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# MORE ATTRACTIVE THAN EXPECTED? EFFECTIVENESS OF THE EMBODIED VIRTUAL AGENT IN ONLINE SHOPPING RECOMMENDATION: MODERATION EFFECT OF CAPABILITY AND MEDIATION EFFECT OF TRUST

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# MORE ATTRACTIVE THAN EXPECTED? EFFECTIVENESS OF THE EMBODIED VIRTUAL AGENT IN ONLINE SHOPPING RECOMMENDATION: MODERATION EFFECT OF CAPABILITY AND MEDIATION EFFECT OF TRUST

A DISSERTATION APPROVED FOR THE

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## Abstract

This study explores the growing field of Intelligent Virtual Agents (IVAs) in e-commerce, with a focus on embodied virtual agents (EVAs) that serve as virtual sales assistants. It examines how the physical attractiveness of EVAs influences consumer attitude and purchase behavior through two empirical studies grounded in expectancy violation theory. The first study assesses the impact of attractiveness-related expectancy violations on consumer attitudes, and purchasing intentions, incorporating novelty-seeking tendencies and the need for cognitive closure as moderating variables as well as trust as a mediating variable. The second study explores the interaction between EVAs' attractiveness violations and their functional capabilities, examining whether an EVA's effectiveness in influencing consumer response depends on its perceived capabilities. This research extends our understanding of how EVAs' appearance impacts digital consumer interactions and offers insights for enhancing online shopping experiences and business performance.

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# More Attractive than Expected? Effectiveness of the Embodied Virtual Agent in Online Shopping Recommendation: Moderation Effect of Capability and Mediation Effect of Trust

## Introduction

The integration of Intelligent Virtual Agents (IVAs) into the digital world, particularly in e-commerce, has seen remarkable growth. The global market size of these IVAs was estimated to be around $5.82 billion in 2020 (Grand View Research, 2021). Moreover, the market is projected to grow at a compound annual growth rate of almost 30% from 2021 to 2028. The growing interest and investment in IVAs underline their increasing significance. This study focuses on a specific type of IVA known as embodied virtual agents (EVAs), which are computer-generated visual characters that function as virtual sales assistants in online stores (Holzwarth et al., 2006).

In recent years, technological advancements have greatly enhanced the visualization quality of EVAs (Korkut & Surer, 2023; Bailenson, Blascovich, Beall, & Loomis, 2003). These EVAs have become more sophisticated, closely resembling real human beings. Because they possess a human-like form, their physical appearance, especially their attractiveness, becomes a key factor influencing consumers' perceptions and decisions. Earlier studies have emphasized the role of physical attractiveness in affecting consumer behaviors. It suggests that attractive salespeople are more likely to influence consumers' purchasing decisions positively (Ohanian, 1990; Kahle & Homer, 1985).

However, despite its potential significance, the concept of attractiveness as applied to EVAs is not straightforward. It can be subjective and influenced by several factors, such as the quality of visualization and individuals past experiences. Nevertheless, past experiences with poorer-quality visualizations could lead to lower expectations and skepticism among

some users.

In response, this study plans to conduct two empirical studies aimed at uncovering the roles and effects of EVAs' physical attractiveness on consumer behaviors, using expectancy violation theory as a guiding framework. This theory suggests that when individuals' expectations are violated, be it positively or negatively, it can have significant impacts on their perceptions and behaviors (Burgoon, 1993).

In specific, the first study aims to uncover whether and how expectancy violations related to the EVAs' physical attractiveness can influence consumers' attitudes toward the EVA and recommendation itself, the product it recommends, and their purchase intentions. Moreover, trust in the EVA serves as a focal mediator that determines whether physical attractiveness translates to credibility and subsequently impacts consumers' actions (Gefen, Karahanna, & Straub, 2003).

This study also takes into account two moderating variables. First, novelty seeking represents one's tendency for new stimuli and experiences (Cloninger et al., 1993), possibly influencing reactions to attractive EVAs (Agarwal & Prasad, 1998). Second, the need for cognitive closure, which is a drive for definitive answers to avoid uncertainty (Kruglanski, 1989), may differentiate consumer reactions to expectancy violations.

After examining the impact of the expectation violation and moderating/mediating variables in the first study, the second study examines by probing the interaction between the expectation violation of EVAs' physical attractiveness and their capabilities. The capabilities of an EVA can span a wide range. This includes the ability to understand and respond accurately to customer requests the ability to provide personalized recommendations, and the ability to engage in human-like interactions with customers. A key question that this study aims to answer is whether the effectiveness of violation of EVAs' physical attractiveness in influencing consumers' behaviors is dependent upon their perceived capabilities. The findings

of these studies could have significant implications for the design and implementation of EVAs in e-commerce, ultimately contributing to enhancing consumers' online shopping experiences and improving businesses' performance. Taken together, this study contributes to the understanding of the influence of EVAs' physical attractiveness on consumers' attitudes and purchase intentions.

# Chapter 2: Literature Review

## 2.1 Embodied Virtual Agents (EVAs)

Embodied Virtual Agents (EVAs) represent a highly dynamic and rapidly advancing field in the broader spectrum of artificial intelligence and consumer-oriented service activities. As reported by Gartner (2016) and Marketer (2018), the implementation of virtual agent systems into business operations, specifically consumer service activities, has been significantly escalating in recent years. Moreover, with technological advancements, these agents are progressively replacing human agents and traditional consumer service methods, reinforcing the digital shift in customer service experiences (Davenport & Ronanki, 2018; Brynjolfsson & McAfee, 2014).

An EVA can be conceptualized as a computer-generated figure that interacts with users in a way that mirrors human-like interaction. It resonates with the Media Equation theory (Reeves & Nass, 1996). These agents, equipped with advanced AI algorithms, not only respond to user questions but also understand the contexts of the conversation. Drawing upon the Media Equation (Reeves & Nass, 1996), this capability makes the interaction more personalized and engaging, associated with the idea that users often apply social rules and expectations to computers and media. The human-like appearance and interactivity of these EVAs enhance the sense of presence for online shoppers. It makes their shopping experience more immersive and enjoyable, as users tend to treat these computerized agents like real people (Nass & Moon, 2000). This trend highlights the increasing integration of advanced

technologies with traditional online marketing strategies to create more engaging and personalized customer experiences (Hoyer et al., 2020; McGoldrick et al., 2008 Nuseir et al., 2023).

One remarkable example of this growing trend is the introduction of an EVA named Anna by Ikea, a renowned Swedish furniture brand. Functioning as a virtual sales assistant, Anna responds to customers' questions regarding Ikea's products and services, which offers a personalized shopping experience. This example demonstrates how leading brands are leveraging the power of EVAs to optimize their customer service efforts and enhance customer engagement.

The utilization of EVAs in e-commerce is not limited to responding to customer questions; they are also increasingly integrated into e-commerce recommender systems (Qiu & Benbasat, 2005; 2009). These systems, equipped with EVAs, provide anthropomorphic personifications, thereby humanizing the communication process related to product information and recommendations (Churchill et al., 2016). Thus, they aim to make the interaction more relatable, thus potentially influencing customers' attitudes and purchase intentions positively.

Moreover, EVAs can mimic various non-verbal cues, such as gestures and facial expressions, to simulate human-like interaction (Jin & Bolebruch, 2009). This ability further augments the realism and engagement of the online shopping experience. Furthermore, the ability to adapt the EVA's appearance, such as its clothes, to fit the brand's image or the context of the interaction can help create a more consistent brand experience.

In this context, the appearance and behavior of the EVA – particularly its human-like characteristics – can profoundly affect the overall consumer experience (Verhagen, Van Nes, Feldberg, & Van Dolen, 2014). In other words, the design of an EVA, from its physical characteristics to its conversational style and interactivity, can influence the effectiveness of

the consumer's interaction with it and thus the perceived value of the product or service (Hess, Fuller, & Campbell, 2009).

While the technological sophistication of these EVAs continues to improve, understanding how to effectively design and implement these agents in the e-commerce space becomes an increasingly critical research question. It is essential to uncover what specific attributes and behaviors of EVAs consumers find appealing or off-putting and how these factors influence their shopping behavior and decision-making process (Djamasbi, Siegel, & Tullis, 2010).

In sum, Embodied Virtual Agents are emerging as a transformative force in the field of e-commerce, transforming customer service operations, and redefining the online shopping experience. Their ability to humanize appearance, provide personalized responses, and enhance customer engagement signifies their potential to serve as effective marketing. The ongoing research and development in this field suggest an exciting future, wherein EVAs might become an inherent part of online shopping environments.

### 2.2 Embodied vs. Disembodied Virtual Agents

Virtual agents, a category of artificial intelligence (AI), are automated systems designed to interact with humans or other agents in a given environment (Russell, 2016). Based on their visibility and interaction modality, they can be classified broadly into two types: Embodied Virtual Agents (EVAs) and Disembodied Virtual Agents.

*Embodied Virtual Agents (EVAs)*

EVAs are computer-generated entities that are represented visually within a digital environment. They possess a graphical form, often resembling human or human-like characters, and interact with users in an immersive and engaging manner (Cassell et al., 2000). These agents, which can be either two-dimensional or three-dimensional, are programmed to execute a range of tasks that involve communication or interaction with users.

The embodiment can contribute significantly to the user's experience as it allows for a more enriched interaction that can include nonverbal cues such as facial expressions, gestures, and postures (Cassell, Vilhjálmsson, & Bickmore, 2001). These visually represented agents can be found in various digital platforms, such as websites, video games, virtual reality (VR) environments, and augmented reality (AR) applications.

*Disembodied Virtual Agents*

On the other hand, disembodied virtual agents do not have a visible form. They interact with users through voice or text-based channels without being represented (Cassell et al., 2000). Examples of these agents include chatbots on websites or virtual personal assistants like Amazon's Alexa and Apple's Siri. While disembodied agents can efficiently deliver information and assist users, they may not provide the same level of engaging interaction as embodied agents. They are designed to comprehend and respond to user inquiries using natural language processing, but their lack of visual representation limits the interaction to verbal communication only.

**2.3 Subtypes of Embodied Virtual Agents (EVAs)**

As Artificial Intelligence (AI) continues to redefine the boundaries of human-machine interaction, Embodied Virtual Agents (EVAs) have emerged as a pivotal interface. These agents characterized by their human-like representation and interaction patterns have been specifically designed to replicate and sometimes augment human roles. EVAs are increasingly prevalent across industries. It aims to provide a seamless, efficient, and engaging user experience. Their applications vary based on their design, purpose, and the context in which they are deployed. Broadly, EVAs can be categorized into three primary types: Virtual Customer Service Agents, Virtual Sales Agents, and Virtual Companions.

*Virtual Customer Service Agents*

Virtual Customer Service Agents, a subtype of Embodied Virtual Agents (EVAs), are

computer-generated entities specifically designed to aid customers in their journey through digital environments (Bickmore & Cassell, 2005). They are present on numerous platforms, such as websites, mobile applications, and even in virtual reality environments. Their primary role is to answer customer inquiries, guide them through the website or application, and provide recommendations, if applicable.

These virtual agents exhibit a great level of approachability and friendliness, which enhances their interaction with customers (Nass & Brave, 2005). Their design often simulates a human-like interaction. It employs natural language processing and understanding to respond to user inquiries in an intelligible and engaging manner. Some may even exhibit a level of emotional intelligence, which adapts their responses based on the perceived emotional state of the user. The visual representation of these agents is often associated with the brand identity and the services they offer (Bailenson, Yee, Merget, & Schroeder, 2006). They may take various forms – human-like characters, brand mascots, or even abstract entities. Some are programmed to employ nonverbal cues such as gestures, facial expressions, or body language, adding a more authentic dimension to the interaction. Beyond customer support, these EVAs often help in managing customer relationships, gathering customer feedback, and providing personalized content and recommendations based on user behavior and preferences.

*Virtual Sales Agents*

Virtual Sales Agents represent another subtype of EVAs. They are designed with the explicit purpose of promoting and selling products or services to users (Gnewuch, Morana, & Maedche, 2017). Much like their human counterparts, these agents actively engage with potential customers, presenting product features, and benefits, and making persuasive arguments to encourage purchase decisions (Huang & Benyoucef, 2013).

The visual and interactive design of Virtual Sales Agents often mirrors the

demographics of the target customers they serve (Bickmore, Schulman, & Yin, 2010). For instance, a virtual sales agent for a tech-savvy, younger audience might exhibit a modern, dynamic appearance, while an agent serving an older, more traditional audience might adopt a more formal and professional performance. These agents employ a wide range of sales tactics, from presenting personalized product recommendations to cross-selling and upselling strategies (Adomavicius & Tuzhilin, 2005). Advanced algorithms allow them to analyze user behavior, preferences, and past purchase history to deliver highly targeted and relevant product suggestions.

*Virtual Companions*

Virtual Companions offer a more social and emotional dimension to the concept of EVAs. They act as constant digital companions to users, which provides not only assistance and information but also companionship, entertainment, and emotional support (Reeves & Nass, 1996). Often employed in video games, mobile applications, or social media platforms, these agents can take various forms, from human-like characters to pets or fantasy creatures (Bickmore & Picard, 2005). They are programmed to exhibit personalities, exhibit emotions, and build long-term relationships with users (Picard, 2000). Some virtual companions are designed to learn from their interactions with users, which adapts their behavior and responses to provide a more personalized and engaging experience (Paiva, et al., 2004). Virtual Companions have a wide range of applications, from entertainment and socialization to therapeutic uses such as helping individuals with anxiety, loneliness, or those needing cognitive or emotional support (Ring, Bickmore, & Pedrelli, 2016).

Each type of EVA plays a unique role and serves different needs. They are designed to enhance user engagement and satisfaction, and understanding these categories and their respective roles provides valuable insights when designing or implementing EVAs. Thus, the understanding of these specific categories of EVAs and their distinct functions contributes to

a comprehensive comprehension of their utility and significance in the area of human-computer interactions.

Moreover, each subtype has unique traits that should be carefully considered during their design and implementation process (Ruttkay & Pelachaud, 2004). For instance, Virtual Customer Service Agents should emphasize efficient problem-solving abilities, clarity in communication, and a friendly attitude. On the other hand, Virtual Sales Agents need to focus on persuasive communication and an in-depth understanding of the product or service line, effectively matching user requirements with the best aid. Virtual Companions that deals with more emotionally engaged interactions require advanced capabilities to understand, learn from, and adapt to users' emotional states and personal preferences.

Toward the end, Embodied Virtual Agents, regardless of their subtype, are shaping the future of human-computer interactions. Their abilities to deliver personalized, engaging, and satisfying experiences are central to their roles, from e-commerce and customer service to gaming and social applications (Bailenson, 2018; Cassell & Vilhjálmsson, 1999). As technology advances, these agents are expected to play even more significant roles in digital interactions, which makes the understanding of their functions, design, in turn, impacts crucial for the future of digital industries.

*Application of Embodied Virtual Agent*

Embodied Virtual Agents (EVAs) are finding their way into various sectors and applications. It has been gaining significant attention in domains such as e-commerce, education, healthcare, entertainment, and social networking, among others. The presence and roles of these agents in these domains are continually evolving with technological advancements and greater acceptance of virtual characters.

EVAs have been deployed to enhance customer service, sales, and overall customer experience. As previously mentioned, the utilization of a virtual assistant like Anna by the

Swedish furniture brand, Ikea, demonstrates the application of EVAs. Anna supports customers by addressing their questions and suggesting products and services, thus improving the consumer interaction experience (Holzwarth et al., 2006). Educational platforms have also started incorporating EVAs to offer personalized learning experiences. These agents can take on the role of tutors or learning companions, which provides interactive and adaptive learning environments to students (Baylor & Kim, 2004). For example, AutoTutor, an intelligent tutoring system, employs animated conversational agents to facilitate deep learning (Graesser et al., 2005).

Healthcare is another arena where EVAs have shown potential. Virtual healthcare assistants are used for tasks such as providing health information, facilitating doctor-patient communication, and even assisting in psychological therapies. For instance, the virtual nurse, Elizabeth, developed by Boston Medical Center, assists in the care and communication with discharged patients (Sillice et al., 2018). In addition, the entertainment industry, particularly video games and virtual reality applications, is a notable field where EVAs play a prominent role. They are crucial elements that enhance user engagement and immersion within these environments (Yee et al., 2007). Furthermore, social networking platforms and applications have also integrated EVAs as part of their user experience. They function as personalized avatars that facilitate social interactions (Fox et al., 2015).

Within the domain of customer service, Embodied Virtual Agents (EVAs) have become indispensable tools in various industries. For instance, in addition to "Anna" by IKEA, "Mitsuku," an award-winning chatbot, presents itself as a visually represented virtual agent, which engages users in real-time conversations. Such embodiments enable users to engage more naturally, mirroring face-to-face interactions to some extent (Kerly et al., 2007). While the broader applications of EVAs are diverse, this study narrows its focus to their role in e-commerce as virtual sales assistants and their impacts on consumer perceptions and

decisions in terms of level of anthropomorphism. They are programmed to answer customer queries, provide product recommendations, and essentially function as digital extensions of in-store salespersons. Their presence significantly enhances the online shopping experience, offering customers a more engaging journey.

### 2.4 Online Shopping Recommendation

The field of online shopping recommendation, also known as e-commerce recommender systems, is a rapidly evolving area of technology. These systems are algorithm-driven tools designed to suggest products to customers by analyzing their behavior and preferences (Chen et al., 2024; Necula & Păvăloaia, 2023; Salunke & Nichite, 2022; Ricci, Rokach, & Shapira, 2011). They have been increasingly integrated into e-commerce platforms due to their potential to enhance user engagement, streamline shopping processes, and boost sales.

One common type of recommender system is the collaborative filtering system, which predicts a customer's interest in a product based on the interests of other customers who have similar purchase histories (Schafer, Frankowski, Herlocker, & Sen, 2007). Collaborative filtering has been successfully used by major companies like Amazon and Netflix to generate personalized recommendations (Koren, Bell, & Volinsky, 2009). Despite its popularity, this approach has its limitations, such as the so-called "cold start" problem, where it becomes difficult to make accurate recommendations for new users with no prior purchase history.

To address this, content-based recommendation systems have been introduced. These systems suggest items by comparing the content of the items with a user's profile, which contains the preferences and needs of the user (Lops, De Gemmis, & Semeraro, 2011). The item content can be anything, from product descriptions and specifications to customer reviews and ratings. A major advantage of content-based systems is their ability to

recommend items that are distinct from a user's past purchases, thus allowing for the exploration of novel products. Hybrid recommendation systems combined with the strengths of collaborative filtering and content-based systems have also gained traction in recent years. They can provide more comprehensive and accurate recommendations by considering both the user's personal preferences and the preferences of similar users (Burke, 2002).

More recently, there has been a shift toward interactive recommendation systems that go beyond simple product suggestions. With the rise of machine learning and AI, these systems have the ability to engage with users through dialogue, understand user requirements more accurately, and provide personalized recommendations accordingly (Chen et al., 2024; Necula & Păvăloaia, 2023; Salunke & Nichite, 2022; Zhang, Vucetic, & Yeung, 2021). This interactivity has been shown to significantly improve the effectiveness of recommendations and user satisfaction (Chen et al., 2024; Necula & Păvăloaia, 2023; Salunke & Nichite, 2022; Zhang, Vucetic, & Yeung, 2021). Thus, we need to pay attention to how these advanced systems are integrated into e-commerce platforms by focusing on designing them in a user-centric manner that prioritizes clear communication, privacy, and adaptability to diverse user preferences.

*The application of EVAs in Online Shopping Recommendation*

As augmented humanization technologies, these agents can enhance the shopping experience by providing more personalized, human-like interactions. A remarkable example of this trend can be seen with Ikea which employs an EVA named Anna, who assists customers with inquiries regarding products and services. This real-world application demonstrates the practical and transformative impact of EVAs in online retail.

Incorporating EVA into e-commerce recommender systems has several benefits. First, EVAs add an anthropomorphic dimension to these systems, making them more relatable to customers (Beldad et al., 2016; McGoldrick et al., 2008). They bridge the gap between

technology and humans by creating a virtual yet personable touchpoint for customers to interact with. Indeed, Research has shown that users are more comfortable and inclined to interact with entities that resemble human figures (Nass et al., 1994; Qiu & Benbasat, 2005; 2009). This humanization effect can create more engaging customer interactions, as users often prefer to interact with entities that resemble humans (Nass et al., 1994; Qiu & Benbasat, 2005; 2009). Specifically, the visual appeal of EVAs plays a vital role in their effectiveness. The use of high-definition graphics can create more lifelike and engaging EVAs, further humanizing the online shopping experience (Holzwarth, Janiszewski, & Neumann, 2006).

Secondly, as the integration of AI technologies becomes more widespread, the combination of EVAs and AI can offer potential advancements in the e-commerce field. For instance, the integration of advanced AI capabilities with the human-like interactions offered by Electronic Virtual Assistants (EVAs) represents the improvement in how customers interact with online platforms. The creation of AI-powered EVAs aims to provide highly personalized and intuitive customer interactions. This innovation has the potential to significantly enhance the online shopping experience (Zhang et al., 2014). The continued refinement and development of these agents are set to have profound impacts on the way online shopping is conducted, making it a crucial area of both academic and commercial interest.

Looking ahead, as technology advances, the role of Electronic Virtual Assistants (EVAs) in online shopping is prepared for further sophistication. Anticipated to exceed simple product suggestions, EVAs are expected to tackle more complex responsibilities, such as managing customer complaints and offering detailed product insights. This evolution will not only transform business-customer interactions online but also chart a new course for e-commerce's future.

Enhancing EVAs within e-commerce platforms calls for cutting-edge technological

integration. Employing advanced AI for better conversational interactions, utilizing machine learning for deeper personalization, and adopting superior graphics for visual enrichment are critical. Such advancements will confirm EVAs provide both aesthetic value and functional efficiency, advancing the online shopping journey.

### 2.5 Expectation Violations Theory (EVT)

Expectation Violations Theory (EVT) is a communication theory that suggests that when people engage in communication, they have certain expectations about the behavior of others (Burgoon, 1978). When these expectations are violated, it draws increased attention and causes the individuals to evaluate the discrepancy. EVT was first proposed by Burgoon (1978) as a means to predict how individuals respond to nonverbal communication behaviors that deviate from the norm. The theory was later expanded to combine verbal communication and has been widely used to understand interpersonal communication, persuasion, and social influence (Burgoon & Hale, 1988). EVT postulates that people form expectations based on social norms and their past experiences. These expectations serve as a benchmark against which individuals judge the behaviors of others. For instance, in a formal business meeting, one might expect others to be professional, punctual, and polite. A violation occurs when these expectations are not met, such as when someone arrives late or behaves rudely.

However, a violation of expectations does not necessarily lead to negative outcomes. Instead, the theory suggests that the effect of a violation depends on the valence or the positive or negative interpretation of the violation, which is determined by several factors such as the relationship between the individuals involved, the situation, and the nature of the violation itself (Burgoon et al., 1989). For example, if a close friend shows up late to a casual meeting, the violation may be perceived as minimal concern to the close relationship. Yet, if an acquaintance or stranger were to arrive late to a formal event, the violation might be viewed negatively due to the lack of familiarity and formality of the situation.

Applying it to the case of EVA, EVT suggests that users come to these interactions with pre-existing expectations about how users' evaluations of these agents are influenced by their physical appearance. Specifically, if the appearance of an EVA violates a user's pre-existing expectations – for instance, if the EVA appears more or less human-like than expected – this may elicit heightened attention and lead to a thorough evaluation of the agent.

*The violation of Physical attractiveness under EVT*

Expectation Violations Theory (EVT) suggests that when expectations are violated, individuals experience increased attention toward the violation and assign it either positive or negative valence, which then greatly impacts their subsequent evaluation of the situation or object in question (Burgoon et al., 1989). In regard to embodied virtual agents (EVAs), consumers are likely to have certain expectations about the physical appearance of these virtual agents, which may be influenced by prior experiences perhaps even exposure to poorly designed EVAs in the past, or stereotypes associated with virtual entities. This evaluation may yield either a positive or negative outcome, depending on a range of factors. For example, if a user anticipates a simplistic, cartoon-like avatar and instead encounters a highly realistic, human-like EVA, this violation of expectations may yield a positive response if the user values realism and authenticity in their interactions with virtual agents. Conversely, this same violation may result in a negative response if the user finds the high degree of realism unsettling or discomforting (a phenomenon known as the "uncanny valley") (Mori, 1970).

In either case, EVT suggests that violations of expectations can lead to more intense evaluations of embodied virtual agents, which makes the agents' physical appearance a salient factor in user evaluation. As such, understanding and managing user expectations about the appearance of EVAs may be a critical component of successful virtual agent design and implementation (Burgoon et al., 1989). If an EVA's physical attractiveness greatly exceeds a

user's expectations, this can be perceived as a positive violation. Such positive violations often result in enhanced attention and a favorable evaluation of the agent (Burgoon & Hale, 1988). Conversely, if an EVA's physical attractiveness falls short of user expectations, this would establish a negative violation. According to EVT, such negative violations are likely to lead to an unfavorable evaluation of the agent, potentially reducing the user's willingness to interact with the EVA or follow its recommendations (Burgoon et al., 1989).

In this study, Embodied Virtual Agents (EVAs) refer to digital entities designed to provide a human-like interface for interaction within online environments. The physical attractiveness of these agents is defined by their visual appeal. This aesthetic component can significantly impact user perceptions, attitudes, and ultimately the engagement with the agent (Tractinsky, Katz, & Ikar, 2000). Furthermore, the focus on physical attractiveness is associated with the expectancy violation theory which proposes that any deviations from pre-set expectations can influence perceptions and behaviors (Burgoon, 1978). EVAs serve as virtual sales assistants that are assigned to support customers as they navigate through digital platforms.

Taken together, the consideration of EVT in the context of EVA design and implementation opens up innovative opportunities for research and practical application. As the use of these virtual agents continues to proliferate, their design and perceived attractiveness will continue to shape the view of online consumer interactions and experiences.

### 2.6 Physical Attractiveness of EVAs and Source Credibility

Attractiveness significantly influences the formation of interpersonal relationships and is often regarded as a form of societal capital (Bowling et al., 2004; Hakim, 2010). In EVAs, the application of high-quality graphic textures—encompassing aspects like detailed skin textures or realistic clothing—enhances their realism and human likeness. Such

enhancements in quality have been found to improve the perception of attractiveness, which in turn can make EVAs more persuasive and trustworthy in their interactions with users, especially in roles requiring a high degree of user trust and engagement, like virtual assistance or online shopping recommendations (Holzwarth, Janiszewski, & Neumann, 2006).

Attractive endorsers, including EVAs with high-quality textures, are often perceived as more competent and warmer, which leads to more favorable perceptions of the products or services they endorse. This supports findings that physical attractiveness can influence perceptions of competency and warmth (Langlois et al., 2000; Amos et al., 2008).

However, it is important to note that while high-quality textures contribute to attractiveness, they represent only one aspect of a broader concept. Studies have highlighted the role of realistic textures in enhancing the authenticity and appeal of virtual characters (Westerhoff et al., 2009). Additionally, visual complexity driven by high-quality textures has been shown to enhance the appeal of virtual agents, thereby enriching the user's aesthetic experience and perception of attractiveness (Reber, Schwarz, & Winkielman, 2004). The integration of detailed graphics with human-like traits and high-quality textures also positively influences user engagement and the perception of realism (Kätsyri & Förger, 2021; Bailenson et al., 2006).

The best example of this is seen in the process of designing virtual influencers. These virtual entities are not only created with advanced graphic textures but also with a focus on overall aesthetic appeal. The design of virtual influencers involves careful consideration of features like facial symmetry, body proportions, and style elements that contribute to their attractiveness. The attractiveness of EVAs, therefore, goes beyond just the surface level of graphic quality. It includes the thoughtful integration of design elements that enhance their visual appeal. This approach similar to the design principles used in creating virtual

influencers, ensures that EVAs are not only technologically advanced but also aesthetically pleasing.

In redefining the concept of attractiveness for Embodied Virtual Agents (EVAs), this study highlights the significance of perceived attractiveness. It recognizes its subjective nature and the diverse perceptions it elicits from different individuals. While high-quality graphic textures, such as detailed skin textures and realistic clothing, enhance the realism and human-likeness of EVAs, these technical aspects alone do not entirely define an EVA's attractiveness. Perceived attractiveness includes a wider array of elements, including the combination of detailed graphics with human-like traits and the overall aesthetic appeal. It takes into account factors like facial symmetry, body proportions, and style elements. However, these factors are not universally definitive of attractiveness. Thus, this study conducts a pilot study to gain a more empirical understanding of what features are generally perceived as attractive in EVAs.

Physical attractiveness has been recognized as a key subset of source credibility, influencing the ways in which individuals perceive and respond to a given source. Source credibility is an important concept, especially in areas like marketing and advertising, where the credibility of a spokesperson or endorser can greatly impact consumers' attitudes and behaviors (Ohanian, 1990).

The "halo effect" is a well-known psychological phenomenon that plays into this. It refers to the tendency of individuals to associate physical attractiveness with other positive traits, such as intelligence, kindness, and reliability (Dion, Berscheid, & Walster, 1972). In other words, individuals are more likely to perceive an attractive person as credible, likable, and competent, which can influence their attitudes and behaviors in a positive way (Eagly, Ashmore, Makhijani, & Longo, 1991; Chaiken, 1979). This effect extends to marketing and advertising. For instance, research has demonstrated that physically attractive models or

endorsers can enhance positive attitudes toward the advertisement, the brand, and the product, and even increase purchase intentions (Baker & Churchill, 1977; Petroshius & Crocker, 1989).

EVAs that are designed to be physically attractive might be perceived as more persuasive, likable, and trustworthy (Holzwarth, Janiszewski, & Neumann, 2006). This could potentially enhance user engagement and satisfaction. Thus, it contributes to more effective online shopping recommendations and overall user experience. Consequently, physical attractiveness as a subset of source credibility can significantly influence perceptions and evaluations of EVAs. It is important to investigate how best to leverage the physical attractiveness of EVAs to enhance their effectiveness in roles such as online shopping recommendations.

### 2.7 Moderators

#### 2.7.1 Novelty Seeking

Novelty seeking is one of the individual difference factors that characterize an individual's predisposition toward exploratory behavior, impulsive actions, and a distinct avoidance of monotony (Cloninger, Przybeck, & Svrakic, 1991). It is characterized by an inherent inclination to seek novel experiences and stimulation. It makes it closely associated with traits such as thrill-seeking, curiosity, and an increased susceptibility to boredom (Zuckerman, 1994). In particular, individuals exhibiting high novelty-seeking behaviors typically demonstrate a greater receptiveness to new experiences and situations, particularly in the context of emerging technologies (Leue & Beauducel, 2011). As such, they are likely to be more comfortable and engaged with novel and unfamiliar technology interfaces, including Embodied Virtual Agents (EVAs). The incorporation of novel elements into their daily routines or tasks presents them with a source of new stimuli, which is a primary motivator for individuals with high novelty-seeking traits.

The trait of novelty seeking may play a significant role in determining the speed and extent to which new technologies are adopted. Individuals high in novelty seeking are often early adopters of innovative technologies, as these offer new experiences and break away from routine or monotony (Rogers, 2003). Accordingly, novelty seeking is a complex personality trait associated with an individual's inclination toward novel experiences and their ability to handle, adapt to, and even thrive in unfamiliar scenarios, which can significantly influence their interactions with emerging technologies such as virtual agents.

### 2.7.2 Need for Cognitive Closure

The Need for Cognitive Closure (NFCC) is a psychological trait described as an individual's motivation to seek answers that offer certainty and avoid situations that are ambiguous or uncertain (Webster & Kruglanski, 1994). NFCC involves two major components: urgency, the desire to quickly reach a conclusion, and permanency, the desire to maintain that conclusion over time (Kruglanski & Webster, 1996). Specifically, individuals with high NFCC tend to be uncomfortable with uncertainty and ambiguity, prefer predictability and order, and avoid situations that provoke doubt or confusion (Roets & Van Hiel, 2011). They tend to seek closure promptly and are likely to stick to the obtained answers that resist information that may challenge or contradict their conclusions (Kruglanski, 2004). This craving for definitive knowledge and early closure can influence how they process information, make decisions, and interact with their environment. On the contrary, individuals with low NFCC have a higher tolerance for ambiguity and uncertainty. They are more open to different perspectives considering a broad range of information before forming conclusions. It is comfortable revising their beliefs when confronted with new evidence. Understanding this concept is crucial because it sheds light on how people seek, process, and interpret information, and how these tendencies can affect their decisions and behaviors, particularly in novel or uncertain situations.

### 2.8 Perception of Trust

Trust represents a psychological inclination, one wherein individuals are prepared to expose themselves to vulnerabilities based on a foundational belief that the other party act in a manner that pertains to their expectations (Rousseau, Sitkin, Burt, & Camerer, 1998). In simpler terms, trust is the readiness to take risks that is grounded in the anticipation of favorable conduct from the counterpart.

This definition adopts a subtle distinction in the field of Embodied Virtual Agents (EVAs). In this study, trust can be characterized by users' propensity to depend on these virtual entities which is hinged on the presumption that these agents would function in a manner that is either advantageous or, at the very least, not harmful to the user. This shifts the traditional trust paradigm from interpersonal relations to a human-machine dynamic, presenting a novel dimension of trust exploration.

Historically, trust has been spotlighted as a dominant method influencing the initial embrace and continuous utilization of varied technological innovations (Gefen, Karahanna, & Straub, 2003). This pivotal role of trust amplifies in the field of EVAs. Users often make first impressions based on appearance, so their willingness to interact with an EVA is closely tied to its perceived attractiveness. The degree to which users are willing to engage with EVAs are intimately secured to their trust amount. A user who perceives an EVA as trustworthy is more likely to rely on its recommendations, share personal information, or indulge in prolonged interactions (Cassell & Bickmore, 2003).

#### 2.8.1 Trust as a Mediating Variable

Drawing from the Social Cognitive Theory, which emphasizes the role of mediators in understanding the relationships between environmental factors, personal factors, and behavior (Bandura, 1986), trust can be conceptualized as an essential middle mechanism, mediating the relationship between user experience and user satisfaction or continued use of

the EVA. In other words, the extent to which user expectations of EVAs are met or unmet can significantly influence their trust in both the information and the EVA. This, in turn, can shape their attitudes toward the EVA and influence their subsequent behaviors, such as willingness to follow recommendations or engage in repeat interactions.

## Chapter 3: The Research Problem of Study 1

This chapter aims to delineate the research problems in Study 1 by examining the influence of the physical attractiveness of Embodied Virtual Agents (EVAs) on user attitudes and intentions. The study covers the expectancy violation of the physical attractiveness of EVAs and its subsequent impact on user perceptions.

### 3.1 Impact of Physical Attractiveness of Embodied Virtual Agent under Expectancy Violation Theory

As EVAs become increasingly realistic and integrated into digital environments, their design can significantly shape user perceptions, attitudes, and behaviors. Indeed, EVAs improve to the point where they are almost identical to human beings, individual perceptions of these virtual agents can greatly vary based on their expectations.

Given that these virtual agents often serve in roles parallel to online salespersons and sources of product information, their visual depiction becomes a critical factor in shaping user perceptions and attitudes. Indeed, several prior studies have demonstrated a correlation between physical attractiveness and positive evaluations (Eagly, Ashmore, Makhijani, & Longo, 1991). For instance, advertising campaigns featuring attractive models have been found to elicit more favorable affective evaluations (Baker & Churchill, 1977). Furthermore, research by Petroshius and Crocker (1989), and Patzer (1983) revealed that advertisements featuring physically attractive figures led to more positive attitudes toward the advertising and stronger purchase intentions.

In essence, people may disguise certain stereotypes or assumptions regarding the

appearance of virtual agents before interacting with them in reality. These stereotypes act as individuals' expectations regarding the appearance of virtual agents. Any deviations from these expectations - whether positive or negative - can significantly influence the evaluations of these EVAs. Furthermore, these stereotypes play a vital role in shaping the overall thoughts and feelings toward virtual agents, which in turn, influence attitudes and purchase intentions toward the products recommended by these agents.

### 3.1.1 Problem Statement

EVT serves as a lens through which this study can examine the interaction between appearance and perception. Its principles suggest that deviations from the norm (expectation violations) can produce stronger impacts – whether positive or negative – than simply meeting expectations. It implies that their effectiveness, perceived attractiveness, and the consumer responses they evoke are intrinsically linked to the expectations people have prior to interaction. In the perspective, the question arises: how does the violation of user expectations concerning an EVA's physical attractiveness influence their perception and interactions with the agent? Does the direction of the violation (positive or negative) determine the extent of its impact? The hypotheses are as follows:

H1: The high level of physical attractiveness of an EVA positively influences the consumer's attitude toward both the EVA, recommendations, and the product it recommends, and the intention to purchase compared to an EVA with low physical attractiveness.

H2: The high level of consumer expectations influences their attitudes toward EVA and the product it recommends, and the intention to purchase.

H2a: In the context of low expectations regarding embodied virtual agents, an EVA with high physical attractiveness (positive violation) leads to a positive attitude toward the EVA, recommendations, and the product, and a higher intention to purchase, compared to an EVA that either confirms the low expectations or provides a negative violation of those

expectations.

H2b: In the context of high expectations regarding embodied virtual agents, an EVA with low physical attractiveness (negative violation) leads to a negative attitude toward the EVA, recommendations, and the product, and a higher intention to purchase, compared to an EVA that either confirms the high expectations or provides a positive violation of those expectations.

### 3.2 Moderators

#### 3.2.1 Novelty seeking

Novelty seeking as a personality trait can also shape the way users respond to situations of the violation of expectation. In cases of positive expectation violation, novelty seeking individuals may react with more enthusiasm compared to those low in novelty seeking, as they perceive the unexpected outcome as an exciting novelty rather than a deviation from their expectations (Leue & Beauducel, 2011). Conversely, in scenarios of negative expectation violation, high novelty seeking individuals may exhibit less disappointment or dissatisfaction. They may perceive the unexpected outcome as a unique challenge or a source of novel stimulation, instead of a hindrance or setback (Zuckerman, 1994). Ultimately, novelty seeking can have significant implications for the interaction between users and EVAs, particularly in situations of violation of expectation.

##### 3.2.1.1 Problem Statement

Novelty seeking stands out as a pivotal determinant in users' reception of unexpected scenarios. Those high in novelty seeking tend to enjoy the unfamiliar, using it as a foundation for engagement and exploration. This propensity might be fundamental in shaping users' reception of and interaction with EVAs, especially when these agents diverge from anticipated benchmarks, be they favorable or unfavorable. As such, the following hypotheses are proposed:

H3: Novelty seeking moderates the relationship between expectation violation (both positive and negative) by an EVA's physical attractiveness and users' attitudes toward a) EVAs, b) the product, and c) purchase intentions.

H3a: When the expectations are violated, the effect is strengthened for individuals with high novelty seeking compared to those with low novelty seeking.

H3b: When the expectations are not violated (confirmed), the effect is weakened for individuals with high novelty seeking compared to those with low novelty seeking.

### 3.2.2 Need for Cognitive Closure

The Need for Cognitive Closure (NFCC) can have a significant influence on how users react to the violation of expectation scenarios involving Embodied Virtual Agents (EVAs). Given their strong preference for certainty and clear outcomes, individuals high in NFCC exhibit more extreme reactions when their expectations are violated (Webster & Kruglanski, 1994). This is because such violations challenge their desire for predictability and definitive answers, which potentially leads to higher levels of discomfort and negative attitudes toward EVAs. For instance, if an EVA exceeds their expectations, high NFCC individuals might react more favorably as their desire for definite answers is exceeded. However, in the case of negative expectation violation, they might react more unfavorably, as the uncertainty and unpredictability would conflict with their desire for closure and definitive outcomes (Kruglanski & Webster, 1996).

On the other hand, low NFCC individuals are typically more comfortable with ambiguity and uncertainty (Roets & Van Hiel, 2011). Therefore, they might demonstrate more moderate or even flexible reactions to the violation of expectation. When their expectations are not met, they might not view it as a clear negative violation, but rather an opportunity for further exploration and learning. In the case of a positive expectation violation, they might see it as a pleasant surprise. In turn, it leads to a positive reaction, but

perhaps not as intense as that of individuals high in NFCC.

#### 3.2.2.1 Problem Statement

The Need for Cognitive Closure (NFCC) captures an individual's disposition for definitive answers and an aversion to ambiguity. When confronted with Embodied Virtual Agents (EVAs) that either relate to or deviate from their preconceived expectations, how do individuals, based on their NFCC levels, reconcile with these scenarios? To examine this interplay, the following hypothesis are posited:

H4: Need for Cognitive Closure moderates the relationship between expectation violation (both positive and negative) by an EVA's physical attractiveness and users' attitudes toward a) EVAs, b) recommendations, c) the product, and d) purchase intentions.

H4a: When the expectations are violated, the effect is strengthened for individuals with high need for cognitive closure compared to those with low need for cognitive closure.

H4b: When the expectations are not violated (confirmed), the effect is weakened for individuals with high need for cognitive closure compared to those with low need for cognitive closure.

## 3.3 Mediator

### 3.3.1 Trust

Research in the technology acceptance domain further reiterates the mediating role of trust. For instance, Gefen and Straub (2004) found that trust mediated the relationship between perceived credibility and intention to perform in an online environment. Drawing connections, this study hypothesizes that the disconfirmation of user expectations in interactions with EVAs can either bolster or wear down trust, which subsequently determines their attitudes and intentions.

### 3.3.2 Problem Statement

Trust has long been recognized as a pillar in the acceptance and adoption of

technology, which often serves as the bridge between user perceptions and subsequent behaviors. Connected to Embodied Virtual Agents (EVAs), how do discrepancies between anticipated and actual EVA appearances influence this essential mediator? The following hypotheses are put forth:

H5: Trust in EVAs mediates the effect of expectation violations regarding their physical attractiveness on users' attitudes toward a) EVAs, b) the product, and c) purchase intentions.

# Chapter 4: Study 1

This chapter examines user perceptions, unfolding the methodological framework utilized in the first study. The focus of this exploration is to investigate the role of the Embodied Virtual Agent's (EVA) physical attractiveness and how it influences, or results in, expectancy violations within user perceptions.

## 4.1 Method

### 4.1.1 Research Design

Study 1 implements a between-subjects 2x2 (expectation level: high vs. low) X (EVA's physical attractiveness: high vs. low) factorial design, where participants are randomly assigned to one of four experimental conditions. The core of this study centers on a twofold process: priming participants with anticipatory perceptions regarding EVA's appearance and subsequently comparing these anticipations against EVA's portrayed level of attractiveness. In specific, the design comprises two independent variables: expectation level (high vs. low) based on the vignettes, and EVA's physical attractiveness (high vs. low) as shown in the visual representation. Previous to the main studies, a pretest was conducted to verify the manipulation's effectiveness.

### 4.1.2 Independent Variables

#### 4.1.2.1 Expectation Setting

Participants in the Qualtrics survey are presented with one of two vignettes, depending on their randomized experimental condition. For the low-expectation group, the vignette introduces EVA as an outdated virtual agent, similar to the early stages of virtual assistant design, lacking sophistication and detailed aesthetics found in more modern versions. The narrative specifically points out that EVA does not meet the visually impressive standards of realism and attractiveness that are engaging and captivating.

*Low Expectation Vignette*: "In today's world of virtual human-like assistant technology, we are observing continuous advancements, yet there is still a notable gap between current capabilities and truly advanced visual sophistication. The aesthetic aspect of these virtual assistants, especially, often remains a work in progress. Despite ongoing technological progress, they still fall short of being truly lifelike or visually impressive. Today's versions, though improved, often lack the sophisticated design elements and visual style that would categorize them as genuinely advanced in appearance. Their aesthetic appeal especially does not fully match the level of sophistication seen in other digital worlds. The current look of these virtual assistants is still a journey ahead to achieve a level of visual realism and attractiveness that truly captivates and engages users."

Participants in the high-expectation group are presented with a vignette that paints EVA as an exemplar of the latest advancements in virtual agent technology. It emphasizes EVA's real-life aesthetically appealing design and sophisticated design elements.

*High Expectation Vignette*: "In the current virtual human-like assistant technology, we are experiencing a remarkable era where the boundaries of digital artistry and realism are being pushed like never before. Today's virtual assistants represent a level of visual sophistication that closely mirrors real-life aesthetics, which stands for a fusion of advanced technology and artistic design. They are a leap forward in digital innovation, with graphics that are rich, detailed, and vibrant. The color palettes used are not only broad but also deeply

nuanced, capturing the subtleties and complexities of real-world visuals. This time of technological progress has significantly narrowed the gap between virtual and reality. The virtual assistants of today boast sophisticated design elements and a level of visual style that challenges advanced digital creations in other fields. They are not just tools for tasks; they are crafted to be visually engaging, enhancing user interactions with their aesthetic appeal."

#### 4.1.2.2 EVA Physical Attractiveness

Subsequent to the vignette presentation, participants are then shown an image or representation of EVA recommending a product with the following prompt: *"When you are shopping online, imagine a scenario where a virtual assistant appears to help guide you toward products that you are interested in. In the image provided below, the virtual assistant is recommending a product."*

*High Attractiveness Condition:* Participants are shown an image of EVA characterized by high physical attractiveness. This representation is selected based on pretests and is intended to meet the high expectations set by the preceding vignette. The attributes of this condition include high-quality resolution and an attractive appearance that is associated with the descriptions in the high-expectation vignette.

*Low Attractiveness Condition*: In contrast, participants in this condition are exposed to an image of EVA that features low physical attractiveness. Selected from pretests, this representation has a lower quality/resolution and an unattractive appearance that does not meet the expectations set by the low-expectation vignette (see Appendix A).

### 4.1.3 Procedure

Upon entering the study, participants underwent an intervention designed to establish expectations. This was executed by randomly assigning them to one of two conditions: they were either provided with a vignette describing a high expectation of EVA's appearance or a vignette portraying a low expectation. After this narrative-based priming, participants were

presented with a visual representation of EVA.

Before exposing participants to the stimulus, the moderators and covariates were asked, which included the individual differences, the tendencies toward virtual entities, especially robotic personas, and their typical e-shopping patterns and previous experience with virtual entities. Additionally, trust, attitude behavioral intention, and demographic information were collected after the exposure to the stimulus.

### 4.1.4 Sample

#### 4.1.4.1 Sample Size

The sample size for the study was determined using G*Power, a statistical tool that calculates the power of a test based on various input parameters. Considering the anticipated medium effect size ($f = 0.25$), an alpha level of 0.05 (commonly used in social sciences), and desired power ($1-\beta$) of 0.90 (a standard level for sufficient power), the G*Power analysis indicated a required sample size of 171 participants for the four-group design. However, considering the possibility of incomplete responses, and to ensure sufficient power for detecting even small effect sizes, the final sample size was determined to be 180 participants.

#### 4.1.4.2 Sampling Procedure

Participants for this study were primarily obtained through Amazon's Mechanical Turk (M-Turk), targeting U.S. residents over 18 years old who have experience with online shopping websites. Eligibility required not only fitting the demographic and experience criteria but also agreeing to participate and signing a consent form. This consent ensured that participants were fully informed about the nature of the study, their role in it, and the handling of their data, adhering to ethical research standards. Those who met these requirements and expressed a willingness to participate were allowed to proceed with the survey.

### 4.1.5 Stimuli

#### 4.1.5.1 Expectation Vignette Selection

To create an expectation vignette regarding EVA, a pretest was conducted. This pretest was implemented to craft vignettes that would establish either low or high expectations among the participants.

#### 4.1.5.2 Embodied Virtual Agent Selection

EVA's visual representation was centered on the investigation. With attractiveness being a pivotal variable, an extensive review was undertaken of various EVA designs ranging from highly detailed, human-like, and attractive figures to more basic and unattractive representations. To confirm the validity of the selections for "high attractiveness" and "low attractiveness" designs, pretests were conducted.

#### 4.1.5.3 Stimuli Description and Editing

To ensure that participants had a clear framework for assessing the stimuli, each Embodied Virtual Agent (EVA) was introduced with a tailored expectation vignette before the actual exposure. These vignettes were meticulously developed to set specific expectations—either high or low—regarding the attractiveness and human-likeness of the EVA. By providing a narrative that predicated the subsequent visual presentation, these vignettes played a critical role in shaping the participants' initial perceptions and aligning them with the research objectives.

After participants were exposed to the expectation vignette, they were asked to rate the assumed attractiveness of the EVA using a scale adjusted by Kim and Jun (2016). The assessment items included 'I think the EVA would be quite pretty,' 'I think the EVA would look stylish,' 'I think the EVA would be very sexy looking,' 'I think that I would find the EVA very attractive physically,' and 'I think the EVAs' appearance would be quite attractive,' rated on a seven-point Likert scale from 1 ('strongly disagree') to 7 ('strongly agree'). These items were carefully chosen and modified to meet the purposes of our study, ensuring the stimuli

functioned as intended.

Following the expectation-setting phase, each product and EVA was presented with an in-depth description that detailed the key features, utilities, and unique design elements. To facilitate a clear understanding of the stimuli, each product, and especially EVA, came with an in-depth description. These descriptions were crafted to not only outline the key features and utilities but also to elaborate on design elements. To encourage the clarity and impact of the EVA images, advanced graphic design tools were employed by refining their resolution and precision. Furthermore, a uniform template for stimuli presentation was established to ensure that any extraneous influences were minimized and that primary research variables urged the study's outcomes.

After being exposed to the EVA visuals, participants rated its attractiveness on a similar scale with items like "The EVA is quite pretty.", "The EVA looks stylish.", " EVA is very sexy looking.", "I find EVA very attractive physically.", " EVAs' appearance is quite attractive." on a seven-point Likert scale ranging from 1 = "strongly disagree" to 7 = "strongly agree." These items were carefully chosen and modified to meet the purposes of our study. This was established to confirm that the stimuli functioned as intended, with the high-attractiveness EVA perceived as more attractive than the low-attractiveness version. Thus, it confirms both the anticipated high and low expectation cues were effectively conveyed.

#### 4.1.6 Variables and Measurement

*Novelty Seeking*. The items of novelty seeking are drawn from prior research (Manning et al., 1995). The items are " I often seek out information about new and different topics of interest.", "I enjoy visiting places or events that offer me new experiences.", "I am drawn to reading materials (books, magazines, blogs) that introduce fresh perspectives or subjects. I frequently explore new hobbies or activities in my spare time.", "I actively look for situations where I can learn or experience something I haven't before.", "I am continually

looking for new experiences, be it in travel, food, or culture.", "When I have free time, I often find myself exploring new places, even in my local area.", "I seize opportunities to break my routine and try something different. " Responses were recorded on a 7-point Likert scale (1: Strongly Disagree to 7: Strongly Agree; $\alpha$ = .93).

*Need for Cognitive Closure*. The items of need for cognitive closure were utilized from prior research (Webster & Kruglanski, 1994). The items are " I feel uncomfortable when a situation is ambiguous.", " I prefer clear answers over continued uncertainty. " I would rather make a decision quickly than keep pondering on available choices. " using a 7-point Likert scale ($\alpha$ = .55).

*Trust.* Trust in the virtual agent was assessed using a scale developed by Kim & Ahn (2007). The scale measures the user's belief in the virtual agent's integrity, responsibilities, and reliability in maintaining the user's best interests. An example item is, "This virtual agent operates with the user's best interests in mind.", "This virtual agent consistently fulfills promises related to transaction protocols.", "I find this virtual agent to be trustworthy.", "This virtual agent strives to excel in its role and responsibilities" using a 7-point Likert scale ($\alpha$ = .93).

*Attitude toward recommendation*. Based on prior research investigating attitudes toward brands (Homer, 1990; MacKenzie & Lutz, 1989), participants' attitudes regarding the recommendations given by EVA were assessed by asking "What do you feel about the content/recommendation given by the EVA?" This was measured using a semantic differential scale, ranging from 1: unpleasant to 7: pleasant, 1: unlikable to 7: likable, 1: bad to 7: good, and 1: unfavorable to 7: favorable ($\alpha$ = .97).

*Attitude toward the Embodied Virtual Agent*. Drawing from the previous research (Homer, 1990; MacKenzie & Lutz, 1989), the attitude toward EVA was measured. Responses to statements like, "What do you feel about the EVA you interacted with?" were captured on a

semantic differential scale (1: unpleasant to 7: pleasant, 1: unlikable to 7: likable, 1: bad to 7: good, and 1: unfavorable to 7: favorable ($\alpha$ = .98).

*Attitude toward product*. Drawing from the previous research (Homer, 1990; MacKenzie & Lutz, 1989), the attitude toward a product was measured by asking "What do you feel about the product presented by the EVA?" This was measured using a semantic differential scale (1: unpleasant to 7: pleasant, 1: unlikable to 7: likable, 1: bad to 7: good, and 1: unfavorable to 7: favorable ($\alpha$ = .97).

*Purchase Intention*. Based on the constructs established by Lee & Aaker (2004), the likelihood of participants considering a purchase after shown EVA was captured. Respondents rated their agreement to statements, "I would consider purchasing the product recommended by the EVA," on a semantic differential scale (1: unlikely to 7: likely; $\alpha$ = .95). The cumulative scores present a clear picture of the purchase intention post-EVA engagement.

#### 4.1.7 Covariates

*Online shopping frequency*. Building upon the consistent observations that frequent online shoppers may have differing perceptions in the e-commerce environment, the regularity of online shopping activities of participants was measured. Participants were asked questions like, "How often do you shop online in a month?" with responses ranging on a seven-point scale (1: never – 5: multiple times a week). A higher score indicates more frequent online shopping activities.

*Product involvement*. Considering that a user's prior knowledge of a product could affect their interaction and judgment. The involvement adopted by Zaichkowsky (1985) regarding the presented products was assessed. The items included: unimportant-important; irrelevant to me-relevant to me; means nothing to me-means a lot to me.

*Familiarity with Virtual/Robotic Entities.* The degree of familiarity with these entities

among participants was evaluated. Participants were asked to rate their overall familiarity with the statement, "How familiar are you with virtual humans/robots?" (1: not familiar at all – 7: very familiar).

*Previous Experience with Virtual/Robotic Entities*. Considering virtual agents or robots can shape consumers' proficiency and comfort with such technologies, consumers' experience with automated entities was assessed. Respondents were asked regarding the frequency of their encounters and level of engagement with virtual or robotic technologies, such as "I encounter virtual agents or robots in my daily activities.", "I use virtual agents or robots for assistance with tasks.", "I am confident in my ability to interact with virtual agents or robots.", and "I keep informed about a new virtual agent or robot technology." (1: Never – 7: Always.

*Negative attitude toward robots*. Adapted from Nomura, Kanda, Suzuki, & Kato (2008), this measure sought to understand participants' predispositions or reservations toward robotic entities. It includes, "To what extent do you have anxieties about robots?" were posed, scaled from 1 (no anxieties) to 7 (significant anxieties). A higher score implies a more pronounced negative attitude.

*Demographic information*. Basic demographic data, including age, gender, and ethnicity, was gathered to make sure varied participant responses based on these criteria were factored in.

#### 4.1.8 Statistical Procedures for Data Analysis

Given the multifaceted hypotheses of this study, the analytical approach is systematic and comprehensive. The design is shaped to validate the stimuli and effectively test the hypotheses, thereby examining the relationships and interactions proposed.

##### 4.1.8.1 Stimuli Validation Analysis

Considering the significance of participants being able to distinctly recognize the

different levels of embodied virtual agents (EVAs), a one-way ANOVA was utilized. This statistical method measured the perceptual differences between EVAs characterized by high and low attractiveness.

#### 4.1.8.2 Main and Interaction Effects Analysis

Two-way ANOVA for the analysis of hypotheses H1, H2, H3a, and H3b were utilized. This investigates the primary effects of expectation and EVA attractiveness on attitudes and purchase intentions, also exploring their potential interaction.

#### 4.1.8.3 Moderation Analysis

Hypotheses from H3 and H4 highlight the pivotal role of certain personal traits: novelty seeking, and the need for cognitive closure. Model 3 from the PROCESS macro was instrumental in investigating how these traits interact with expectation violations to influence consumers' attitudes and purchase intentions.

#### 4.1.8.4 Mediation Analysis

H5 posits trust in EVAs as a key mediator. Model 8 in PROCESS was deployed to analyze both the direct effects of expectation violation on outcomes and the indirect effects mediated through trust.

To make the results of this study more robust, this study utilized a method called bootstrapping, with 10,000 repeats, to create confidence intervals.

*PLACE FIGURE 1, 2, AND 3 ABOUT HERE*

## 4.2 Results

### 4.2.1 Stimuli Development

To develop stimuli, a series of pretests were conducted. A total of 50 participants were recruited at Amazon's Mechanical Turk (MTurk). Participants were exposed to two different vignettes, each illustrating high expectations for a technological advance or low. After a randomized order of exposure to control the order effect, the participants were asked

to rate the expectations of EVA's overall appeal, resemblance to a real human, and physical attractiveness. A mean difference test showed that the participants rated their expectation of overall appeal higher in the high expectation condition ($M$ = 5.80, $SD$ = 1.18) than in the low expectation condition ($M$ = 3.68, $SD$ = 1.30; $F(1, 49) = 97.20$, $p < .001$). The resemblance also showed a significant difference between the two conditions ($M_H$ = 5.58, $SD_H$ = 1.03; $M_L$ = 3.24, $SD_L$ = 1.51; $F(1, 49) = 88.71$, $p < .001$). Finally, the rating of the physical attractiveness was higher in the high expectation condition ($M$ = 5.05, $SD$ = 1.30) than in the low expectation condition ($M$ = 3.12, $SD$ = 1.55; $F(1, 49) = 68.14$, $p < .001$).

Additionally, they were exposed to 10 different and randomly ordered visual stimuli, each containing a portrait of EVAs. The participants rated each stimulus on the similarly written questions, resulting in significant differences across the stimuli on the overall appeal ($F(4.05, 198.54) = 44.21$, $p < .001$), the resemblance to a real human ($F(4.26, 208.74) = 55.61$, $p < .001$), and the attractiveness ($F(3.43, 168.19) = 55.02$, $p < .001$). The stimulus for each attractiveness condition was selected based on the highest ($M$ = 5.54, $SD$ = 1.52) and the lowest ($M$ = 3.12, $SD$ = 1.43) attractiveness rating.

#### 4.2.2 Manipulation Checks

The manipulation checks for expectation setting of the physical attractiveness of EVA and actual physical attractiveness were conducted. The first manipulation checks focused on the expectation setting for the physical attractiveness of EVA. In this aspect of the study, participants were divided into two groups based on the expectation vignettes they received: high expectation and low expectation. The results indicated a significant difference in the anticipated attractiveness of EVA between the two groups. Participants in the the high expectation group expected the EVA as significantly more (M = 4.60, SD = 1.45), compared to the low expectation group (M = 2.56, SD = 1.35), $t(158) = -9.227$, $p < .001$). confirming the successful manipulation of expectations regarding attractiveness.

The second manipulation check assessed the actual physical attractiveness of the EVA as perceived by participants. For this check, EVAs were designed to vary in attractiveness levels—some intended to be highly attractive and others less so. Participants perceived the more attractive designs as more attractive (M = 5.19, SD = 1.33). Conversely, the less attractive designs received a less attractive (M = 3.39, SD = 1.52), $t(158) = -8.022$, $p < .001$). This confirms that the physical attractiveness of the EVA was effectively manipulated as intended.

### 4.2.3 Sample Profile

To examine the effect of EVA's expectations and appearance on customer outcomes, a total of 180 participants were recruited by Amazon M-Turk. After screening for incomplete responses, and failed attention checks—such as asking participants to select the synonym of "car", solve a simple arithmetic problem like "What is 2 plus 2?" with options, and select "strongly disagree" for a particular statement—, a sample of 160 participants was used in the main analysis.

Of the 160 participants in Study 1, the gender distribution was varied: 96 (60%) were male, 63 (39.4%) were female, and 1 (0.6%) did not reveal their gender. The participants had an average age of 44.44 years, with a standard deviation of 10.47. In terms of ethnicity, a significant majority of 93.8% (n = 150) were non-Hispanic. The racial composition was primarily White (80%, n = 128), followed by Black (8.1%, n = 13), Native American (4.4%, n = 7), Mixed (4.4%, n = 7), with a few identifying as Pacific Islander (0.6%, n = 1) or opting not to reveal their race (2.5%, n = 4).

Regarding Education, the largest group of participants held a bachelor's degree (43.1%, n = 69), with others having an associate or technical degree (19.4%, n = 31), some college but no degree (15%, n = 24), a high school diploma or GED (12.5%, n = 20), or a

graduate or professional degree (8.8%, n = 14). A negligible number had some high school or less (0.6%, n = 1), with one participant's educational level undisclosed.

The employment status showed that a majority were working full-time (70%, n = 112), followed by part-time workers (13.8%, n = 22), and smaller numbers of unemployed (0.6%, n = 1), homemakers (2.5%, n = 4), students (0.6%, n = 1), retirees (4.4%, n = 7), and others (8.1%, n = 13).

Income distribution indicated a wide range, with 20% (n = 32) earning less than $25,000 and a small fraction over $150,000 (6.2%, n = 10). Marital status varied widely as well, with the largest group having never been married (45.6%, n = 73), followed by married (36.9%, n = 59), living with a partner (6.9%, n = 11), divorced or separated (7.5%, n = 12), and widowed (3.1%, n = 5). The details of the participant demographics are in Table 1.

*PLACE TABLE 1 ABOUT HERE.*

To ensure the sampling quality provided by Amazon M-Turk and the randomness in assigning participants into the experiment conditions, demographic compositions were examined across the groups. In a two-way ANOVA, age did not differ by either expectation setting, $F(1, 156) = 1.04$, $p > .05$, attractiveness, $F(1, 156) = 0.476$, $p > .05$, or their interaction, $F(1, 156) = 0.891$, $p > .05$. Moreover, in chi-square tests of independence, gender was not associated with the experimental conditions, $\chi^2(6) = 11.16$, $p > .05$, nor was race, $\chi^2(15) = 11.23$, $p > .05$.

Measures used in Study 1 showed adequate reliability except the need for cognitive closure. The descriptive statistics and the reliability estimate for each measure are presented in Table 2.

*PLACE TABLE 2 ABOUT HERE*

**4.2.4 Hypotheses testing**

To test the main effects and the interaction of the consumer expectation and the

physical attractiveness of an EVA on the consumer's attitudes and the intention to purchase, a series of two-way analyses of variance (ANOVA) was conducted. Specifically, the outcome variables were a) the attitude toward the EVA, b) the attitude toward the recommendation, c) the attitude toward the product that the EVA recommends, and d) the intention to purchase.

The physical attractiveness of EVA had a positive impact on the attitude toward it, $F(1, 156) = 15.70, p < .001$. The attractiveness also had a positive impact on the attitude toward the recommendation, $F(1, 156) = 5.46, p < .05$. Moreover, the attractiveness had a positive impact on the attitude toward the product, $F(1, 156) = 11.99, p < .001$. However, the attractiveness did not impact the intention to purchase the product, $F(1, 156) = 1.66, p = .20$. The positive impact of physical attractiveness on the various consumer attitudes and intentions, which the H1 predicted, was partially supported with exceptions on the purchase intention.

The main focus of Study 1 is to examine the effect of the violation of the consumer's expectation. The H2 stated the prediction where the low expectation violated by high attractiveness (positive violation) yields positive consumer outcomes compared to the confirmation of the expectation and the negative violation. This prediction was tested by the interaction of the expectation and the attractiveness of the consumer outcomes. Unfortunately, none of the outcomes tested was impacted by the interaction between the expectation and the attractiveness, *F*-ratios with the numerator degree of freedom (*df*) 1 and the denominator *df* 156 ranged between 0.04 and 1.10, and p-value ranged between 0.30 and 0.84.

While the initial approach to examine the effect of expectation violation was to test the interaction terms on the two-way ANOVAs on the outcomes, the non-significances do not necessarily conclude the rejection of the H2. We also attempted a more direct approach to examine the effect of violation in the additional analysis covered in the next section.

The differential effect of novelty-seeking on the interaction between the expectation and the attractiveness was tested by examining the three-way interaction of the expectation, the attractiveness, and the novelty seeking on the outcome variables. Unfortunately, no interaction terms were significant on the consumer outcomes we tested, *t*-values ranged between 0.50 to 1.22, and *p*-values ranged between .22 to .62. Thus, the H3 was not supported.

In a similar manner, the need for cognitive closure was predicted to have interaction effects with the expectation and the attractiveness on the consumer's attitude and the purchase intention in the H4. However, the three-way interactions showed no support to the research hypothesis, t-values ranged from -1.16 to 1.43, and *p*-values ranged from .15 to .94.

Consumer trust in the EVA was hypothesized to mediate the relationship between the effect of the expectation violation and the consumer's outcomes in H5. The examination of the mediation effect consisted of two stages where a significant result from the first stage was necessary to continue the analysis. However, the effect of expectation violation did not predict the consumer trust in the EVA, $F(1, 156) = 0.01, p = .92$, This result rendered the first stage of the mediation analysis inconclusive, impeding any further investigation into the mediation effect proposed in H5.

#### 4.2.4.1 Additional Analysis

The primary focus of this study was to investigate how consumer's attitudes were formed in the context of whether their expectation of the EVA is violated or confirmed. The analysis preliminarily tested the effect of violation by including the expectation and the attractiveness conditions independently and examined the significance of the interaction term.

While this approach has the benefit of distinguishing the effect of the expectation and the attractiveness, a more direct approach is possible so that the grouping of the participants represents the variable in the H2. Specifically, participants were divided into three distinct

experimental groups, each representing a unique condition related to expectation violation: the positive violation group, the negative violation group, and the confirmation group. The positive violation group consists of those who were exposed to the low-expectation stimulus and the highly attractive EVA. The negative violation group consists of those who were exposed to the high-expectation stimulus and the low-attractive EVA. The confirmation group consisted of participants whose experiences were associated with their initial expectations, as they were exposed to a congruency between expectation levels and EVA attractiveness. Comparing the means of outcome variables by this alternative grouping allows us to examine the effect of violation more directly.

This strategic division of participants into these three categories enabled a direct and focused examination of the effects of expectation violation. By comparing the mean values of the outcome variables across these groups, the study sought to shed light on how different types of expectation violations—or the confirmation of expectations—influence consumer attitudes.

In the alternative test of the violation effect, the consumer's attitude toward the EVA showed a significant difference between the groups, $F(2, 157) = 4.12, p < .05$. In order to examine which pair of groups actually differ, Tukey's Honest Significant Differences (HSD) test was used as a post-hoc comparison with 95% family-wise confidence level. While the confirmation group did not differ from both violation groups, the means of the positive violation group was 1.01 points higher than the negative violation group, $p_{adjusted} < .05$.

The violation of the consumer's expectation led to a significant difference in the attitude toward the recommendation made by EVA, $F(2, 157) = 5.37, p < .01$. The Tukey's HSD showed that the negative violation group mean was less than the positive violation group mean by 1.01, $p_{adjusted} < .01$, and also less than the confirmation group mean by 0.66, $p_{adjusted} < .05$. The positive violation group and the confirmation group did not

differ, $p_{adjusted} = .34$.

Similarly, the attitude toward the product also was affected by the violation of the consumer's expectation, $F(2, 157) = 8.88, p < .001$. The positive violation group showed 1.14 points higher attitude than the negative violation group, $p_{adjusted} < .001$. Also, the confirmation group showed 0.60 points higher attitude than the negative violation group, $p_{adjusted} < .05$, but showed 0.53 points lower attitude than the positive violation group, $p_{adjusted} < .05$. Figure 4 shows the patterns of means for each outcome.

In contrast, the purchase intention was not affected by the violation of expectation, $F(2, 157) = 1.37, p = .26$.

**4.3 Discussion**

Study 1 employed a two-way analysis of variance (ANOVA) to assess the main effects and interactions between consumer expectations and the physical attractiveness of an Embodied Virtual Agent (EVA) on consumer attitudes and the intention to purchase. Findings indicated a significant positive impact of EVA attractiveness on attitudes toward the EVA, its recommendation, and the product, but not on purchase intentions.

Although the investigation did not find significant interactions between consumer expectations and EVA attractiveness, the additional analysis revealed that violations significantly impact attitudes toward the EVA, its recommendations, and the product. Specifically, positive expectancy violations, which is an EVA's attractiveness surpassing initially low expectations, lead to favorable consumer attitudes. When EVAs appear more attractive than anticipated, they trigger a reassessment process that enhances consumers' perceptions and attitudes toward the EVA, its recommendations, and the product. In contrast, negative expectancy violations lead to less favorable consumer attitudes due to unmet expectations. This result underlines the assertion of EVT that violations can lead to a

reevaluation of the source of the violation.

Contrasting anticipations, a lack of significant interactions was found between novelty-seeking, the need for cognitive closure, and consumer expectations versus the actual attractiveness of Embodied Virtual Agents (EVAs). This indicates that the influence of traits like novelty-seeking and the need for cognitive closure on attitudes and purchase intention might be more complex than previously believed. While such characteristics affect responses to new technology and experiences, their specific impact on responses to the gap between expected and actual EVA attractiveness appears indirect and complex. Additionally, the static presentation of EVAs within the study may not have been engaging enough to generate a strong interaction effect. For those who are inclined toward seeking new and stimulating experiences, the static display of EVAs likely fell short of delivering the level of excitement needed to significantly alter their perceptions in light of expectancy violations. In the same vein, for individuals who prefer clear and concise information, the limited nature of the interaction may not have introduced enough uncertainty or complexity to noticeably change their attitudes.

Moreover, the absence of significant findings regarding trust as a mediator suggests the presence of other influential factors not captured in this study, potentially including EVA design, or variations in individual trust tendencies. While technology acceptance research underlines the vital role of trust in influencing user behavior, the relationship between trust and expectancy violations in EVA interactions may involve additional factors not considered in this analysis (Gefen & Straub, 2004).

Despite the lack of significant findings in the initial analysis, further analysis brought to light that expectancy violations had a significant effect on attitudes toward the EVA, its recommendations, and its products. Acknowledging the impact of expectancy violations observed in Study1, Study 2 investigates how the interaction of an EVA's design and

consumer expectations combined with functionality affects attitudes and behaviors. Thus, it allows us to investigate the comprehensive implications of expectancy violations in human-EVA interactions, particularly within environments that more accurately reflect genuine digital interactions.

# Chapter 5: Study 2

## 5.1 The Capabilities of the Embodied Virtual Agents

The proliferation of the application of EVAs across sectors – from therapy, and e-commerce, to education – speaks volumes about their multi-faceted products. This broad-spectrum utility is anchored in their sophisticated blend of visual design and operational competence. The development of basic chat platforms, which elaborates interactive entities is a testament to the developments made in technology and design (Kooli, 2023; Yang et al., 2020; Crompton & Burke, 2023). Drawing upon research insights, study 2 specifically examines the capabilities of EVAs, particularly emphasizing the influence of their physical attractiveness under the view of EVT.

The capabilities of Embodied Virtual Agents (EVAs) are informed by extensive research on human-computer interactions and artificial intelligence. One primary focus in the literature has been the ability of these agents to effectively interact with humans in a variety of contexts. Prior research provided early insights, which emphasize the role of visual representation, intelligence, and interface in EVAs (Cassell, Vilhjálmsson, & Bickmore, 2001). They pointed out that these factors enable EVAs to do more than just answer questions; they can engage in detailed conversations. One of the pioneering studies (Bickmore & Cassell, 2001) investigated the breadth of tasks EVAs can execute. Their analysis underscored that EVAs are not just about simplistic responses but rather understanding and reacting to complex human behaviors, all the while making informed decisions. Furthermore, research conducted by Cassell, Sullivan, Prevost, and Churchill

(2000) emphasized their growing importance in human-computer dialogues. Prior research has been on the precision with which EVAs perform. In addition, it has been revealed that consistent and contextually capable responses from EVAs foster increased trust and satisfaction among users (Thellman, Silvervarg, & Ziemke, 2016).

Lastly, the concept of EVAs learning from continuous feedback has been explored, demonstrating that with each interaction, they become more affiliated with user needs (McTear, Callejas, & Griol, 2016). This self-improving model, powered by sophisticated algorithms, ensures that EVAs grow progressively more sophisticated in their interactions. In this context, the previous study underlined the significance of an adaptive approach, emphasizing that recognizing shifts in user preferences and modulating responses is crucial for a more organic human-EVA engagement (Bickmore, Pfeifer, & Paasche-Orlow, 2009).

Taken together, the capabilities of EVAs in this study can be defined as the ability of an Embodied Virtual Agent (EVA) to process, interpret, and respond to user inputs in a contextually appropriate and efficient manner by demonstrating proficiency and adaptability.

### 5.2 The Research Problem of Study 2

Capabilities, especially in digital agents, are critical in dictating user experience. While attractiveness might serve as the initial attraction, it is the agent's capabilities that sustain prolonged user engagement (McTear, Callejas, & Griol, 2016). Further, research suggests that the functional abilities of a product or service can moderate the effects of other attributes on user attitudes and behaviors (Petty, Cacioppo, & Schumann, 1983). By incorporating capabilities, this study acknowledges the focal role of an EVA's technical ability in influencing user perceptions. The level of visual appearance of an EVA can either align with or deviate from a user's expectations. When users anticipate a visually appealing EVA to exhibit superior competence and it falls short, the disappointment from this negative expectation violation intensifies. Conversely, encountering an EVA that might lack in

physical attractiveness but surpasses functional expectations can lead to a positive surprise.

The role of physical attractiveness needs to be balanced with other crucial factors such as the relevance of the information provided by the EVA, its interactivity, and its responsiveness to user needs (Qiu & Benbasat, 2009). Therefore, a well-designed EVA should integrate an appealing physical appearance with competent and reliable performance to maximize its effectiveness. Recognizing this interaction, this study incorporates capabilities as a crucial moderating variable. Specifically, even an attractive EVA that is not associated with expectations could still foster positive user perceptions if its technical capabilities are outstanding. Similarly, an EVA that may not appeal visually but delivers exceptional functionality can significantly bolster positive attitudes and purchase intentions. Thus, based on the above understanding, the following hypotheses are set forth.

H6. For EVAs that exceed high expectations of physical attractiveness, capabilities interact with the attractiveness to influence attitudes toward an EVA, recommendation, and product, and purchase intentions.

H6a. In the context of high expectations of physical attractiveness aligned with an EVA with low physical attractiveness, low capabilities enhance users' negative attitude toward the 1) EVA, 2) recommendation, 3) product, as well as reduced 3) intention to purchase, while its high capabilities weaken these negative outcomes.

H6b. In the context of low expectations of physical attractiveness aligned with high physical attractiveness, high capabilities enhance positive attitudes toward 1) EVA, 2) recommendation, 3) product, as well as increased 3) intention to purchase, while its low capabilities weaken these positive outcomes.

## 5.3. Method

### 5.3.1 Research Design

Study 2 employs a 2x2x2 (expected physical attractiveness: high vs. low, EVA

physical attractiveness: high vs. low, and capabilities: high vs. low) between-subjects design, directing participants through one of eight experimental conditions. This structure incorporates three primary factors: The first two factors are consistent with Study 1. In specific, the first factor, expected physical attractiveness, is related to user expectations about the EVA's appearance. In conditions with high expectations, users anticipate interacting with an EVA that is visually attractive, while in low-expectation conditions, users are set for an EVA with a less attractive appearance. The second factor, the actual physical attractiveness of the EVA, involves the real visual appeal presented to the participants. The participant either encounters an EVA designed with high visual appeal, characterized by aesthetically pleasing features, or an EVA with a more basic, less visually appealing design. Lastly, the EVA's capabilities compose the third factor. In conditions with high capabilities, the EVA is designed to efficiently handle and process user needs. It displays technical competence and adaptability in interactions. Conversely, an EVA with low capabilities is characterized by simpler, more basic interactions, with limited processing and response abilities.

The overarching goal of Study 2 is to understand how these factors interact, especially in the context of online shopping. The study evaluates how users react when their expectations are met or not, and how the violation of the EVA's attractiveness and capabilities influence their attitude and behavior intention.

### 5.3.2 Independent Variables

#### 5.3.2.1 Expectation versus Reality in EVA's Appearance

Before participants entered the online shopping platform, they introduced EVA through a narrative vignette that outlined its visual appeal. Following this narrative, they are shown a visual representation of EVA, which either supports or contrasts the expectations set. The specific narrative vignettes and visuals employed for EVA are consistent with those utilized in Study 1.

### 5.3.3 Moderating variable

#### 5.3.3.1 Level of Capabilities

In Study 2, the capabilities of an Embodied Virtual Agent (EVA) are important. This pertains to EVA's capability to effectively process, interpret, and respond to user inputs, guaranteeing contextually appropriate and efficient interactions while exhibiting technical competence and adaptability. In detail, in high capabilities conditions, participants engaging with EVA in this condition undergo a rich and interactive session. An EVA equipped for a thorough and enriched engagement. It is not just about the series of questions EVA puts forth to gauge consumer preferences, needs, and past shopping encounters. Rather, the emphasis lies in the depths of its understanding, swiftly adapting and responding to dynamic user feedback. Conversely, in the low capability scenario, participants are met with an EVA of limited depth. It is not about the breadth of the questions, but their lack of depth. It often results in generalized or even wrong product recommendations. The essence of this condition is EVA's limited capacity to recognize user preferences and adjust responses accordingly.

The comprehensive model for Study 2 is illustrated in Figure 5.

*PLACE FIGURE 5 ABOUT HERE*

### 5.3.4 Procedure

Upon beginning, participants underwent an expectation-setting stage. They were randomly assigned to experience either a high or low-expectation vignette about EVA's appearance. Following this narrative introduction, a visual representation of EVA was displayed, with its attractiveness level determined by another random assignment. Some participants observed a finely detailed EVA, while others encountered a less appealing version. Next, participants began by interacting with a specified EVA through a provided website link which is displayed around eight products. Depending on random assignment, participants encountered one of four combinations: A highly attractive EVA possessing high

capabilities, a less attractive EVA with low capabilities, a highly attractive EVA with low capabilities, and a less attractive EVA having high capabilities.

The participants were given 15 seconds to browse. Following this, a programmed chat with a virtual salesperson (EVA) proceeded, with the salesperson's appearance and capability level corresponding to the earlier assignment. In the final stage of the selection process, participants received recommendations based on their choices. Additionally, depending on the quality of the responses, participants were required to spend either 20 seconds (high quality) or 5 seconds (low quality) reading the last response provided by the EVA, which included a description or simple recommendation of the product. Following this, participants were directed to the last pages of the website, where they were prompted to enter the product that they had selected. This served to repeat their choice and prepare them for subsequent questions in the survey. To guarantee participants fully explored the website, a Personal Identification Number (PIN) was incorporated on the last page of the website, which participants had to correctly input upon returning to the survey before proceeding to answer any further questions. The survey concluded with manipulation checks, measurements of dependent variables, and demographic data collection (see Appendix B and C).

### 5.3.5 Sample

#### 5.3.5.1 Sample Size

The sample size for the study was determined using G*Power, a statistical tool that calculates the power of a test based on various input parameters. Considering the anticipated medium effect size ($f = 0.25$), an alpha level of 0.05 (commonly used in social sciences), and desired power ($1-\beta$) of 0.90 (a standard benchmark for sufficient power), the G*Power analysis indicated a required sample size of 171 participants for the eight-group design. However, considering the possibility of incomplete responses, and to ensure sufficient statistical power, the final sample size was set at 250 participants.

#### 5.3.5.2 Sampling Procedure

Participants for this study were recruited from CloudResearch, targeting U.S. residents over 18 years old who have experience with online shopping websites. Eligibility required not only fitting the demographic and experience criteria but also agreeing to participate and signing a consent form. This consent ensured that participants were fully informed about the nature of this study, their role in it, and the handling of their data, adhering to ethical research standards. Those who met these requirements and expressed a willingness to participate were allowed to proceed with the survey.5.3.5.3 Stimuli

The identical stimuli for expectation-setting vignettes and the visual representations of the EVA along with the manipulation check questions in Study 1 were employed. Moreover, the evaluation of the EVA's capabilities incorporated two comprehensive 9-item scales that measure performance efficacy (Davis, 1989) and adaptability (Knijnenburg et al., 2012): the scales of performance efficacy from the Technology Acceptance Model (TAM) were adapted in the context of evaluating the EVA. The items include "The EVA responded to my inputs in a timely manner.", "I believe the EVA processed my preferences effectively.", "The recommendations provided by EVA were in line with my preferences.", "I found the EVA to be a useful tool in enhancing my shopping experience.", "The EVA made my product search more efficient.", "I could rely on the EVA to understand my needs.", "Interacting with the EVA saved me time in finding the right products.", "The EVA seemed knowledgeable about the product options.", "I felt the EVA accurately interpreted my inputs and preferences.". For Adaptability which is based on the Perceived recommendation quality and system effectiveness includes "I liked the items recommended by the system.", "The recommended items were well-chosen.", "The recommended items were relevant.", "The list of recommendations was appealing.", "The system is useless.", "The system makes me more aware of my choice options.", "I make better choices with the system.", "I can find better

items using the recommender system.", "The system showed useful items."

Given the absence of commonly used manipulation checks for the capabilities, these adapted scales played a crucial role in determining the effectiveness of the manipulation. While the measurement properties of these scales have been established in previous research, the current study undertook a confirmatory factor analysis (CFA) to ensure their applicability in assessing the EVA's capabilities.

### 5.3.6 Product Selection

Reflecting current e-commerce dynamics and the focus of study 2, product and brand selections were informed by two focal considerations. Firstly, categories with a marked online presence and robust sales volumes were prioritized. Secondly, in light of the emphasis on EVA's capabilities, the inclusion of high-involvement products was emphasized. As a result, categories like consumer electronics, home appliances, beauty & personal care, and fashion and apparel emerged as primary choices for the selection process. In the course of interactions with the EVAs, two high-involvement purchase items from the categories of consumer electronics and home appliances, and two routine purchase items from beauty & personal care and fashion and apparel, are presented in the recommendation lists from EVA.

### 5.3.7 Variables and Measurement

In Study 2, several dependent variables and measurements were carried over from Study 1.

*Attitude.* All attitudes, attitudes toward the recommendation, attitude toward the Embodied Virtual Agent (EVA), and product adopted by (Homer, 1990; MacKenzie & Lutz, 1989) were measured using semantic differential scales, as detailed in Study 1.

*Purchase Intention.* Adopting measurements developed by Lee & Aaker (2004), this examined the likelihood of participants considering a purchase post-EVA. This employed a semantic differential scale, as detailed in Study 1.

*Covariates.* Online shopping frequency, product familiarity, negative attitudes toward robots, and robot acceptance were taken into account and assessed in association with the metrics and scales defined in Study 1.

### 5.3.8 Statistical Procedures for Data Analysis

#### 5.3.8.1 Stimuli Validation Analysis

Study 2 applied the stimuli that were selected through the pretest and checked the manipulations. This approach ensures consistency in the variables being tested across different phases of our research. By using the pre-tested stimuli, this study aims to validate the reliability and replicability of our findings, which allows for a more robust comparison of results between the studies.

#### 5.3.8.2 Main and Interaction Effects Analysis

A Three-Way ANOVA (2x2x2; expected physical attractiveness, actual EVA attractiveness, and capabilities) is performed to unpack the interaction effects among the factors. This serves to reveal any significant main effects and interactions related to H6a and H6b. Specifically, the focus is on how the interaction between attractiveness and capabilities affects attitudes and purchase intentions when physical attractiveness expectations are met or unmet.

## 5.4 Results

### 5.4.1 Manipulation Checks

The manipulation checks for expectation setting of the physical attractiveness of EVA and actual physical attractiveness were conducted. For expectation setting, the high expectation group expected the EVA as significantly more attractive ($M = 4.58$, $SD = 1.33$) than the low expectation group ($M = 3.26$, $SD = 1.66$), $t(222) = 6.54$, $p < .001$. Similarly, the actual physical attractiveness manipulation check showed that EVAs intended to be attractive were perceived as more attractive ($M = 4.76$, $SD = 1.57$) than less attractive designs ($M =$

3.65, *SD* = 1.64), $t(222) = 5.15$, $p < .001$. The findings indicated that the manipulation of both expectation setting and actual physical attractiveness was successfully achieved.

The manipulation of EVA's capability was newly introduced in Study 2. Due to a lack of commonly used manipulation checks on this factor, two different 9-item scales, performance efficacy and adaptability, were adapted to reflect the current experiment context and used to see how effective the manipulation was. Although the measurement properties of these scales are known (Davis, 1989; Knijnenburg et al., 2012), the current study performed a confirmatory factor analysis to ensure that the usage of these scales is justified to examine the capabilities of EVA. A two-factor measurement model yielded fit indices in the acceptable ranges (Hu & Bentler, 1999), CFA = 0.923, TLI = 0.911, and SRMR = 0.052. Detailed results of the CFA including the factor loadings of the items are contained in Table 3. A factor correlation between perceived efficacy and adaptability was .88.

*PLACE TABLE 3 ABOUT HERE*

Unfortunately, all items in the two scales were not able to distinguish between two experimental conditions of capability. Closer examinations of the distribution of responses suggested that there might be a ceiling effect, where most of the participants in both conditions responded with very high scores. Although the scales did not respond to the manipulation of the conditions, this does not necessarily mean that the manipulation was unsuccessful in two ways. First, even in the low capability condition, the EVA was designed to provide seemingly helpful advice. Thus, there is a possibility that the participants perceived the advice was useful. Second, both scales are not tailored to detect the difference between the conditions that the current study examines.

### 5.4.2 Sample Profile

To examine the effect of EVA's capability on customer outcomes in the junction of expectation and appearance, a total of 250 participants were recruited by CloudResearch.

After screening for incomplete responses, and failed attention checks—such as asking participants to select the synonym of "car", solve a simple arithmetic problem like "What is 2 plus 2?" with options, and select "strongly disagree" for a particular statement— a sample of 224 participants was used in the main analysis.

In specific, the gender distribution across the sample was almost evenly split with 113 (50.4%) identifying as male, 110 (49.1%) as female, and 1 (0.4%) opting not to reveal their gender. The participants had an average age of 37.87 years, with a standard deviation of 12.75. Ethnicity among participants was predominantly non-Hispanic, accounting for 84.4% (n = 189) of the sample. Racial demographics showed a majority of White participants at 69.6% (n = 156), followed by Black (9.8%, n = 22), Asian (12.5%, n = 28), Mixed (5.8%, n = 13), and Native American (0.4%, n = 1), with a few participants choosing not to disclose their race (0.4%, n = 1).

Educational attainment varied within the sample: the largest segment held a bachelor's degree (45.5%, n = 102), with the remainder distributed among those with some college but no degree (17.9%, n = 40), a high school diploma or GED (11.6%, n = 26), an associate or technical degree (8.9%, n = 20), and a graduate or professional degree (14.3%, n = 32). A minimal number reported having some high school education or less (0.9%, n = 2), and the education level of 0.9% (n = 2) was not disclosed. Employment status revealed that the majority were working full-time (58.5%, n = 131), with part-time employment (11.6%, n = 26), unemployment (9.4%, n = 21), homemakers (5.8%, n = 13), students (7.6%, n = 17), retirees (4.9%, n = 11), and others (2.2%, n = 5) also represented in the sample.

Income levels showed a broad distribution: 12.9% (n = 29) earned less than $25,000, and 7.1% (n = 16) earned over $150,000, with the remainder spread across various income brackets. Marital status varied, with 46.9% (n = 105) having never been married, 36.2% (n = 81) married, 8.9% (n = 20) living with a partner, 6.7% (n = 15) divorced or separated, and a

small number widowed (1.3%, n = 3). The details of the participant demographics are in Table 4.

*PLACE TABLE 4 ABOUT HERE*

To verify the quality of the sampling from CloudResearch and the random allocation of participants into the experimental conditions, the demographic breakdowns of the groups were analyzed. Using a three-way ANOVA, it was found that age did not significantly vary across different expectations, $F(1, 216) = 0.68$, $p > .05$, attractiveness levels, $F(1, 216) = 1.70$, $p > .05$, capability, $F(1, 216) = 0.17$, $p > .05$, or their interactions (expectation × attractiveness, $F(1, 216) = 1.18$, $p > .05$; expectation × capability, $F(1, 216) = 0.41$, $p > .05$, attractiveness × capability, $F(1, 216) = 0.14$, $p > .05$; expectation × attractiveness × capability, $F(1, 216) = 0.88$, $p > .05$). Additionally, chi-square tests showed no significant association between gender and the experimental conditions, $\chi2(14) = 10.84$, $p > .05$, or between race and the conditions, $\chi2(42) = 44.96$, $p > .05$.

The descriptive statistics and the reliability estimate of measured constructs for Study 2 are presented in Table 5.

*PLACE TABLE 5 ABOUT HERE*

**5.4.3 Hypotheses testing**

Study 2 hypothesized that the effect of expectation violation on customer outcomes depends on the EVA's capability. To test this hypothesis, a 2 (expectation) x 2 (appearance) x 2 (capability) ANOVA was conducted on attitudes and purchase intention. Three-way interactions on the attitude toward EVA were significant, $F(1, 216) = 8.56$, $p < .01$. To examine the interaction further, simple interactions at each level of capability were tested. While there was no interaction between the expectation and the appearance of EVA at the low capability condition, $F(1, 216) = 1.75$, $p > .05$, a significant simple interaction was found at the high capability condition, $F(1,216) = 7.63$, $p < .01$. The direction of the interaction was

illustrated in Figure 6. When the capability is high, the confirmation conditions—low expectation with low attractiveness and high expectation with high attractiveness—showed the highest level of attitude toward EVA, while the positive violation —low expectation with high attractiveness—was higher than the negative violation condition—high expectation with low attractiveness.

A similar pattern was found in the attitude toward recommendations made by EVA. The three-way interaction was significant, $F(1,216) = 5.99$, $p < .05$. The simple interaction of expectation and attractiveness was significant only in high capability condition, $F(1,216) = 11.42$, $p < .001$. The direction of the interaction is depicted in Figure 7. In addition, the results pertaining to the attitude toward the product endorsed by EVA showed a similar pattern. The three-way interaction was significant, $F(1,216) = 4.10$, $p < .05$. The simple interaction of expectation and attractiveness was significant only in high capability condition, $F(1,216) = 10.87$, $p < .01$. The direction of the interaction displayed in Figure 8. In terms of the purchase intention, a corresponding pattern was found. The three-way interaction was significant, $F(1,216) = 4.01$, $p < .05$. The simple interaction of expectation and attractiveness was significant only in high capability condition, $F(1,216) = 5.32$, $p < .05$. The direction of the interaction is presented in Figure 9.

*PLACE TABLE 6, 7, 8 AND 9 ABOUT HERE*

*PLACE FIGURE 6, 7, 8, AND 9 ABOUT HERE*

**5.5 Discussion**

Study 2 investigated the interaction between expectation and actual physical attractiveness of Embodied Virtual Agents (EVAs) depending on the capabilities of EVAs on attitudes and purchase intentions. By distinguishing between scenarios of high and low EVA capabilities, the study provided an understanding of how these factors influence consumer's attitudes and behaviors.

Specifically, in high-capability scenarios, EVAs that fail to meet high expectations for physical attractiveness evoke significantly stronger negative reactions compared to when they meet low expectations. This heightened response underscores the importance of expectation management in advanced systems. It lines up with the Expectation Violation Theory (EVT), which posits that larger discrepancies between anticipated and actual experiences profoundly impact consumer attitudes. Moreover, the observed gap between negative violations and confirmations, compared to positive situations, indicates a negativity bias where failures in meeting high expectations are more impactful than surpassing lower ones. In high-capability contexts, this means that the lack in physical attractiveness is particularly negative, significantly influencing consumer attitudes and behaviors.

Contrary to what EVT posits, the study reveals that positive confirmations can lead to stronger, favorable responses compared to positive violations. This unexpected result suggests that consumers might value the reliability and assurance provided by an EVA that meets high expectations. Such outcomes reinforce trust and satisfaction, which highlights the importance of consistency when technology plays a critical or essential role in operations or daily activities (Bhattacherjee, 2001). The findings imply that in that environment, consumers heavily rely on technology consistent performance from an EVA builds trust and ensures consumer satisfaction by eliminating uncertainty.

The comparison between negative confirmations and positive violations offers an interesting insight into consumer behavior in high-capability contexts. While EVT would suggest that positive violations should result in more favorable reactions than negative confirmations, the data could indicate that the reactions to these situations are more complicated. Factors such as the value of the EVA's capabilities and consumer risk aversion might influence these outcomes (Kahneman & Tversky, 2013). Consumers may prefer the predictability and lower risk associated with negative confirmations in high-capability

settings over the uncertainties that might accompany exceeding expectations.

In conditions where EVAs possess low capabilities, variations between expected and actual appearance do not significantly alter consumers' attitudes and behaviors. This indicates a prioritizing functional capability over appearance in shaping consumers' responses. In the case of limited EVA functionality, consumers seem to focus more on what the EVA can do rather than how it looks. In other words, when interacting with technology, consumers ultimately seek to accomplish specific tasks or fulfill certain needs. Their ability to provide utility becomes the primary concern for consumers. If an EVA cannot perform the basic functions, its aesthetic appeal becomes largely irrelevant to the consumer's overall satisfaction and perception. Thus, it emphasizes the importance of functional capabilities shaping attitudes toward the EVA, its recommendations, and endorsed products, and influencing purchase intentions.

Study 2 highlights the role of EVA capabilities in moderating the effects of expectation violations on consumers' attitudes and behaviors. Specifically, the high capabilities of EVA can enhance positive attitudes and mitigate negative influences related to appearance.

# Chapter 6: Discussion

## 6.1 General Discussion

Study 1 focused on the effects of expected and actual physical attractiveness of EVAs on consumer attitudes and intentions. This initial investigation sought to determine how consumer expectations regarding an EVA's physical appearance influenced their attitudes and intentions when those expectations were either met or not met. Building on this foundation, Study 2 investigates the interaction between expectations of physical attractiveness and the capabilities of EVAs. This study emphasized the additional impact of EVA capabilities by examining how the combination of an EVA's appearance and its technical competence affects

consumer attitudes and purchase intentions.

The primary aim of Study 1 was to examine the impact of the expected and actual physical attractiveness of Embodied Virtual Agents (EVAs) on consumer attitudes and intentions. Specifically, the finding discovered that EVA attractiveness positively affects consumer's attitudes toward EVA, its recommendations, and the product. As previously assumed, this result can be explained by the Halo Effect (Nisbett & Wilson, 1977). This cognitive bias, which is the overall impression significantly influences perceptions of specific traits or qualities, suggests that an attractive EVA might be deemed more credible or likable. Consequently, it enhances attitudes toward the agent, its recommendations, and the endorsed products. However, this initial positive bias toward attractiveness may not necessarily carry over into the purchase intentions, which are likely influenced by a broader range of factors including need, cost, and product utility.

Further examining consumer attitudes through the Elaboration Likelihood Model (ELM) offers an interesting lens. According to Petty and Cacioppo (1986), the model explains two paths to persuasion: the central route, dependent on the content's substance, and the peripheral route, influenced by superficial cues like attractiveness. The findings of this study suggest that while attractiveness can serve as a powerful initial appeal, influencing attitudes positively, the route from attitude to action specifically, the decision to purchase is navigated through various considerations and judgments, not solely guided by aesthetic appeal.

In examining the effects of expectancy violations regarding the physical attractiveness of EVAs on consumer attitudes and intentions, Study 1 revealed that the type of expectancy violation plays a key role in shaping attitudes toward the EVA, its recommendations, and the product. Specifically, the results highlight those positive violations significantly boosting their attitudes. This finding resonates with the theory that positive

surprises can augment perceptions and evaluative judgments, as the unexpected attractiveness of the EVA induces a favorable reevaluation of the interaction. Moreover, encountering an EVA that falls short of high expectations affects attitudes. This comparison demonstrates how disappointment from unmet expectations can negatively affect consumer perceptions of the EVA, its recommendations, and the product recommended.

In relation to novelty seeking, although we anticipated that novelty-seeking traits would significantly impact our findings, the interaction between the expected and actual attractiveness of EVAs was discovered otherwise. Multiple reasons can account for this phenomenon. Firstly, the Optimal Stimulation Level (OSL) Theory proposes that individuals have varying preferences for novelty and complexity, seeking an optimal level of stimulation (Berlyne, 1960). Individuals with high novelty-seeking tendencies might not find the variance in actual physical attractiveness of EVAs sufficient to affect their attitudes or behaviors if it does not significantly deviate from their expectations. This suggests that the level of stimulation provided by the physical attractiveness of EVAs might not meet the higher threshold required by novelty-seekers.

Pertaining to NFCC, Dual-Process Theories of Persuasion, such as the Elaboration Likelihood Model (ELM) and the Heuristic-Systematic Model (HSM) (Petty & Cacioppo, 1986), help us understand why NFCC might not significantly moderate the influence of expected versus actual EVA attractiveness. Individuals with a high NFCC who typically favor a more detailed and thorough processing approach might still lean on peripheral cues like attractiveness in situations that do not demand extensive cognitive engagement. This dependence could diminish the expected moderating effect of NFCC on reactions to physical attractiveness. Additionally, Schema Congruity Theory provides a lens through which to view consumer evaluations based on the congruence between stimuli and existing schemas or expectations (Mandler, 1982). In the context of EVA attractiveness, this theory posits that

reactions to the match or mismatch between expected and actual attractiveness might not be critically influenced by NFCC. Individuals with high NFCC, who generally seek consistency and predictability, may not find their need for closure significantly challenged by discrepancies in attractiveness—a peripheral attribute—especially if these do not conflict with their functional or usability schemas regarding EVAs. This could explain the lack of significant moderation by NFCC, as the congruity related to attractiveness might not strongly impact their evaluative processes.

As for trust as a mediator which was not found significant, several theoretical perspectives offer invaluable insights. Uncertainty Reduction Theory underscores the innate desire to minimize uncertainty in interactions (Berger & Calabrese, 1975). If engaging with the EVA failed to adequately address or reduce uncertainty—especially when actual attractiveness did not meet expectations—it is possible that building trust would become more difficult, then, it affects the EVA's potential to positively influence consumer attitudes and intentions. Furthermore, the Affect Infusion Model (AIM) proposed by Forgas (1995) suggests that emotional responses can play a critical role in information processing and decision-making, particularly under conditions of uncertainty or cognitive load. When consumers encounter an EVA whose attractiveness surpasses their expectations, the following positive emotional response could directly bolster attitudes, which bypasses the mediator role of trust. Conversely, if the EVA's attractiveness falls short, the negative emotions could directly induce negative attitudes, again without the mediating influence of trust.

Building on the findings from Study 1, Study 2 further explores how the interplay between consumer expectations and the actual physical attractiveness of EVAs by capabilities impacts consumer attitudes and purchase intentions.

In the high capabilities of EVAs, in line with EVT, the findings support those negative violations elicit significantly stronger adverse reactions than negative confirmations.

This distinction is particularly pronounced in high-capability contexts. When EVAs fall short of what is anticipated, the psychological impact is severe. This confirms EVT's statement that the discrepancy between expected and actual experiences has a profound impact on consumer attitudes and behaviors.

More interestingly, the observed larger gap between negative confirmation and negative violation compared to the gap between positive confirmation and positive violation suggests that negativity bias in human psychology, which is negative experiences have a more profound effect on one's emotional state than positive experiences of the same intensity (Rozin, & Royzman, 2001). In the context of high-capability EVAs, consumers likely have a heightened awareness and sensitivity to the EVA's performance, making negative violations particularly impactful.

Contrary to what EVT typically suggests, the study reveals that positive and negative confirmations can lead to stronger, more favorable responses than positive violations. Integrating Cognitive Dissonance Theory (Festinger, 1957), it can be explained. Cognitive dissonance occurs when there is a discrepancy between what people expect and what they experience in terms of physical attractiveness. When an EVA meets expectations in this aspect, this association reduces cognitive dissonance, thus eliciting positive outcomes. This is because consistent performance in meeting visual expectations encourages consumers that their initial beliefs or attitudes toward the EVA's attractiveness were correct, which promotes a harmonious consumer experience that enhances satisfaction and trust. This theory helps explain why consumers might prefer the lower risk and greater predictability associated with positive and negative confirmations over the uncertainties of positive violations, which might disrupt their mental model and expectations.

In the low capabilities of EVA, the focus shifts significantly from physical attractiveness to functional capability. Consumers prioritize what the EVA can achieve over

its appearance. It emphasizes the importance of functionality in shaping consumer responses. Drawing upon, the Technology Acceptance Model (TAM; Davis, 1989) elucidates this by emphasizing the importance of perceived usefulness and ease of use in the adoption of new technologies. In cases where EVAs lack the capabilities to perform effectively, their perceived usefulness drops, severely impacting their acceptance by consumers. This model suggests that no matter how visually appealing and the expectations an EVA might be, if it fails to deliver basic functionality, it will not be perceived as useful, and thus, less likely to be accepted or appreciated by users. In addition, Attribution Theory (Heider, 1958) also provides insight into how consumers assign reasons for their satisfaction or dissatisfaction. When confronted with a low-capability EVA, consumers are likely to attribute their dissatisfaction to the EVA's inability to perform its intended functions, rather than its appearance. This focus on functional shortcomings over appearances indicates that consumers prioritize the utility of the EVA. When functionality is lacking, consumers see this as the root cause of their dissatisfaction, in turn, it affects their overall attitudes and behavior regardless of physical attractiveness.

### 6.2. Implications

#### 6.2.1 Theoretical Implications

Study 1 addresses a gap by examining how consumer expectations regarding the physical attractiveness of Embodied Virtual Agents (EVAs) influence their attitudes and purchase intentions. Study 1 highlighted the impact of EVA attractiveness on consumer attitudes which is supported by the Halo Effect (Nisbett & Wilson, 1977). This cognitive bias suggests that attractive EVAs are perceived as more credible and likable, which in turn enhances attitudes toward the agent and its recommendations (Eagly et al., 1991). These findings extend the literature by demonstrating that while physical attractiveness initially influences consumer attitudes through peripheral cues, deeper decision-making processes

concerning purchases revert to the central route. It resonates with insights from the Elaboration Likelihood Model (Petty & Cacioppo, 1986). This emphasizes the interplay between superficial attractiveness and substantive content in consumer persuasion processes supported by previous studies that have explored similar phenomena across different forms of media (Johar & Sirgy, 1991).

In terms of the Expectancy Violation Theory (EVT; Burgoon, 1978), observing how positive violations significantly improve consumer attitudes. This conforms to EVT's perspective that positive surprises bolster perceptions and lead to a favorable reassessment of EVAs and their suggestions (Burgoon, 1993). This highlights the value of exceeding expectations to positively shift consumer attitudes (Sunnafrank, 1986). Moreover, negative violations occur when EVAs do not meet high attractiveness expectations, adversely affecting consumer attitudes. This also underscores EVT's view on the adverse effects of unmet expectations, which can significantly damage consumer perceptions (Rozin & Royzman, 2001; Baumeister et al., 2001).

Moreover, integrating technical competence alongside physical attractiveness in Study 2 provides a new perspective on the dual influence of EVA attributes on consumer attitude and behavior. Building on foundational research (Tractinsky et al., 2000; Cyr et al., 2006), it is clear that the aesthetic appeal of a system can impact user satisfaction by influencing initial emotional reactions. These reactions, in turn, can shape perceptions of usability and functionality. Such findings suggest that an appealing design might lead to more favorable evaluations of a system's capabilities, sometimes even before the user has fully engaged with its functional attributes.

However, as further explored in the study, while attractiveness can draw consumer attention and generate a positive initial response, it is the technical competence that sustains long-term engagement and satisfaction. This insight calls for a balanced approach in EVA

design, where aesthetics is not merely an enhancement to functionality but is essential for creating a comprehensive user experience. The relationship between aesthetics and functionality indicates that overlooking one can diminish the overall impact and effectiveness of the EVA.

This perspective lines up broader paradigms in human-computer interaction and marketing that emphasize a holistic approach to design. By considering both visual appeal and operational efficiency, developers and designers can craft more satisfying and effective digital experiences. Such a holistic approach can foster better adoption rates, elevate satisfaction, and boost loyalty, especially in settings where ongoing interaction with technology, such as customer service or e-commerce, is a norm. Moreover, these insights advocate for further exploration into how different demographic groups perceive and respond to the balance between aesthetics and functionality. Tailoring EVA designs to meet specific market needs could significantly enhance the effectiveness of marketing strategies and customer interaction models.

This research introduces a novel approach to integrating virtual assistants within online retail, addressing a relatively unexplored subject in the existing literature. It is a unique perspective combining the appealing attributes of Embodied Virtual Agents (EVAs) with their functional capabilities. It advances beyond traditional research focused solely on digital interfaces or user behavior. The importance of this dual focus is critical as businesses increasingly rely on digital agents to engage consumers, enhance shopping experiences, and strengthen brand relationships.

The research underscores the necessity for strategies that consider both the visual appeal and operational effectiveness of digital agents, thereby extending the body of literature on advertising, virtual assistance, and interpersonal content in digital domains. This dual approach is connected with foundational insights from studies like the integration of AI in

service systems (Huang & Rust, 2018), and the impact of technological advances on customer experiences (Dhruv, Roggeveen, & Nordfält, 2017). Additionally, the study investigated that the emotional engagement of users with AI-driven platforms further supports the critical role of effective digital agent design in enhancing user interactions and marketing communications (Rietveld, et al., 2020). Building upon insights from previous literature, this study establishes theoretical advancements in the digital marketing area involving virtual assistants. Overall, these studies contribute to the existing body of knowledge on consumer behavior in the context of digital interactions with EVAs. The integration of theories provides a deeper theoretical understanding of how expectations of appearances and functionality interact to shape consumer experiences in digital environments. This approach substantially builds upon the foundational work done by researchers in related fields (Komiak & Benbasat, 2006; van der Heijden, 2004).

### 6.2.2 Practical Implications

The results of this study have considerable implications for industries that use Embodied Virtual Agents (EVAs), particularly in sectors like retail, customer service, and marketing. As digital interactions become more common, it is essential for companies to carefully design EVAs that are not only appealing in appearance but also effective in function. This research highlights the importance of both the attractiveness and performance of EVAs in shaping consumer attitudes and decisions.

For businesses to successfully use EVAs, understanding how consumers perceive and interact with these agents is key. Incorporating insights from the Expectancy Violation Theory (EVT) and the Halo Effect, companies can fine-tune their strategies to boost consumer engagement. For example, designing EVAs that sometimes exceed expectations can surprise consumers positively, consequently improving their overall evaluations. Additionally, businesses using these technologies must carefully consider how EVAs appear

to consumers. Training staff to understand the importance of EVAs' visual appeal and continuously adapting based on consumer feedback are crucial strategies.

In specific, in the retail sector, retailers can deploy EVAs as virtual shopping assistants on their e-commerce platforms. By designing these EVAs to not only be visually appealing but also highly functional, they can guide customers through the shopping process, provide personalized recommendations based on customer preferences and past shopping behavior, and answer queries about products in real-time. For instance, an EVA designed with an attractive, approachable look and equipped with the capability to understand and process complex customer requests can enhance the shopping experience, leading to increased sales and customer loyalty.

In terms of customer service, EVAs can be implemented as the first point of contact for customer inquiries. These agents can handle a range of tasks from providing information about products and services to resolving common issues. The attractiveness of these EVAs can make the initial interaction more pleasant, while their ability to effectively resolve issues determines overall customer satisfaction. A customer service EVA that exceeds expectations in both appearance and functionality can significantly reduce the workload on human staff and improve the efficiency of the service department. In the aspect of marketing, EVAs can be used in innovative campaigns to engage customers. For example, an EVA could host a virtual event or interact with customers on social media platforms, providing information and answering questions in real time. By exceeding expectations in terms of visual appeal and interactivity, such EVAs can create memorable experiences that enhance brand perception and deepen customer engagement.

Furthermore, marketing efforts should aim to accurately communicate the visual attributes of EVAs by setting realistic expectations and thereby minimizing the likelihood of consumer disappointment. In customer service, the approachable and attractive appearance of

EVAs plays a critical role in making consumers feel at ease. This can be particularly effective in sectors such as banking or healthcare, where customer anxiety may be higher. For instance, an EVA serving as a financial advisor could be designed with a reassuring appearance and tone, using visual cues that convey trust and professionalism. Such design choices can make complex financial information more accessible and interactions less intimidating, which could lead to higher customer satisfaction.

Creating EVAs that not only meet but exceed visual expectations can significantly impact brand perception and campaign engagement in marketing. Consider a scenario in a car dealership where an EVA interacts with potential buyers. If the EVA is designed to appear as an expert such as sleek, professional, and knowledgeable, it can enhance the consumer's perception of the sophistication and technological advancement of the brand. When such an EVA provides detailed, accurate information about cars with an engaging and interactive character, it leaves a lasting impression that may translate into increased sales and brand loyalty.

Addressing potential mismatches between what EVAs can do and consumer expectations is also crucial. Companies should make certain that the user interface of EVAs is intuitive and straightforward by making it easier for users of all ages and tech-savviness levels to interact without feeling overwhelmed or frustrated. Additionally, enhancing the responsiveness of EVAs can play a significant role in user satisfaction. For example, an EVA used in a customer support role should respond promptly to queries and be capable of handling multiple interactions efficiently without significant delays.

Moreover, integrating adaptive learning algorithms can enable EVAs to learn from past interactions and improve their responses over time, making them more adept at meeting varied consumer needs. This adaptive capability ensures that EVAs evolve continually to better serve consumers, thus aligning more closely with user expectations and reducing the

likelihood of disappointment.

In summary, developing a comprehensive design strategy that considers both the expectations of how it looks, and the capabilities of EVAs can lead to more effective consumer interactions. These findings offer guidance for brands looking to create more engaging and satisfying digital experiences, consequently, improving consumer perceptions of the brand and its products.

### 6.3 Limitations and Future Research

While this study contributes valuable insights into the interaction between consumer expectations and physical attractiveness along with the capabilities of EVAs, there are limitations that suggest areas that need further research.

Firstly, the dependence on online survey platforms such as Mechanical Turk, or CloudResearch for participant recruitment can impact the reliability of the data collected. Although measures like attention checks are used to ensure respondents are engaging with the survey thoughtfully, the primary motivation of compensation might still affect the depth and quality of responses. Participants motivated by financial incentives might focus on completing the surveys quickly rather than accurately, potentially affecting reliability.

Secondly, the experimental design may oversimplify the complexities of human expectations and perceptions in interactions with EVAs. Real-world interactions with technology are often influenced by a field of factors that these controlled environments may not adequately capture. Future studies could incorporate a more continuous measurement of expectations and attractiveness to better represent the varied characteristics of consumer interactions with technology.

Thridly, the use of vignettes and static images to simulate interaction with an EVA might not fully capture the authentic interactions in real-life settings. Future research could employ more interactive and immersive technologies such as virtual reality or real-time

simulations to more accurately mimic the way consumers interact with EVAs in everyday circumstances.

Lastly, the findings of the study are based on immediate reactions to the EVAs rather than long-term engagement or repeated interactions, which could yield different results. The impact of sustained interactions on consumer attitudes and behaviors is an area that need exploration. Longitudinal studies could examine changes in consumer perceptions over time, which provides an understanding of the durability of initial impressions and the changing characteristics of consumer-EVA relationships.

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**Table 1**

**Participants' Demographics of Study 1**

| | | | |
|---|---|---|---|
| Age (mean (SD)) | 44.44 (10.47) | Edu (%) | |
| Gender (%) | | Some high school or less | 1 ( 0.6) |
| Male | 96 (60.0) | High school diploma or GED | 20 (12.5) |
| Female | 63 (39.4) | Some college, but no degree | 24 (15.0) |
| Not revealed | 1 ( 0.6) | Associates or technical degree | 31 (19.4) |
| Employment (%) | | Bachelor's degree | 69 (43.1) |
| Working full-time | 112 (70.0) | Graduate or professional degree | 14 ( 8.8) |
| Working part-time | 22 (13.8) | Not revealed | 1 ( 0.6) |
| Unemployed | 1 ( 0.6) | Income (%) | |
| A homemaker | 4 ( 2.5) | < $25k | 32 (20.0) |
| Student | 1 ( 0.6) | $25k - $50k | 41 (25.6) |
| Retired | 7 ( 4.4) | $50k - $75k | 27 (16.9) |
| Other | 13 ( 8.1) | $75k - $100k | 25 (15.6) |
| Non-Hispanic (%) | 150 (93.8) | $100k - $150k | 16 (10.0) |
| Race (%) | | > $150k | 10 ( 6.2) |
| White | 128 (80.0) | Not revealed | 9 ( 5.6) |
| Black | 13 ( 8.1) | Marital (%) | |
| Native American | 7 ( 4.4) | Married | 59 (36.9) |
| Pacific Islander | 1 ( 0.6) | Living with a partner | 11 ( 6.9) |
| Not revealed | 4 ( 2.5) | Widowed | 5 ( 3.1) |
| Mixed | 7 ( 4.4) | Divorced/Separated | 12 ( 7.5) |
| | | Never been married | 73 (45.6) |

**Table 2**

**Descriptive Statistics of Measures of Study 1**

| Scale | No. of items | Cronbach's Alpha | M | SD |
|---|---|---|---|---|
| Previous exposure to robot | 4 | 0.71 | 2.55 | 0.70 |
| Product involvement | 3 | 0.95 | 6.11 | 1.31 |
| Novelty seeking | 7 | 0.93 | 4.91 | 1.34 |
| Need for cognitive closure | 3 | 0.55 | 4.77 | 1.13 |
| Trust | 4 | 0.93 | 4.52 | 1.39 |
| Attitude toward EVA | 4 | 0.98 | 4.93 | 1.55 |
| Attitude toward recommendation | 4 | 0.97 | 4.91 | 1.46 |
| Attitude toward product | 4 | 0.97 | 5.00 | 1.33 |
| Intention to purchase | 3 | 0.95 | 3.90 | 1.71 |

**Table 3**

**Results of Confirmatory Factor Analysis for Measurements Associated with Capability**

| Item | Standardized Factor Loading |
|---|---|
| Perceived Efficacy | |
| The EVA responded to my inputs in a timely manner. | 0.661 |
| I believe the EVA processed my preferences effectively. | 0.861 |
| The recommendations provided by EVA were in line with my preferences. | 0.884 |
| I found the EVA to be a useful tool in enhancing my shopping experience. | 0.878 |
| The EVA made my product search more efficient. | 0.910 |
| I could rely on the EVA to understand my needs. | 0.895 |
| Interacting with the EVA saved me time in finding the right products. | 0.883 |
| The EVA seemed knowledgeable about the product options. | 0.827 |
| I felt the EVA accurately interpreted my inputs and preferences. | 0.845 |
| Adaptability | |
| I liked the items recommended by the system. | 0.924 |
| The recommended items were well-chosen. | 0.895 |
| The recommended items were relevant. | 0.730 |
| The list of recommendations was appealing. | 0.905 |
| The system is useless. (R) | 0.700 |
| The system makes me more aware of my choice options. | 0.811 |
| I make better choices with the system. | 0.692 |
| I can find better items using the recommender system. | 0.637 |
| The system showed useful items. | 0.817 |

**Table 4**

**Participants' Demographics of Study 2**

| | | | |
|---|---|---|---|
| Age (mean (SD)) | 37.87 (12.75) | Edu (%) | |
| Gender (%) | | Some high school or less | 2 ( 0.9) |
| Male | 113 (50.4) | High school diploma or GED | 26 (11.6) |
| Female | 110 (49.1) | Some college, but no degree | 40 (17.9) |
| Not revealed | 1 ( 0.4) | Associates or technical degree | 20 ( 8.9) |
| Employment (%) | | Bachelor's degree | 102 (45.5) |
| Working full-time | 131 (58.5) | Graduate or professional degree | 32 (14.3) |
| Working part-time | 26 (11.6) | Not revealed | 2 ( 0.9) |
| Unemployed | 21 ( 9.4) | Income (%) | |
| A homemaker | 13 ( 5.8) | < $25k | 29 (12.9) |
| Student | 17 ( 7.6) | $25k - $50k | 53 (23.7) |
| Retired | 11 ( 4.9) | $50k - $75k | 44 (19.6) |
| Other | 5 ( 2.2) | $75k - $100k | 35 (15.6) |
| Non-Hispanic (%) | 189 (84.4) | $100k - $150k | 37 (16.5) |
| Race (%) | | > $150k | 16 ( 7.1) |
| White | 156 (69.6) | Not revealed | 10 ( 4.5) |
| Black | 22 ( 9.8) | Marital (%) | |
| Native American | 1 ( 0.4) | Married | 81 (36.2) |
| Asian | 28 (12.5) | Living with a partner | 20 ( 8.9) |
| Other | 3 ( 1.3) | Widowed | 3 ( 1.3) |
| Not revealed | 1 ( 0.4) | Divorced/Separated | 15 ( 6.7) |
| Mixed | 13 ( 5.8) | Never been married | 105 (46.9) |

**Table 5**

**Descriptive Statistics of Measures of Study 2**

| Scale | No. of items | Cronbach's Alpha | M | SD |
|---|---|---|---|---|
| Previous exposure to robot | 4 | 0.76 | 2.61 | 0.77 |
| Product involvement | 3 | 0.92 | 5.03 | 1.50 |
| Novelty seeking | 7 | 0.91 | 5.00 | 1.11 |
| Need for cognitive closure | 3 | 0.54 | 4.94 | 1.05 |
| Trust | 4 | 0.94 | 4.80 | 1.35 |
| Perceived efficacy of EVA | 9 | 0.96 | 5.14 | 1.33 |
| Adaptability of EVA | 9 | 0.94 | 5.01 | 1.18 |
| Attitude toward EVA | 4 | 0.96 | 5.23 | 1.43 |
| Attitude toward recommendation | 4 | 0.98 | 5.23 | 1.48 |
| Attitude toward product | 4 | 0.97 | 5.30 | 1.44 |
| Intention to purchase | 3 | 0.97 | 4.43 | 1.77 |

**Table 6**

**Effects of expectation, attractiveness, and capability on the customer's attitude toward EVA.**

| Source | Sum of squares | df | Mean square | F | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Expectation (E) | 0.94 | 1 | 0.94 | 0.47 | 0.00 |
| Attractiveness (A) | 7.84 | 1 | 7.84 | 3.93* | 0.02 |
| Capability (C) | 0.29 | 1 | 0.29 | 0.15 | 0.00 |
| E x A | 1.44 | 1 | 1.44 | 0.72 | 0.01 |
| E x C | 2.62 | 1 | 2.62 | 1.31 | 0.01 |
| A x C | 1.59 | 1 | 1.59 | 0.80 | 0.00 |
| E x A x C | 17.09 | 1 | 17.09 | 8.56** | 0.04 |
| E x A at C: low | 3.50 | 1 | 3.50 | 1.75 | |
| E x A at C: high | 15.22 | 1 | 15.22 | 7.63** | |
| Residuals | 431.19 | 216 | 2.00 | | |

*p < .05, **p < .01

**Table 7.**

**Effects of expectation, attractiveness, and capability on the customer's attitude toward the recommendation.**

| Source | Sum of squares | df | Mean square | F | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Expectation (E) | 0.00 | 1 | 0.00 | 0.00 | 0.00 |
| Attractiveness (A) | 0.37 | 1 | 0.37 | 0.18 | 0.00 |
| Capability (C) | 2.00 | 1 | 2.00 | 0.98 | 0.00 |
| E x A | 10.84 | 1 | 10.84 | 5.32* | 0.03 |
| E x C | 1.43 | 1 | 1.43 | 0.70 | 0.01 |
| A x C | 1.04 | 1 | 1.04 | 0.51 | 0.00 |
| E x A x C | 12.22 | 1 | 12.22 | 5.99* | 0.03 |
| E x A at C: low | 0.00 | 1 | 0.00 | 0.00 | |
| E x A at C: high | 23.30 | 1 | 23.30 | 11.42*** | |
| Residuals | 440.35 | 216 | 2.04 | | |

*p < .05, **p < .01, ***p < .001

**Table 8.**

**Effects of expectation, attractiveness, and capability on the customer's attitude toward the product.**

| Source | Sum of squares | df | Mean square | F | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Expectation (E) | 0.00 | 1 | 0.00 | 0.00 | 0.00 |
| Attractiveness (A) | 2.62 | 1 | 2.62 | 1.37 | 0.01 |
| Capability (C) | 1.38 | 1 | 1.38 | 0.72 | 0.00 |
| E x A | 13.33 | 1 | 13.33 | 6.99** | 0.04 |
| E x C | 1.32 | 1 | 1.32 | 0.69 | 0.01 |
| A x C | 2.37 | 1 | 2.37 | 1.24 | 0.01 |
| E x A x C | 7.82 | 1 | 7.82 | 4.10* | 0.02 |
| E x A at C: low | 0.64 | 1 | 0.64 | 0.33 | |
| E x A at C: high | 20.73 | 1 | 20.73 | 10.87** | |
| Residuals | 411.88 | 216 | 1.91 | | |

*p < .05, **p < .01

**Table 9.**

**Effects of expectation, attractiveness, and capability on the customer's attitude toward the purchase intention.**

| Source | Sum of squares | df | Mean square | F | Partial $\eta^2$ |
|---|---|---|---|---|---|
| Expectation (E) | 0.16 | 1 | 0.16 | 0.05 | 0.00 |
| Attractiveness (A) | 3.93 | 1 | 3.93 | 1.30 | 0.01 |
| Capability (C) | 0.42 | 1 | 0.42 | 0.14 | 0.00 |
| E x A | 4.22 | 1 | 4.22 | 1.40 | 0.01 |
| E x C | 5.90 | 1 | 5.90 | 1.96 | 0.01 |
| A x C | 0.50 | 1 | 0.50 | 0.17 | 0.00 |
| E x A x C | 12.09 | 1 | 12.09 | 4.01 * | 0.02 |
| E x A at C: low | 0.62 | 1 | 0.62 | 0.21 | |
| E x A at C: high | 16.06 | 1 | 16.06 | 5.32 * | |
| Residuals | 651.80 | 216 | 3.02 | | |

*p < .05

**Figure 1**

**Conceptual Research Model of Study 1**

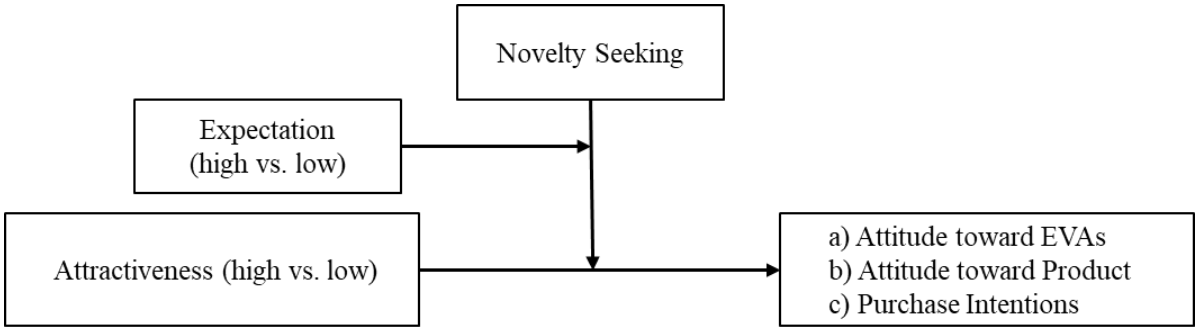


**Figure 2**

**Conceptual Research Model of Study 1**

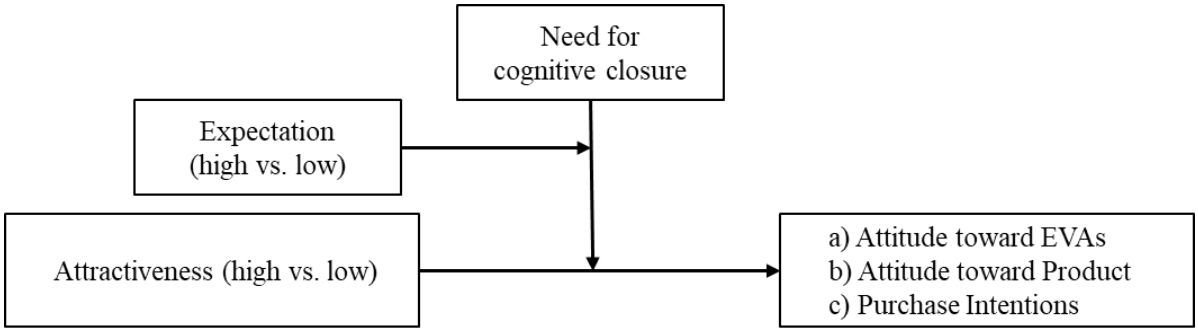


**Figure 3**

**Conceptual Research Model of Study 1**

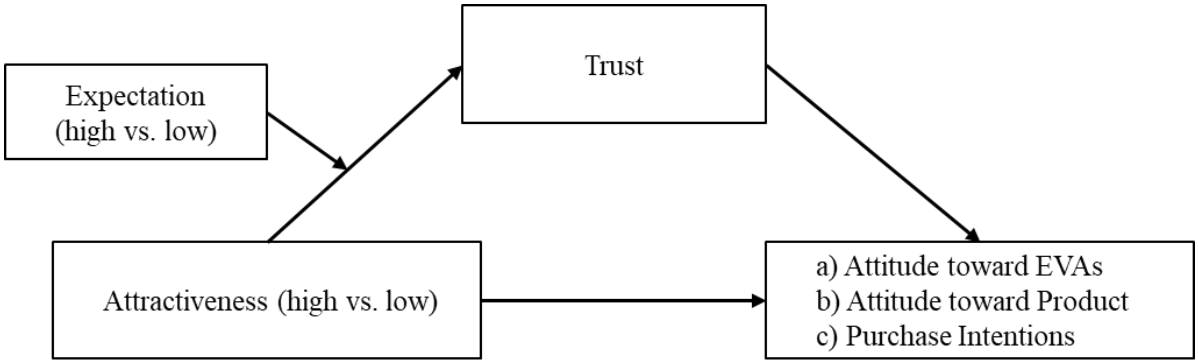


**Figure 4**

**The attitudes by expectation violation and confirmation**

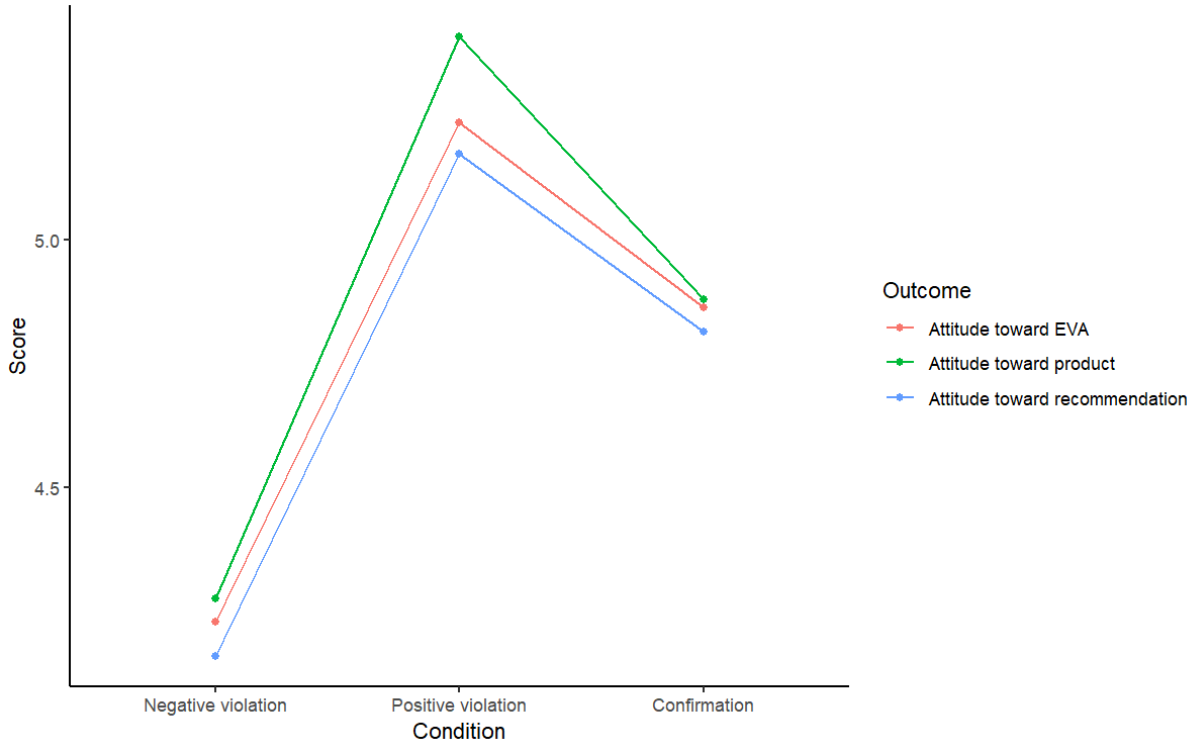


**Figure 5**

**Conceptual Research Model of Study 2**

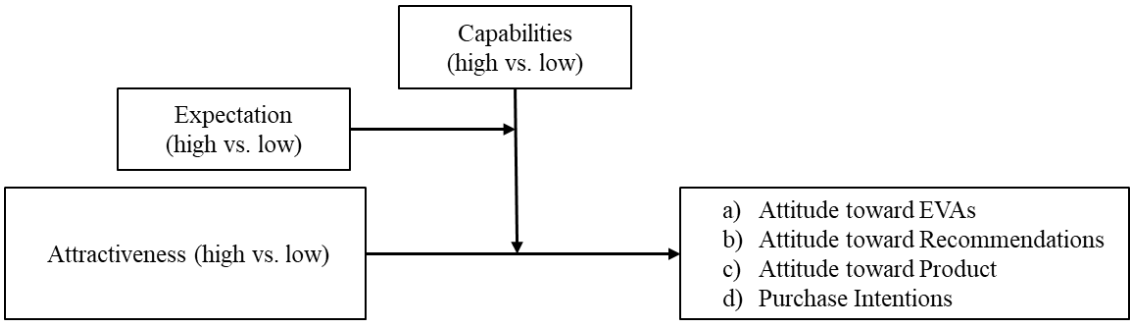


**Figure 6.**

**The interplay of expectation, attractiveness, and capability on the customer's attitude toward the EVA.**

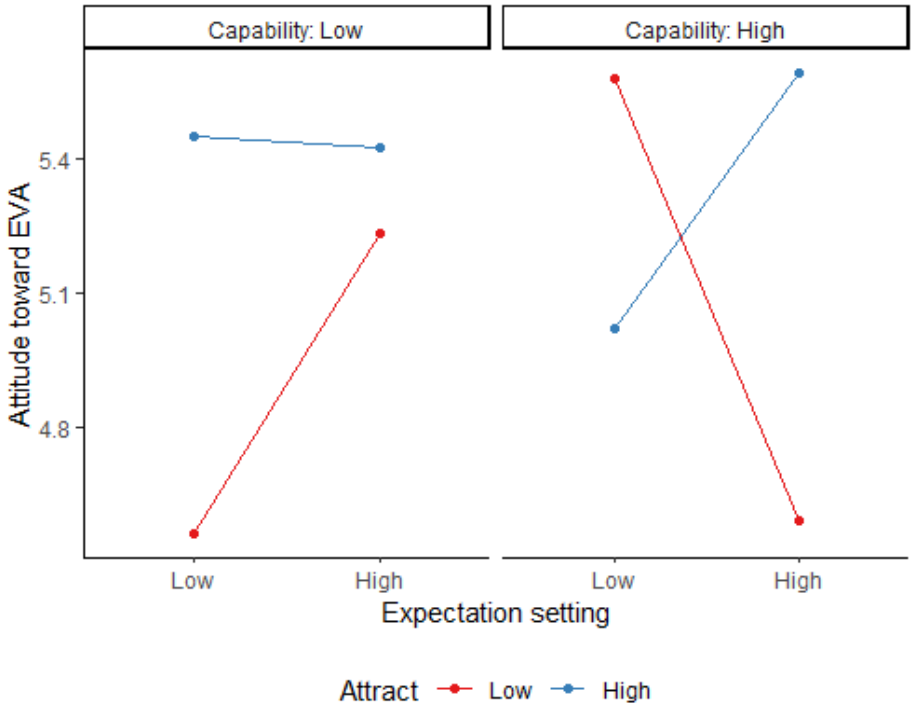


**Figure 7.**

**The interplay of expectation, attractiveness, and capability on the customer's attitude toward the recommendation.**

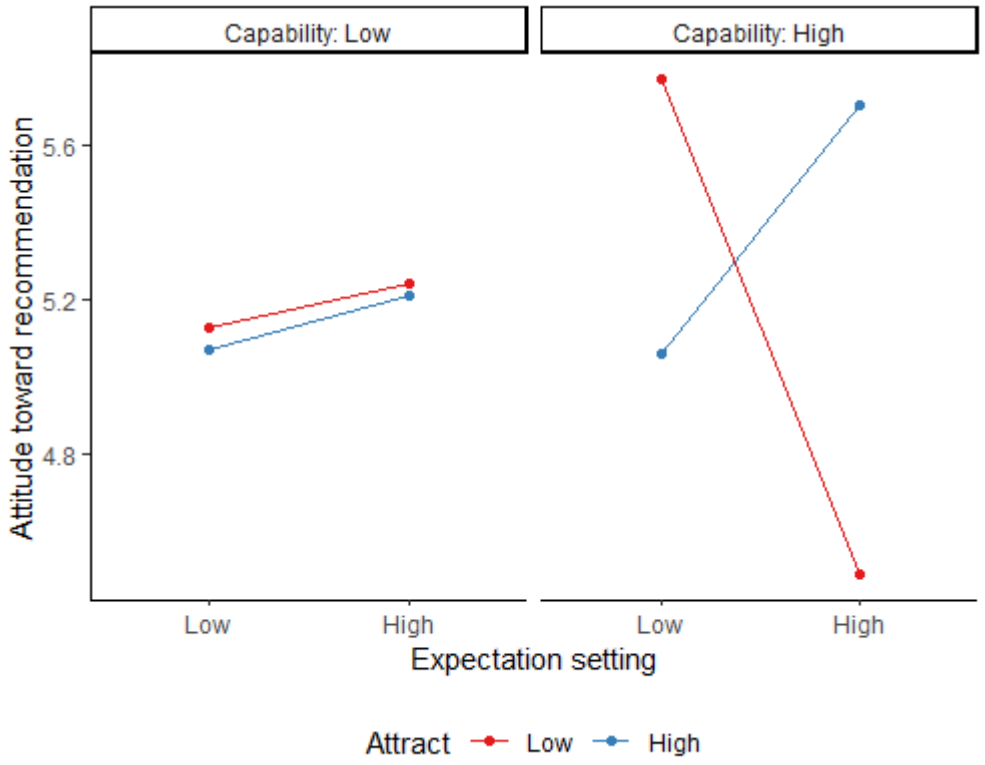


**Figure 8.**

**The interplay of expectation, attractiveness, and capability on the customer's attitude toward the product.**

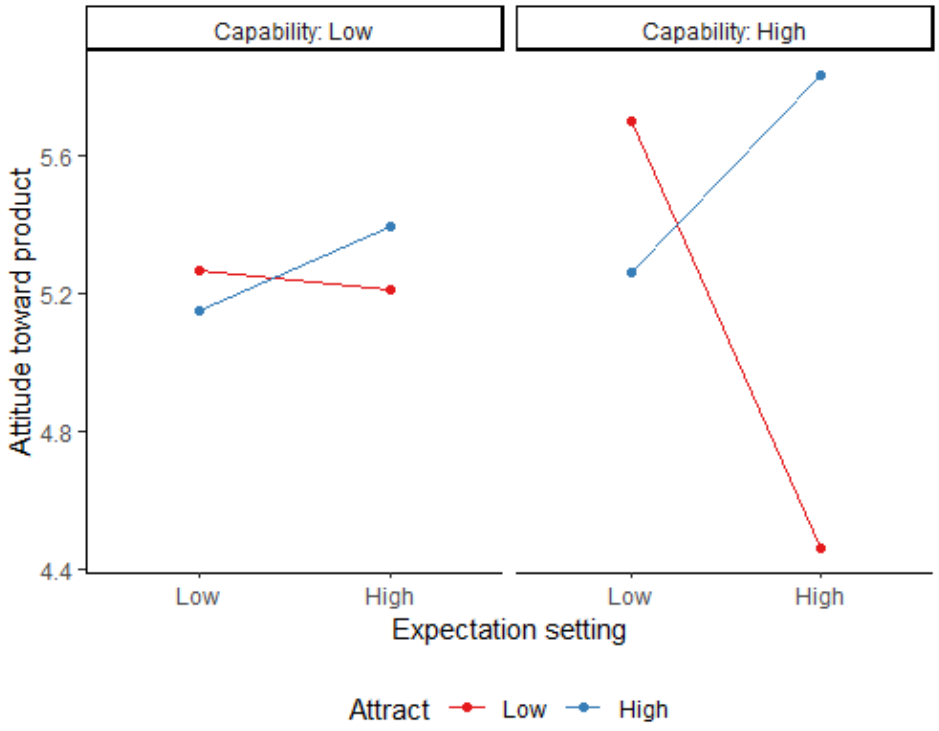
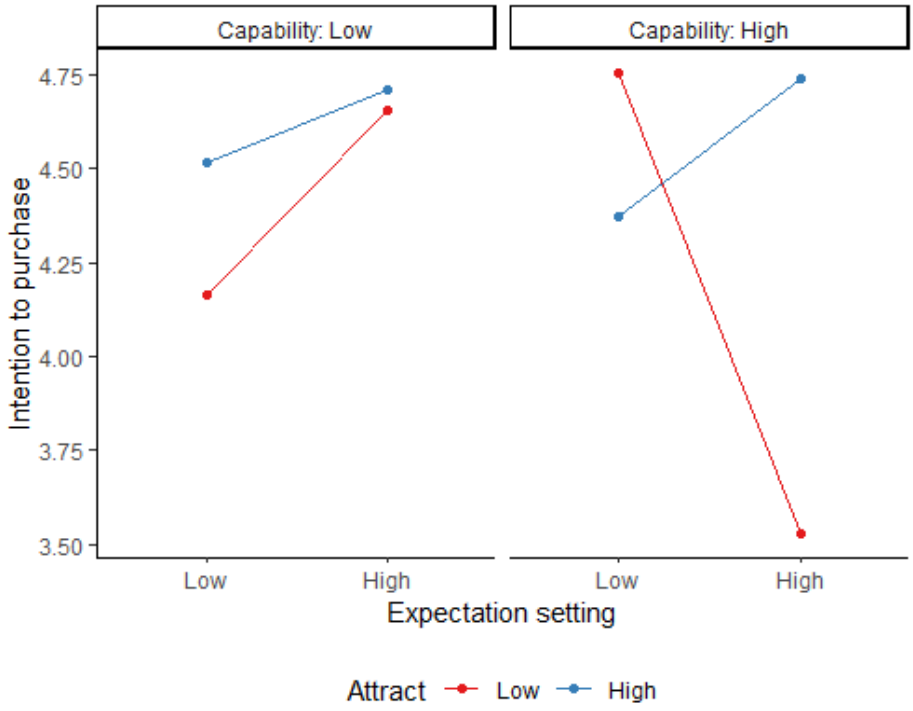


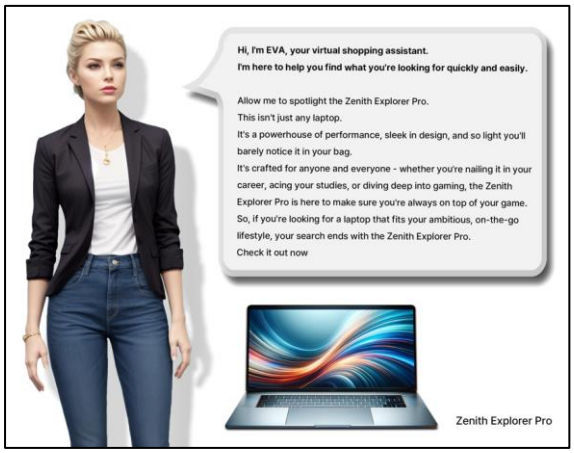
**Figure 9.**

**The interplay of expectation, attractiveness, and capability on the customer's attitude toward the purchase intention.**

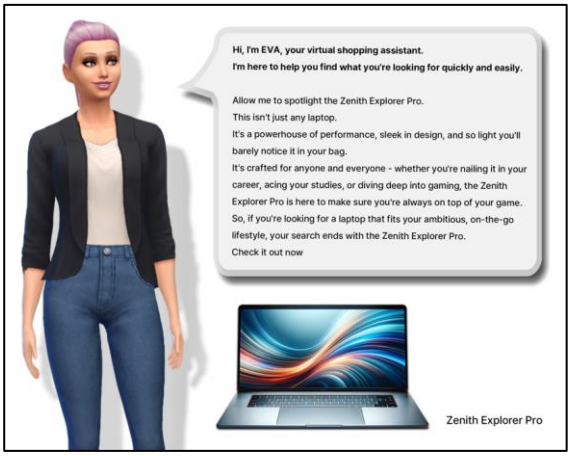


## **Appendix A-** Stimuli of Study 1

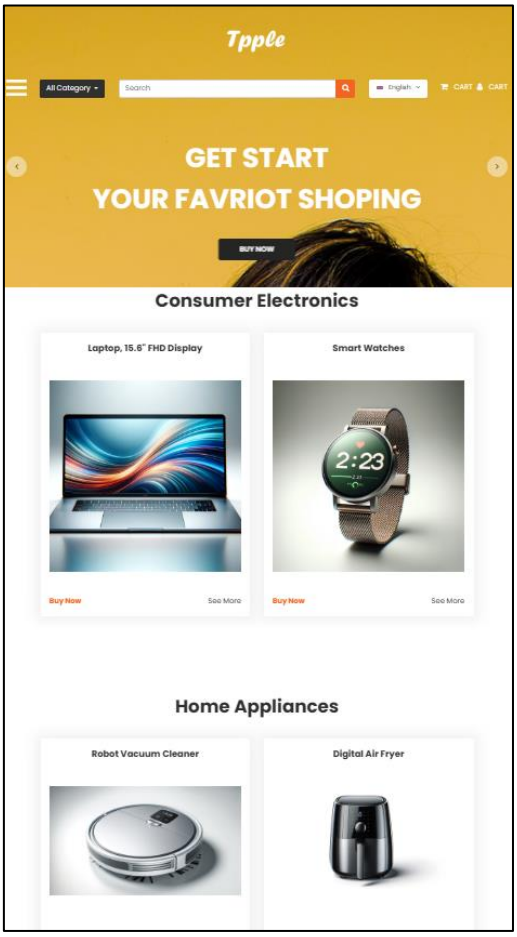
High physical attractiveness




Low physical attractiveness

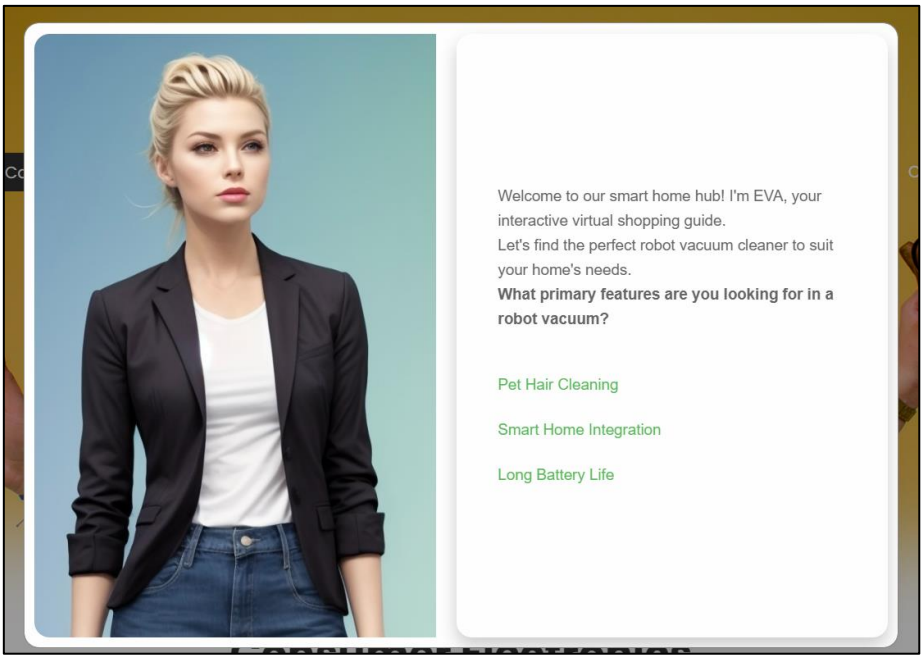


**Appendix B-** Online Shopping Site Stimuli of Study 2



## **Appendix C**- Stimuli of Study 2

High capabilities and high attractiveness




Low capabilities and low attractiveness

