its limitations. One potential extension is to investigate additional anthropomorphic cues, such as social interaction or other design aspects such as gender, name, and age. This could shed light on whether the results observed in the current study can be extended to other cues beyond visual and verbal ones. In addition to examining additional anthropomorphic cues, future research could seek to probe how the levels of particuar cues may alter consumers' perceptions of collobrating with AI service agents. For instance, whilst verbal anthropomorphism was demonstrated as a useful way to anthropomorphize AI service agents in the current research, future research could examine whether too much affective language use may diminish its positive impact. This type of extension could also support the boundaries around the best way to deliver negative outcomes via AI. Future research may like to investigate negative service outcomes like those explored in the current studies, with transparency around the decision making process which has been highlighted as an important area of future investigation (Ostrom et al., 2019). Understanding the intersect of anthropomorphic cues and message transparancy offers avenues to improve consumer well-being further.

It is crucial to acknowledge that the scope of this research has been limited to studying consumers' reactions to AI service agents specifically in the context of financial services, using experimental research methods. While this approach has provided valuable insights into the dynamics of AI-agent interactions in banking settings, it may raise questions about the generalizability of the findings to other service domains. To gain a more comprehensive understanding of the broader implications of AI service agents, future research could explore how consumers' reactions differ when transitioning from utilitarian services, such as banking, to hedonic services, such as travel and tourism. The impact of AI

service agents could potentially vary across different service contexts, given the diverse nature of consumer needs, expectations, and emotional experiences.

While this research successfully demonstrated the impact of anthropomorphism on AI anxiety, its methodological design limited its ability to determine whether there was a change in consumers' pre-existing AI anxiety levels. To further enhance our understanding, future research should consider employing research designs that measure AI anxiety before and after exposure to anthropomorphized AI. By doing so, we can gain insights into the potential shift in individuals' anxiety levels. Additionally, future work could investigate whether anthropomorphism of AI influences various dimensions of well-being, a topic that fell outside the scope of the current research. Exploring this aspect would provide a more comprehensive understanding of the effects of AI anthropomorphism on consumers. To achieve this, researchers could utilize frameworks such as PERMA (positive emotions, engagement, relationships, meaning, and achievement) or other multi-dimensional well-being frameworks. These frameworks can serve as valuable tools to explore the boundaries where AI anthropomorphism positively contributes to consumer well-being. Another interesting area for future research is to examine how consumer traits or competencies, such as emotional intelligence or need for social interaction, may affect their openness to accept anthropomorphism in AI service agents and subsquent collobrations. Frameworks like the Technology Readiness Index and Emotional Intellgience may provide insights into the heterogeneous or homogeneous effects of anthropomorphism on consumers. Lastly, personalization is a promising area for future research, particularly exploring how offering consumers the ability to customize the anthropomorphic features of their AI service agent might enhance collaboration and improve subjective well-being. The current research randomly allocated participants with the anthropomorphic features of their AI service agent. However, future research could consider personalization in a way similar to how people

choose the features of their video game avatars. Providing options for personalizing the anthropomorphised AI service agents may help reduce anxiety when collobrating with AI. Indeed, research demonstrates that personalization of service experiences can enhance both consumer and organizational outcomes (Chandra, et al., 2022). It would be interesting to see whether such relationships may extend to personalizing the anthropomorphic features of AI service agents and how this may mitigate anxiety when collobrating with them.

Finally, another avenue deserving of attention centers on the demonstrated significance of AI familiarity, which was found to enhance co-creation, trust in the message, and well-being, albeit with some inconsistencies observed across the studies. Nevertheless, there is compelling evidence indicating that AI familiarity indeed exerts an influence, even though the exact nature of this influence remains enigmatic.Subsequent research efforts could aim to explore whether AI familiarity might offer additional insights into the extent to which various forms of anthropomorphism can be seamlessly integrated into AI, and how these integrations impact evaluations of AI-human interactions. Furthermore, examining which metrics or sources of AI familiarity are most pertinent may yield valuable insights. Understanding the nuances of how familiarity with AI shapes perceptions and behaviors could prove instrumental in enhancing our comprehension of the evolving landscape of human-AI interactions and, by extension, inform the design and implementation of AI systems across different contexts.

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Appendix A scale items used across studies

AI anxiety scale

Learning

- Learning to understand all of the special functions associated with an AI technique/product makes me anxious.
- Learning to use AI techniques/products makes me anxious.
- Learning to use specific functions of an AI technique/product makes me anxious.
- Learning how an AI technique/product works makes me anxious.
- Learning to interact with an AI technique/product makes me anxious.
- Taking a class about the development of AI techniques/products makes me anxious.
- Reading an AI technique/product manual makes me anxious.

Job Replacement

- I am afraid that an AI technique/product may make us dependent.
- I am afraid that an AI technique/product may make us even lazier.
- I am afraid that an AI technique/product may replace humans.
- I am afraid that widespread use of humanoid robots will take jobs away from people.
- I am afraid that if I begin to use AI techniques/products I will become dependent upon them and lose some of my reasoning skills.
- I am afraid that AI techniques/products will replace someone's job.

Sociotechnical Blindness

- I am afraid that an AI technique/product may be misused.
- I am afraid of various problems potentially associated with an AI technique/product.
- I am afraid that an AI technique/product may get out of control and malfunction.
- I am afraid that an AI technique/product may lead to robot autonomy.

AI Configuration

- I find humanoid AI techniques/products (e.g. humanoid robots) scary.
- I find humanoid AI techniques/products (e.g. humanoid robots) intimidating.
- I don't know why, but humanoid AI techniques/products (e.g. humanoid robots) scare me.

Trust in message scale

- Dishonest/honest
- Phony/Genuine
- Unethical/Ethical
- Unreliable/Reliable
- Insincere/Sincere
- Not convincing/Convincing
- Not credible/Credible
- Unreasonable/Reasonable
- Unquestionable/Questionable

- Inconclusive/Conclusive
- Not authentic/Authentic
- Untrustworthy/Trustworthy

Well-being scale

- The chatbot made me feel relaxed (dropped due to poor loading)
- The chatbot made me feel anxious*
- The chatbot made me feel redundant*
- The chatbot made me feel useless*
- The chatbot made me feel inferior*
- The chatbot increased my satisfaction (dropped due to poor loading)

Note: * items reversed when computed

Co-creation behavior scale

Information seeking

- I would ask the chatbot for information on what this service offers.
- I would search for information on where this service is located.
- I would pay attention to how others behave to use this chatbot as well.

Information sharing

- I would clearly explain what I wanted the chatbot to do.
- I would give the chatbot proper information.
- I would provide necessary information to that the chatbot could perform their duties.
- I would answer all the chatbot service related questions.

Responsible behavior

- I would perform all the tasks that required by the chatbot.
- I would adequately complete all expected behaviors by the chatbot.
- I would fulfill responsibilities to the chatbot.
- I would follow the chatbot directions.

Personal interaction

- I would be friendly to the chatbot.
- I would be kind to the chatbot.
- I would be courteous to the chatbot.
- I wouldn’t act rudely to the chatbot.

Feedback

- If I have a useful idea on how to improve the service, I would let the chatbot know.
- When I receive good service from the chatbot, I would comment about it.
- If I experienced a problem, I would let the chatbot know about it.

Advocacy

- If the service provided by the chatbot is not as expected, I would be willing to put up with it.
- If the chatbot makes a mistake during service delivery, I would be willing to be patient.
- If I had to wait longer than normally expected to receive the service from the chatbot, I would be willing to adapt.

Helping

- I would give advice on where to use the chatbot.
- I would assist other people in using the chatbot.
- I would show other people how to use the chatbot.
- I would show other people how to use certain features of the chatbot.