

The Post-Print of Anthropomorphic Effects of Virtual Sales Agents

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Abstract

In online shopping, a Virtual Sales Agent (VSA) refers to a dynamic human-like character with anthropomorphic features that interacts and communicates with consumers through verbal or non-verbal forms, and can provide consumers with information about products and services as well as necessary assistance. In recent years, numerous studies have confirmed the anthropomorphic effect of virtual sales agents, that is, when anthropomorphic sales agents are incorporated into the online shopping environment, they positively influence shoppers' perceived experience of the online shopping process and their purchase intentions. Related theories have explained the underlying mechanisms of the anthropomorphic effect of virtual sales agents from different perspectives. A review of previous empirical research has found that the occurrence of the anthropomorphic effect of virtual sales agents is influenced by factors such as virtual sales agent characteristics, consumer factors, and product factors; social presence, personalized service perception, social support perception, trust, and risk perception constitute the internal psychological mechanisms underlying the anthropomorphic effect. Future research should focus on the neurophysiological basis of the anthropomorphic effect of virtual sales agents, enrich the influencing factors of the anthropomorphic effect, strengthen research on personalized customized virtual sales agents, explore the negative effects of virtual sales agents, and investigate the barrier factors that hinder the use of virtual sales agents.

Full Text

The Persona Effect of Virtual Sales Agents

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Abstract: Virtual sales agents (VSA) in online shopping refer to dynamic human-like figures that interact and communicate with consumers through verbal or non-verbal forms, providing product and service information as well as necessary assistance. Recent research has consistently demonstrated the persona effect of VSA—when anthropomorphic sales agents are integrated into online shopping environments, they generate positive influences on shoppers' perceived experience and purchase intentions. Various theories offer different perspectives to explain why this persona effect occurs. A review of existing empirical studies reveals that the VSA persona effect is influenced by VSA characteristics, consumer factors, and product factors. The underlying psychological mechanisms include social presence, sense of personalization, perceived social support, trust, and risk perception. Future research should explore the neurophysiological basis of the persona effect, expand the range of influencing factors, strengthen studies on personalized/customized VSAs, examine potential negative effects, and investigate barriers to VSA adoption.

Keywords: online shopping; virtual sales agent; persona effect; psychological mechanism

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1 Introduction

As online shopping becomes increasingly popular, improving consumers' shopping experience and purchase intentions has emerged as a key concern for both businesses and researchers. In physical retail environments, consumers can obtain needed information and personalized services through face-to-face social interactions with sales staff (Burke, 2002). Salespersons' appearance (Shao, Baker, & Wagner, 2004), personality traits, and behavioral performance (Darman, Tucci, & Wiman, 2001) affect consumer satisfaction with products and services, thereby influencing purchase intentions. However, in online shopping environments, the inability to engage in face-to-face communication and social interaction makes it difficult for consumers to obtain assistance from sellers and creates a lack of social presence, trust, and enjoyable experiences—representing a major obstacle to online shopping (Barlow, Alexis, Noreen, Siddiqui, & Mannion, 2004; Eroglu, Machleit, & Davis, 2001). Advances in human-computer interaction technology have introduced interactive and human-like social cues into shopping websites, which partially compensate for these deficiencies and have been widely applied in website design (Prendinger, Helmut, & Ishizuka, 2004).

With the development of artificial intelligence and virtual reality technology, virtual sales agents (VSA) that interact with users through animated figures via verbal or non-verbal forms have become increasingly prevalent social cues in shopping websites (Cassell, Sullivan, Prevost, & Churchill, 2000). VSAs com-

compensate for the lack of social cues (i.e., cues based on human characteristics) and interpersonal interaction in traditional shopping websites, positively influencing consumers' shopping process perceptions and purchase intentions (Holzwarth, Janiszewski, & Neumann, 2006)—this influence constitutes the “persona effect” of VSA. Researchers have conducted extensive studies on the theoretical foundations, influencing factors, and underlying mechanisms of the VSA persona effect. This paper aims to review existing research findings from China and abroad to provide references for related research and applications.

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2.1 Virtual Sales Agents in Online Shopping

A virtual sales agent (VSA) is a dynamic human-like figure that interacts and communicates with consumers through verbal or non-verbal forms (Cassell et al., 2000), providing product or service information and necessary assistance (Zanker, Bricman, & Jessenitschnig, 2011). VSAs may take the form of interactive animated avatars (Keeling, McGoldrick, & Beaty, 2010), animated pictures (Zanker et al., 2011), or photographs of real salespeople (Verhagen, Van Nes, Feldberg, & Van Dolen, 2014). For example, IKEA, the Swedish home furnishings retailer, features an automated virtual sales agent named Anna on its website (Ikea.com), who wears company uniform and answers customer inquiries about IKEA products and services.

Compared to face-to-face interpersonal contact in physical environments and web-based or technology-mediated service delivery, VSAs represent a high degree of integration between information technology and human social contact [Figure 1: see original paper] (Bitner, Brown, & Meuter, 2000; Verhagen et al., 2014). On one hand, information technology provides an interactive platform for information access; on the other hand, VSAs exhibit certain personality traits, human-like behaviors, and capabilities for social and interpersonal interaction, thereby more readily evoking social presence, social perception, and sense of personalized service (Qiu & Benbasat, 2009; Wang, Baker, Wagner, & Wakefield, 2007).

VSAs possess both internal and external attributes. Internal attributes refer to their technical support functions. In terms of information search support, VSAs understand consumers' personalized needs through conversation and provide customized products (Choy & Loker, 2004) or service information (Dash & Saji, 2007). For users experiencing difficulties in online shopping, navigational/procedural support functions assist them in completing transactions and order processes to achieve shopping goals (Chattaraman, Kwon, & Gilbert, 2012;

Joyner, 2010). In decision support functions, VSAs help consumers make choices by comparing alternatives (Sproule & Archer, 2000).

External attributes refer to the visual presentation of VSAs—visualized dynamic figures (real person images, anthropomorphic cartoon figures, or virtual avatars) that can display different personality traits (sincerity, competence, attractiveness) through various appearances (gender, age, ethnicity, facial expressions, clothing, identity) and communication styles (social, task-oriented). By simulating social cues through anthropomorphic appearance, voice, gestures, and greetings (Dash & Saji, 2007; Keeling et al., 2009; Wang et al., 2007), as well as social roles such as sales agents or customer representatives (Qiu & Benbasat, 2009; Wang et al., 2007), VSAs facilitate social interaction between consumers and businesses, increase consumers' social presence and perception of the website's social nature, and satisfy consumers' interpersonal needs during shopping (Wang et al., 2007). This enables consumers to become more immersed in online shopping, derive greater shopping enjoyment, trust the information provided by the website more readily, and consequently increase their purchase intentions.

2.2 The Persona Effect of Virtual Sales Agents

Building upon research on pedagogical agent effects in multimedia learning, Lester et al. (1997) proposed the “persona effect” —the addition of anthropomorphic pedagogical agents to multimedia interactive learning environments positively influences learners' perceived experience and learning outcomes, even when the agents are not highly expressive. Similarly, VSAs in shopping websites not only help consumers solve product or service-related problems (Zanker et al., 2011) but also evoke consumers' social perceptions during online shopping, making them feel the real presence of sales staff and experience personalized service (Komiak & Benbasat, 2004) as well as social and interpersonal support (Verhagen et al., 2014), thereby positively influencing their shopping experience and purchase intentions (Holzwarth et al., 2006). This constitutes the persona effect of VSAs.

Previous research has examined the VSA persona effect using various indicators including consumer attitudes toward businesses and products, as well as purchase intentions. Product or service satisfaction represents an important manifestation of consumer attitudes—a cognitive or emotional evaluation of product or service quality (Caruana, 2002) and a crucial outcome variable in both offline and online shopping experiences (Bitner et al., 2000). In online shopping, interaction with VSAs similarly affects consumer attitudes. Studies have found that compared to websites without sales agents, VSAs lead to higher satisfaction or more positive attitudes toward businesses, shopping websites, and products or services (Holzwarth et al., 2006; Jin, 2009; Jin & Sung, 2010; Riedl, Mohr, Kenning, Davis, & Heekeren, 2014; Shim, Kwon, Chattaraman, & Gilbert, 2012; Verhagen et al., 2014).

Driving consumers toward purchase intentions represents both the goal of busi-

nesses and an important indicator of VSA effectiveness. Holzwarth et al. (2006) found that using VSAs strengthens consumers' purchase intentions. Wang et al. (2007) further discovered that during online shopping, when VSA representing businesses possess human-like attributes or social cues, consumers' purchase intentions increase significantly. Subsequent research has shown that the presence of VSAs promotes genuine social interaction, leads consumers to perceive technical and social support from shopping websites, and consequently influences their purchase intentions (Beldad, Hegner, & Hoppen, 2016; Bente, Dratsch, Rehbach, Reyl, & Lushaj, 2014; Chattaraman et al., 2012; Shim et al., 2012).

These studies demonstrate that using VSAs in shopping websites positively influences consumer attitudes and purchase intentions, confirming the existence of the VSA persona effect.

3 Theoretical Foundations of the VSA Persona Effect

Existing theories explain the VSA persona effect from different perspectives. Social Response Theory, the Threshold Model of Social Influence, and Parasocial Interaction Theory explain the internal and external factors influencing the persona effect, while Social Presence Theory reveals its underlying psychological mechanisms.

3.1 Social Response Theory

Social Response Theory posits that during human-computer interaction, when computers display human-like attributes or social cues (e.g., human faces, voices, gender), humans respond socially according to social rules (Nass & Moon, 2000; Reeves & Nass, 1996). In other words, although users know they are interacting with machines rather than humans, they still treat computers as social actors rather than machines. Users treat computers as they would humans, exhibiting similar social responses such as flattery (Fogg & Nass, 1997), politeness (Nass, Moon, & Carney, 1999), and reciprocity (Moon, 2000). Eye-tracking studies of virtual pedagogical agents found that learners focus more on the nose area when viewing agents (Louwerse, Graesser, Mcnamara, & Lu, 2009). fMRI research has shown that viewing virtual characters' facial expressions activates the same brain regions as human-human interaction (Schilbach et al., 2006), indicating that interaction with virtual characters follows patterns consistent with real-world human communication. This theory has received support from numerous researchers (Kothgassner, Kafka, Rudyk, Beutl, Hlavacs, & Felnhofer, 2014; Kothgassner et al., 2017; Felnhofer et al., 2018; Von der Pütten, Krämer, Gratch, & Kang, 2010).

According to Social Response Theory, when sufficient social cues are present in computers (e.g., human voice, language), humans automatically and unconsciously attend to and respond socially to them—an evolutionary outcome (Nass & Moon, 2000). This may occur because social cues in computers activate users' memory schemas, scripts, labels, and expectations related to human in-

teraction (Langer, 1989), while people tend to make automatic responses to computers based on simplified social scripts (e.g., politely responding to computer-generated greetings). This automated social response in human-computer interaction primarily stems from humans' tendency to process social information using heuristic information processing (Tversky & Kahnemann, 1974) rather than curiosity about new technology.

Based on Social Response Theory, Wang et al. (2007) argued that when social cues such as human voice, language, interactivity, and social roles (e.g., shopping guides) appear on shopping websites (Steuer, Jonathan, & Nass, 1993), they evoke consumers' social perception of the website—consumers treat the website as a social interaction object (Reeves & Nass, 1996; Steuer et al., 1993). Therefore, during online shopping, when VSA representing businesses possess human-like attributes or social cues, consumers may exhibit social responses similar to human communication, experience social presence, increase arousal levels and shopping enjoyment, and consequently influence their shopping behavior (Wang et al., 2007).

3.2 Threshold Model of Social Influence

The Threshold Model of Social Influence posits that the key for virtual characters to evoke social responses and generate social influence is the emergence of “social verification” —the degree to which individuals experience meaningful semantic exchange with other virtual individuals in virtual groups and thus feel co-presence (Blascovich, 2002). Two critical factors affect social verification: the anthropomorphism level of virtual characters (including human-controlled avatars and computer-controlled agents) and behavioral realism. Social influence only occurs when social verification reaches a certain threshold [Figure 2: see original paper] (Blascovich, 2002). As shown in Figure 2, when users know the virtual character represents a real human (avatar), social verification and social influence occur regardless of behavioral realism. Conversely, when users know the virtual character is computer-controlled (agent), behavioral realism must be sufficiently high to generate social responses and influence (Blascovich, 2002).

According to this model, individuals' social responses to virtual avatars or agents are not automatic, unconscious processes but rather more complex cognitive processes (social verification) (Blascovich, 2002). Therefore, social responses depend on the characteristics of the virtual agent itself (Bailenson, Blascovich, Beall, & Loomis, 2001; Guadagno, Blascovich, Bailenson, & McCall, 2007). In online shopping, only when consumers perceive that the VSA is operated by a real person, or that although computer-controlled, the VSA exhibits extremely high behavioral realism, can “social verification” emerge to evoke social responses and subsequently influence attitudes and behaviors.

3.3 Parasocial Interaction Theory

The concept of parasocial interaction was originally proposed by Horton and Wohl (1956) to describe the relationship between media users and media characters—audiences react to media figures as if they were real people and develop attachments to favored media personalities or characters (including celebrities, film characters, or virtual characters in animations and games), forming an imagined interpersonal relationship. Parasocial interaction often exhibits highly automatic, unconscious, stylized, and heuristic characteristics, with audiences frequently making automatic, unconscious social responses to media characters (Schramm & Wirth, 2010). In traditional media environments, parasocial interaction involves one-way communication from audience to media character without strict interaction. Because this social interaction resembles yet differs from real social interaction, Horton and Wohl (1956) termed it “parasocial interaction,” with the resulting relationship called a “parasocial relationship.”

Although parasocial interaction primarily describes audiences’ relationships with traditional media characters (e.g., film figures), research has also applied it to user experiences in online environments (Hoerner, 1999). In the digital age, parasocial interaction has broken through the unidirectional flow of information and interaction, with audiences experiencing bidirectional interactive parasocial communication (隋岩, 周琼, 2016). In online environments, parasocial interaction represents the degree of interpersonal involvement network users experience and their perception of interacting with media characters (Goldberg & Allen, 2008). For instance, research shows that virtual chat agents in online conversations elicit emotional responses from other online communicators, increasing emotional involvement and empathy levels, demonstrating that virtual agents increase social presence and create a sense of chatting with real people (Taylor, 2011). Additionally, media users’ tendency to form parasocial relationships with media figures serves as an important moderator of social presence in human-computer interaction (Lee, Peng, Jin, & Yan, 2006). Therefore, when VSAs in shopping websites possess anthropomorphic features or social cues, consumers automatically treat them as real people, engage in parasocial interaction, and form parasocial relationships, which reduces social distance and increases trust, consequently influencing purchase intentions (Keeling et al., 2010).

3.4 Social Presence Theory

While the aforementioned theories posit that humans respond socially to computers or virtual characters, they do not reveal the internal mechanisms of these social responses—Social Presence Theory addresses this gap (Lee et al., 2006). Social presence refers to users’ experiences of social and interpersonal interaction in virtual environments, representing a psychological state in which virtual social actors are experienced as real social actors through sensory or non-sensory means (Lee, 2004). It reflects the degree to which users experience others’ presence and “being with others,” perceive others as “real people,” and feel connected to them (Lowenthal, 2009). When users experience virtual so-

cial interaction objects as real social interaction objects in virtual environments, they generate three types of experiences and responses: co-presence (feeling of being in the same space), psychological involvement (attention allocation and empathic responses to others' emotions), and behavioral engagement (interaction with others' behaviors) (Biocca, Harms, & Gregg, 2001).

Different media possess varying capacities for conveying verbal and non-verbal cues of social affect (Short, Williams, & Christie, 1976). Media with high social presence are typically perceived as sociable, warm, and humanized, while low social presence media are considered dehumanized. Therefore, high social presence media are more suitable for tasks related to interpersonal relationships (腾艳杨, 2013). Although computer-mediated communication (CMC) lacks non-verbal information and social cues present in face-to-face interaction and possesses dehumanized attributes (Walther & Parks, 2002), social presence can be enhanced through multiple approaches, such as interacting with others via instant chat, virtual communities, and message boards, and promoting simulated interaction with virtual agents through voice, video, socially rich text and visual content, and anthropomorphic greetings (Hassanein & Head, 2007).

Research indicates that in computer-mediated environments, social cues such as human voice, language, interactivity, and social roles can evoke social responses including politeness, respect, self-disclosure, trust, and emotional reactions from other users (Nass & Moon, 2000; Reeves & Nass, 1996), regardless of whether these cues originate from virtual agents or avatars (vonder Pütten et al., 2010). Moreover, in immersive virtual environments, anthropomorphic virtual agents elicit social presence (Nowak & Biocca, 2003; Verhagen et al., 2014). Thus, when humanized social cues appear in computer-mediated communication, consumers perceive the presence of service providers during online shopping and experience contact with them (Oh, Fiorito, Cho, & Hofacker, 2008). Social presence constitutes an important factor influencing online consumers' psychology and behavior, positively affecting consumer emotions, cognition, and quality perception (Hassanein & Head, 2007). According to Social Presence Theory, integrating VSAs into virtual shopping websites enhances consumers' perception of real service personnel or shopping guides in the virtual shopping environment, substantially increasing social presence (Hassanein, Head, & Ju, 2009), leading to more positive and satisfying shopping experiences (Holzwarth et al., 2006), while increasing trust and social support, reducing risk perception, and ultimately influencing purchase intentions (Beldad et al., 2016; Chattaraman et al., 2012).

3.5 Summary

In summary, the four theories offer both distinct and interconnected explanations for the VSA persona effect. To clarify the relationships among these theories, we propose a structural diagram [Figure 3: see original paper]. First, Social Response Theory, the Threshold Model of Social Influence, and Parasocial Interaction Theory explain the factors influencing the persona effect from different

perspectives. Social Response Theory suggests that regardless of whether VSAs are operated by humans or computers, anthropomorphic features or social cues automatically evoke consumers' social perception, leading them to treat VSAs as social members and exhibit social responses similar to human communication, thereby improving consumer experiences and influencing attitudes and purchase intentions. The Threshold Model of Social Influence argues differently, positing that only when the anthropomorphic features or behavioral realism of VSAs reach the threshold for evoking social influence can social responses be triggered. Parasocial Interaction Theory maintains that humans' tendency to treat VSAs as real people constitutes the key to the persona effect, as this tendency drives parasocial interaction and relationship formation, reducing social distance and influencing purchase intentions. These three theories reveal influencing factors from different angles: VSA characteristics (human-like features, social cues, behavioral realism) serve as external conditions, while humans' tendency to treat VSAs as real people represents the internal condition.

Second, Social Presence Theory reveals the internal psychological process through which consumers develop social responses and interactions with VSAs (Lee et al., 2006; Jin & Park, 2009). Under the combined influence of these internal and external factors, consumers experience social presence—perceiving VSAs as real people and feeling co-present with them. This social presence experience further activates consumers' social perception, evokes social responses, and enhances parasocial interaction and relationship formation with VSAs.

4 Mechanisms of the VSA Persona Effect

According to the theoretical explanations of the VSA persona effect, VSAs evoke consumers' social presence experiences, generate social perception, and enable parasocial interaction—forming the basis for the persona effect. However, these theories do not further reveal how these social experiences influence consumer psychology and behavior. Building on these theories, researchers have conducted numerous studies on the mechanisms of the VSA persona effect from the perspective of social interaction between consumers and VSAs.

4.1 Sense of Personalization

During product or service purchases, when consumers perceive that the goods or services provided by businesses are based on personal information and individualized needs and are appropriate, they develop a sense of personalization (Lee & Park, 2009). VSAs combine personalized service technology with interpersonal contact. On one hand, personalized service technology can collect extensive customer information to better identify and satisfy customers' specific needs, providing products and services that match consumer preferences (Ho, Davern, & Tam, 2008). On the other hand, anthropomorphic representation can evoke one-on-one interaction experiences with service providers (Suprenant

& Solomon, 1987). Driven by anthropomorphic experiences, VSAs can demonstrate that they understand and represent customers' personalized needs (Komiak & Benbasat, 2004). Thus, VSAs can respond to consumer needs, creating a sense of being understood and enabling consumers to experience personalized service during online shopping (Verhagen et al., 2014).

Meanwhile, the sense of personalization evoked by VSAs influences customers' attitudes toward businesses. Understanding, politeness, and personal attention are important factors affecting service quality evaluation (Zeithaml, Parasuraman, & Malhotra, 2002), and sense of personalization influences consumer satisfaction with services (e.g., Ho et al., 2008; Suprenant & Solomon, 1987). Therefore, the sense of personalization evoked by VSAs affects consumers' service quality satisfaction (Verhagen et al., 2014).

4.2 Perceived Social Support

Social support refers to individuals providing resources to help others (Shumaker & Brownell, 1984). Social support can reduce the negative impact of stressful situations and change recipients' emotional responses to stress. During online shopping, insufficient technical or customer support can make online activities a stressful situation for certain groups (e.g., older adults), leading to anxiety and avoidance (Adams, Stubbs, & Woods, 2005). Therefore, providing social support during online shopping is essential (Adams et al., 2005).

The service delivery process heavily relies on interpersonal contact and possesses social characteristics (Bitner, Booms, & Tetreault, 1990), which influence consumers' perceived social support (Bearden, Malhotra, & Uscategui, 1998). In complex online shopping environments, VSAs increase the social perception of shopping websites through simulated social cues such as anthropomorphic appearance, voice, gestures, and greetings (Dash & Saji, 2007; Keeling et al., 2009; Wang et al., 2007), as well as social roles like sales agents (Qiu & Benbasat, 2009; Wang et al., 2007). This facilitates consumer-business interaction, helps increase consumers' social presence during online shopping, enhances consumers' sense of control, and reduces anxiety (Wang et al., 2007). Therefore, similar to humans, VSAs can serve as virtual companions, creating a social shopping experience through continuous provision of immediate support and information, thereby generating perceived social support (Chattaraman et al., 2012; Shim et al., 2012), which in turn influences consumers' attitudes toward businesses and their purchase intentions (Chattaraman et al., 2012; Shim et al., 2012).

4.3 Trust

Trust is a psychological state based on positive expectations of others' behavior (Rousseau, Sitkin, Burt, & Camerer, 1998), including cognition-based trust and affect-based trust (Lewis & Weigert, 1985). In online shopping, trust has been defined as a set of specific beliefs held by the trustor (the trusting party) about the trustee (the trusted party) during transactions—namely, that the trusted

party' s competence meets the trustor' s needs, their actions serve the trustor' s interests, and they possess characteristics of integrity, credibility, benevolence, and competence (Gefen, Karahanna, & Straub, 2003; Qiu & Benbasat, 2005).

VSA s are often perceived as possessing trustworthiness traits such as integrity, benevolence, and competence (Komiak & Benbasat, 2004). Therefore, VSA s can promote trust formation through repeated fulfillment of commitments (Papadopoulou, Andreou, Kanellis, & Martakos, 2001) and become objects of consumer trust (Xiao & Benbasat, 2007). Additionally, VSA s' information communication modes (e.g., text, voice) (Qiu & Benbasat, 2005), peripheral cue characteristics (e.g., appearance, voice) (Papadopoulou et al., 2001; Qiu & Benbasat, 2009), support functions (Komiak & Benbasat, 2006), and perceptions of their knowledge, professionalism, integrity, credibility, and benevolence all influence consumers' cognitive or affective trust (Beldad & Kusumadewi, 2015). Furthermore, VSA s indirectly increase consumer trust in online shopping through social presence (Almutairi & Rigas, 2014; Dash & Saji, 2008; Gefen & Straub, 2003; Hassanein & Head, 2006; Qiu & Benbasat, 2009) and perceived social support (Chattaraman et al., 2012). Trust represents a critical factor in online shopping behavior and an internal driver of consumer purchasing (Harris & Goode, 2004). Once trust in VSA s is established, it positively influences consumers' intentions to use virtual agents and online stores (Qiu & Benbasat, 2009) as well as their purchase desires (Darley, Blankson, & Luethge, 2010; Jin & Sung, 2010; Lee, Sun, Chen, & Jhu, 2015).

4.4 Risk Perception

Risk perception refers to consumers' subjective experience of uncertainty arising from unpredictable purchase outcomes and their consequences during product or service purchases (Stone & Grønhaug, 1993), including product risk, financial risk, time risk, etc. (Corbitt, Thanasankit, & Yi, 2003; Forsythe & Shi, 2003). Consumers' risk aversion reduces their online shopping intentions (Reisenwitz, Iyer, Kuhlmeier, & Eastman, 2007), making risk perception one of the greatest obstacles to online shopping (vander Heijden, Verhagen, & Creemers, 2003).

However, using VSA s in shopping websites can effectively address this issue (Chattaraman et al., 2012). From a functional perspective, navigational support helps reduce risk perception in complex, unfamiliar online shopping environments (Rickel & Johnson, 2000). Sales agents can also provide product search suggestions based on analysis of consumers' purchase histories (Gilbert & Han, 2002), thereby improving decision quality. Additionally, sales agents can search for and present information matching consumers' needs, effectively reducing cognitive load and increasing shopping satisfaction (Hostler, Yoon, & Guimaraes, 2005). Furthermore, high social presence generated by sales agents (Dash & Saji, 2008) and the resulting trust in shopping websites (Dash & Saji, 2008; Harridge-March, 2006) can effectively reduce risk perception in online shopping. In summary, VSA s can effectively reduce risk perception in online shopping and consequently increase purchase intentions (Chattaraman et al.,

2012).

These studies indicate that the VSA persona effect involves a complex psychological process. To describe this process, we propose a structural diagram of the mechanism [Figure 4: see original paper]. Although this mechanism structure has not been fully supported by empirical research, based on existing theories, empirical studies, and logical relationships among variables, we argue that VSAs can evoke consumers' social perception, making them perceive VSAs as real social members, experience social presence, and engage in parasocial interaction and relationship formation—forming the basis of the persona effect. Building upon this foundation, consumers develop a sense of personalization, experience social support, increase trust in businesses and websites, reduce risk perception, and ultimately influence their attitudes and purchase intentions.

5 Influencing Factors of the VSA Persona Effect

Research has not only confirmed the VSA persona effect but also extensively investigated its influencing factors—potential moderating variables—including three categories: VSA characteristics, product factors, and consumer factors.

5.1.1 Appearance Characteristics of VSAs

Interaction with VSAs in online shopping influences consumers' attitudes toward brands and businesses (Riedl et al., 2014). Therefore, VSA appearance characteristics affect consumers' shopping processes. Previous research has examined how VSA appearance characteristics—anthropomorphism, clothing, and attractiveness—influence the persona effect.

Anthropomorphism refers to the attribution of human characteristics (e.g., friendliness or sociability) to non-human entities, representing a human tendency to assign social attributes to non-human objects (Lee, 2010). According to Social Response Theory (Nass & Moon, 2000), anthropomorphic features in virtual agents facilitate social relationship formation. Research shows that more realistic anthropomorphic features in virtual agents elicit more positive social interaction (Yee, Bailenson, & Rickertsen, 2007), and interacting with conversational agents possessing human characteristics leads to stronger social presence (Araujo, 2018). Additionally, anthropomorphic features affect users' perceptions of virtual agents—more anthropomorphic agents are perceived as more attractive and credible (Nowak & Rauh, 2005). For instance, adding a virtual agent with movable head and eyes to audio-only conversations increases users' perceptions of trust and friendliness toward the virtual communication partner (Donath & Judith, 2007). Moreover, people prefer attractive human-like avatars, which influences the perceived value of information conveyed by the avatar and its persuasive effects (Jin & Bolebruch, 2010). Therefore, when VSAs possess more anthropomorphic features, they enhance social and interpersonal interaction experiences and positively influence consumer attitudes and behaviors. However, some research suggests that VSA anthropomorphic

features have no significant impact on consumer experience (Verhagen et al., 2014).

Based on priming effects mechanisms, Peña and Yoo (2014) examined how VSA clothing color influences consumers. Results showed that compared to VSAs wearing white clothing, those wearing black clothing negatively affect consumers' brand attitudes and purchase intentions, and consumers maintain greater interpersonal distance from black-clothed VSAs. This may occur because contextual cues and stereotypes increase the readiness of cognitive and behavioral automatic responses—once stereotype-related contextual cues appear, individuals exhibit consistent behavioral responses (Bargh & Chartrand, 2000). Additionally, exposure to black-colored stimuli automatically triggers negative thoughts and emotions (Sherman & Clore, 2009), with black clothing evoking negative perceptions such as suspicion and distrust (Vrij, 1997). Therefore, black-clothed VSAs may unconsciously prime consumers' negative cognitions and emotions, subsequently exerting negative influences on attitudes, purchase intentions, trust, and interpersonal distance (Peña & Yoo, 2014).

VSA attractiveness influences persuasive effects. Kelman (1961) argued that a message source's interpersonal attractiveness increases receivers' identification and liking, facilitating attitude adoption through imitation or internalization. Thus, message sources' physical attractiveness enhances persuasive effects. Interacting with attractive individuals is pleasant, and this pleasant experience promotes acceptance of the information source's attitudes (McGuire & William, 1985). Like real people, individuals enjoy interacting with attractive virtual characters (Principe & Langlois, 2013). Consequently, attractive virtual agents are more persuasive (Holzwarth et al., 2006). Additionally, VSA attractiveness increases consumers' affective trust (Lee et al., 2015) and enhances persuasive effects by influencing consumer liking (Holzwarth et al., 2006).

5.1.2 Facial Expressions of VSAs

Facial expression is a non-verbal communicative behavior that plays an important role in social interaction (Fridlund, Ekman, & Oster, 1987). Smiling is a universal expression reflecting high levels of social interest and acceptance (DeWall, Maner, & Rouby, 2009) and constitutes an important factor in interpersonal attraction and communication (Krämer, Kopp, & Becker-Asano, 2013). Primitive emotional contagion theory posits that individuals have an unconscious tendency to synchronize their behavior with others, with emotional states converging in this process (Barger & Grandey, 2006). Therefore, smiling expressions influence interaction partners' emotional experiences.

Digital technology enables control and modification of non-verbal behaviors during virtual social interaction. In online chat, virtual agents create a sense of communicating with real people, increase social presence, and promote communicators' emotional responses or connections, enhancing emotional involvement and empathy (Taylor, 2011). Research also shows that compared to low-smiling

virtual agents, high-smiling agents generate stronger social presence, more positive emotions and interaction experiences, and greater interpersonal attraction (Oh, Bailenson, Krämer, & Li, 2016). Meanwhile, non-verbal cues such as facial expressions influence the dimensions consumers initially perceive about salespeople and their evaluations (Leigh & Summers, 2002). When facing smiling VSAs, consumers experience more humanized, socialized, and sensitive interpersonal contact and more positive emotions (Brave & Nass, 2002). Thus, VSA smiling expressions evoke stronger social presence and positive emotions in consumers, facilitating the formation of positive attitudes and purchase intentions.

5.1.3 Information Presentation Modalities of VSAs

In computer-mediated communication (CMC), media modalities refer to media's capacity to convey multiple information cues simultaneously (Daft & Lengel, 1984). VSAs also convey information through various modalities during consumer interaction. Text is currently the most common information presentation form in online shopping, with email, instant messaging, and forums widely used to facilitate communication between online consumers and businesses. With the development of human-computer dialogue technology, "text-to-speech" (TTS) systems have been widely applied in website information access, automatic voice response services, interactive voice response systems, computer games, intelligent agents, and VR environments.

Media characteristics influence users' attitudes toward the media they use (Dennis & Valacich, 1999), and different information presentation modalities similarly affect user attitudes. For example, researchers found that using TTS technology has more positive effects on interaction outcomes compared to text-only interaction (Jensen, Farnham, Drucker, & Kollock, 2000). Additionally, information presentation modalities affect interpersonal trust—compared to text chat, face-to-face, video, and audio communication have similarly positive effects in more effectively increasing communicators' trust (Bos, Olson, Gergle, Olson, & Wright, 2002).

In online shopping environments, the information presentation modalities used in VSA-consumer interactions also affect consumer experiences. Social Presence Theory suggests that the number and fidelity of media sensory channels influence communication vividness (Reeves & Nass, 1996). Therefore, when consumers interact with VSAs in rich audio-visual environments, they perceive more sensory cues, which increases social presence and subsequently enhances trust in VSAs. For instance, compared to text-only information presentation, consumers exhibit higher cognitive and affective trust toward VSAs using TTS voice (Qiu & Benbasat, 2005). However, rich information presentation modalities do not always have positive effects. Some research found that compared to audio channels, text-based information presentation makes consumers experience stronger social presence and perceive VSAs as more professional with higher information value (Jin, 2009). This suggests that media richness does not always guarantee high-quality communication. While the breadth of media richness can trigger

emotional responses (e.g., pleasure) during interactive media experiences, the depth of information presentation channels (message quality) is more important for cognitive processing of persuasive messages.

5.1.4 Communication Style of VSAs

During shopping, various communication styles exist between consumers and sellers, such as task-orientation and social-orientation (Sheth, 1976). Communication style between consumers and sellers influences consumer trust and loyalty (Crosby, Evans, & Cowles, 1990). Efficient task-oriented styles and friendly social-oriented styles are the most popular and effective communication approaches in sales (Williams & Spiro, 1985). Task-oriented style is a goal-directed, purposeful communication approach emphasizing task efficiency with minimal cost, effort, and time, while social-oriented style uses personalized, social approaches to build relationships with consumers and promote sales (Williams & Spiro, 1985).

Offline sales research shows that salespeople using task-oriented styles must demonstrate professionalism and competence to gain consumer trust (Crosby et al., 1990; Williams & Spiro, 1985) and influence purchase intentions (Darian et al., 2001). When using social-oriented styles, salespeople can use verbal and non-verbal behaviors that reduce psychological distance to demonstrate warmth, friendliness, and approachability, thereby enhancing interpersonal attraction and building trust. Additionally, social-oriented communication satisfies social needs, allowing individuals to experience positive emotions, with friendships with salespeople and positive emotions influencing consumer purchase intentions (Lynch et al., 2001). Although research on salesperson communication styles found that task-orientation has greater impact, social-oriented styles can also effectively increase persuasion, trust, and purchase intentions in most cases (Darian, Wiman, & Tucci, 2005).

In shopping websites, interface interactivity features evoke users' social presence experiences of interacting with real people (Kumar & Benbasat, 2002). Therefore, VSA communication styles similarly affect online shopping. Unlike face-to-face offline communication, shopping websites can completely control VSA communication styles. If consumers expect to apply social rules and expectations in interactions as they would in offline shopping, both task-oriented and social-oriented communication styles are needed. Research on VSA communication style effects shows that both task-oriented and social-oriented styles significantly increase consumer trust in shopping websites and businesses, thereby increasing purchase intentions (Keeling et al., 2010). Thus, both task-oriented and social-oriented communication styles are effective in VSA-consumer interactions.

5.1.5 Personality Characteristics of VSAs

Extensive research shows that humans have a tendency to attribute personality traits to non-human entities, such as computers (Nass & Moon, 2000) and products (Aaker, 1997). In shopping websites, businesses can easily and effectively design, create, and manipulate VSA personality characteristics to convey desired brand and product images, thereby increasing VSA persuasive effects (Jin & Sung, 2010). Existing research has explored the effects of VSA personality traits including friendliness, trustworthiness, competence, and sincerity.

Friendliness refers to the perception of politeness, responsiveness, extra attention, and mutual understanding toward interaction partners (Price, Arnould, & Deibler, 1995). Service providers' warmth and friendliness help build good relationships with consumers (Li, 2009) and are crucial for evoking social presence (Keeling et al., 2010). Therefore, when perceiving VSAs as friendly, consumers sense the VSA's sensitivity and understanding of their needs, generating social presence experiences and increasing their sense of personalization (Verhagen et al., 2014).

Trustworthiness refers to the degree to which a message source is perceived as reliable and the confidence information recipients have in the communicator's ability to ensure reliable claims (Hovland, Janis, & Kelly, 1953). If a communicator is perceived as an expert or trustworthy, their conveyed information is deemed trustworthy. Recipients' perceptions of a message source's trustworthiness positively influence persuasion (Maddux & Rogers, 1980). A communicator's expertise or expert status is an important factor in forming trustworthiness perceptions—experienced or knowledgeable individuals are often viewed as experts, and expert persuaders typically possess higher credibility (Brehm, Kassin, & Fein, 2005). Similarly, VSA professionalism affects its trustworthiness. For example, consumers develop cognitive trust in expert-type VSAs (Lee et al., 2015), increasing persuasive effects and improving consumer satisfaction with businesses and products as well as purchase intentions (Holzwarth et al., 2006; Martin, Janiszewski, & Neumann, 2006).

Competence and sincerity are two personality traits closely related to trustworthiness (Aaker, 1997). According to Aaker's (1997) five-dimensional brand personality structure, competence is defined by characteristics such as success, confidence, expertise, reliability, stability, and efficiency, while sincerity is defined by warmth, cheerfulness, honesty, authenticity, friendliness, down-to-earthness, and healthiness. High competence is closely related to high credibility and trust, while sincerity is associated with keeping promises and fulfilling commitments. Consequently, brands perceived as competent and sincere are more likely to be trusted (Aaker, Fournier, & Brasel, 2004). Similarly, when VSAs are perceived as possessing sincere and competent personality traits, their conveyed information is more likely to be perceived as credible, leading to more positive brand attitudes, higher brand satisfaction, and stronger purchase intentions (Jin & Sung, 2010).

5.1.6 Value Characteristics of VSAs

Utilitarian and hedonic motivations represent two types of consumer motivations for online shopping (Childers, Carr, Peck, & Carson, 2002), with shopping websites correspondingly offering utilitarian and hedonic value (Utilitarian Hedonic value). Utilitarian value focuses on the effectiveness of obtaining needed information from websites, including usefulness, effectiveness, benefit, functionality, necessity, and appropriateness (Childers et al., 2002), while hedonic value focuses on website characteristics such as fun, enjoyment, pleasure, excitement, and thrill (Babin, Darden, & Griffin, 1994).

VSA social cues can evoke website social perception, reduce social distance (Keeling et al., 2010), increase social presence, arousal levels, and enjoyment (Wang et al., 2007), and generate positive online shopping experiences (e.g., Hassanein & Head, 2007), positively influencing both utilitarian and hedonic value. Additionally, website value characteristics significantly affect user perceptions. Etemad-Sajadi and Ghachem (2015) found that compared to hedonic value, VSA utilitarian value more significantly and positively influences consumers' perceptions and evaluations of online product or service quality. VSA specific knowledge and practicality are more important than interactive hedonic value because they can provide personalized services and collect consumer information (e.g., preferences, needs, complaints). Thus, VSA value characteristics influence consumers' online shopping experiences, particularly utilitarian value (usefulness, effectiveness, etc.), which generates more significant positive effects. Therefore, businesses should prioritize utilitarian value when designing VSAs.

5.1.7 VSA-Product Feature Matching

Information is persuasive only when internalized, requiring a certain degree of matching between information source and information (Kamins & Gupta, 1994). Research shows that consumers' product preferences are partly influenced by the match between product endorsers' gender and the endorsed product (Kanungo & Pang, 1973)—for example, cars endorsed by males are more favored by consumers than those endorsed by females. When searching for cosmetics information, consumers prefer consulting female sales staff due to their femininity and greater cosmetics knowledge (Foster & Resnick, 2013). Additionally, matching between brand endorser characteristics (e.g., age, gender, or ethnicity) and product type increases trust in the endorser (Kamins & Gupta, 1994) and their product-related recommendations (Foster, 2004). When brand endorsers match the endorsed brand, consumers' attitudes toward the product brand correlate positively with their evaluations of endorser effectiveness (Till & Busler, 2000).

In online shopping environments, VSA-product feature matching similarly exerts positive effects on consumers. Beldad et al. (2016) found that compared to mismatching conditions, matching VSA gender (e.g., female) with product gender (e.g., female product, lipstick) more positively influences consumer trust in the VSA and business as well as purchase intentions. This demonstrates that

while using VSAs affects consumer trust and purchase intentions, VSA-product feature matching generates even more positive effects.

5.1.8 VSA-Consumer Similarity

VSA characteristics serve as important non-verbal cues for similarity judgment and categorization, enabling perception of VSA-consumer similarity through observable physical attributes (e.g., age, gender, clothing) or inferred internal characteristics (e.g., taste, opinions). Research shows that consumer-salesperson similarity (e.g., race, gender) influences salesperson credibility (Jones, Moore, Stanaland, & Wyatt, 1998), customer relationship quality (Smith, 1998), changes in consumers' product attitudes (Woodside & Davenport, 1974), and sales effectiveness (Tajfel & Turner, 1986). Using VSAs with characteristics similar to consumers also positively affects online sales. For example, similarity between computer and human behavior evokes more cooperative behavior from consumers (Moon, 2000). Compared to dissimilar conditions, consumers who perceive racial similarity with VSAs experience stronger social presence, more interaction enjoyment, and greater usefulness, though gender similarity shows no significant difference (Qiu & Benbasat, 2010). However, some research found that gender dissimilarity between consumers and VSAs increases gender attractiveness and generates positive emotions, positively affecting sales effectiveness (Pentina & Taylor, 2010).

Researchers have explained similarity effects from different theoretical perspectives. Social Identity Theory suggests that individuals' self-categorization is a process of identifying and emphasizing similarities between individuals. People frequently categorize themselves based on gender, age, and ethnicity (Messick & Mackie, 1989) and use these observable external cues to categorize others as in-group or out-group members (Biernat & Vescio, 1993). Similarity-attraction theory also posits that similarity characteristics increase interpersonal attraction and influence mutual liking. People are attracted to groups with similar characteristics and desire to become members (Byrne, 1971). Therefore, when VSAs share characteristics with consumers, they are more likely to be viewed as in-group members, liked by consumers, and attract increased attention (Elsass & Graves, 1997). Additionally, this social group membership increases persuasiveness in sales contexts (Lichtenthal, David, Tellefsen, & Thomas, 2001), positively affecting sales effectiveness.

5.2.1 Product Type

Based on consumers' knowledge of product attributes, products can be categorized as search goods or experience goods. Search goods are those whose quality attributes consumers can fully understand before purchase (e.g., books), while experience goods are those whose main attributes are difficult to know before purchase (e.g., food). Compared to search goods, experience goods create greater uncertainty and risk perception for consumers. Therefore, product

type influences consumer decision-making processes. For example, when products require experience to understand quality attributes, trust in businesses becomes important in decision-making, whereas it is less important for search goods (Grabner-Kraeuter, 2002).

In online shopping environments, product type also significantly moderates the relationship between shopping website features (e.g., VSA effects) and consumer purchase decisions (Lynch et al., 2001). Keeling et al. (2010) found through online experiments and surveys that product type moderates the relationship between VSA communication style and consumer trust and purchase intentions. Compared to experience goods, when selling search goods, VSAs using task-oriented communication styles are more effective at gaining consumer trust and promoting purchase intentions; for experience goods, VSAs using social-oriented communication styles help consumers develop trust and purchase intentions.

5.2.2 Product Involvement

According to the Elaboration Likelihood Model (ELM), involvement refers to the degree of relevance between information and the individual. When information is personally relevant, individuals exhibit higher involvement levels and pay more attention to the information, making involvement a decisive factor in information elaboration (Petty, Cacioppo, & Schumann, 1983). Research has confirmed involvement's moderating role in persuasion: under high involvement conditions, individuals expend more cognitive effort evaluating event-related information, pay more attention to details, and their attitudes become a function of information processing activities (central route); under low involvement conditions, persuasion can be achieved through peripheral routes, with simple cues (e.g., information presentation channels) influencing attitudes (Petty et al., 1983).

Product involvement refers to the degree of association between products and consumers' selves, influencing consumer attitudes and brand preferences (Suh & Yi, 2006). When consumers consider a product important to their self-concept (e.g., brand personality matches self-values) or when products have high purchase prices, product involvement is high (王财玉, 雷雳, 2017). In virtual shopping environments, consumers purchasing high-involvement products are more likely to interact with VSAs and demonstrate higher communication willingness. Therefore, compared to consumers purchasing low-involvement products, those purchasing high-involvement products have higher interaction perception, more positive product attitudes, and stronger purchase intentions (Jin, 2009). For example, Wang et al. (2007) found that VSAs only increase purchase intentions for high-involvement products.

Furthermore, product involvement moderates the relationship between VSA characteristics and persuasive effects. Holzwarth et al. (2006) found that VSA attractiveness influences persuasive effects as a log function of product involvement, while VSA expertise influences persuasive effects as a linear function of

product involvement. For moderately involving products, VSA attractiveness has better persuasive effects than expertise; for highly involving products, VSA expertise has better persuasive effects than attractiveness. Jin (2009) found that product involvement moderates how different VSA information presentation channels (text/voice) affect perceived information value. For low product involvement consumers, information presentation channel type has a greater impact on perceived information value than for high product involvement consumers. Pentina and Taylor (2010) found that product involvement moderates the effect of consumer-VSA similarity perception on purchase decisions. Under low product involvement conditions, dissimilarity between VSA appearance (gender, ethnicity) and consumers positively influences purchase intentions; under high product involvement conditions, VSA appearance characteristics do not affect purchase intentions.

5.3.1 Product Knowledge

Consumers' product knowledge plays an important role in memory and problem-solving (Hadar, Sood, & Fox, 2013), including objective knowledge (actual product knowledge) and subjective knowledge (perceptions of their own product knowledge). Objective knowledge depends on ability or expertise, while subjective knowledge depends on expertise, experience, or other factors (Carlson, Vincent, Hardesty, & Bearden, 2009).

Researchers believe consumers' product knowledge influences decision-making processes (Carlson et al., 2009; Hadar et al., 2013). For example, Selnes and Howell (1999) found that consumers with different product knowledge levels differ in information processing and decision-making behaviors. High product knowledge consumers possess cognitive skills to search for internal information cues, evaluating and selecting based on cognition; low product knowledge consumers lack these skills and are more likely to evaluate and select based on external descriptions. Therefore, during online shopping, low product knowledge consumers are more likely to refer to external cues such as VSA external characteristics and process information based on emotional factors (Lee et al., 2015). Lee et al. (2015) investigated differences in consumer trust toward VSAs among consumers with varying product knowledge levels. Results showed that high product knowledge consumers have more cognitive trust in VSAs, while low product knowledge consumers have more affective trust, with trust in VSAs increasing consumers' purchase intentions.

5.3.2 Need for Cognition

Need for cognition is a personality variable closely related to consumer behavior, referring to an individual's tendency to engage in and enjoy thinking activities, though this trait can be influenced by situational factors (Cacioppo, Petty, Feinstein, & Jarvis, 1996). When processing complex problems, individuals low in need for cognition dislike cognitive effort, prefer relying on others' opinions

(e.g., experts), and like forming attitudes through simple cues such as information source attractiveness (Petty, Cacioppo, & Goldman, 1981). Individuals high in need for cognition have more cognitive resources and are more likely to use systematic rules to process information, tending to seek and acquire information (Olson, Camp, & Fuller, 1984). For high need for cognition individuals, argument strength is particularly important for information processing or decision-making (Cacioppo, Petty, & Morris, 1983).

Pentina and Taylor (2010) found in their study on consumer-VSA similarity effects that consumers' information processing path selection during purchase decisions is influenced by the personality trait of need for cognition. Under moderate product involvement conditions, consumers process information through both peripheral and central routes, but path selection is moderated by need for cognition—high need for cognition consumers rely more on central route cues, tending to be influenced by VSA argument strength; low need for cognition consumers, not considering argument strength, rely more on peripheral route cues, with internal similarity to VSAs positively influencing purchase intentions.

These studies demonstrate that the VSA persona effect is influenced by multiple factors, with no single factor providing a complete explanation. Moreover, these influencing factors not only exert independent effects but also produce interactive effects with other factors.

In summary, we have compiled existing research on the VSA persona effect, organized its mechanisms and influencing factors, and extracted an integrated model [Figure 5: see original paper]. As shown in Figure 5, on one hand, the VSA persona effect is influenced by VSA characteristics, product factors, and consumer factors; on the other hand, these three types of factors affect outcome variables such as consumer attitudes and purchase intentions through multiple mediating mechanisms.

6 Conclusion and Future Directions

With the development of digital media technology, computer-generated virtual agents increasingly possess appearances and behaviors more similar to humans. How these human-like appearances and behaviors affect people's interactions with virtual agents, whether interaction experiences are identical to human-human interaction, and whether social presence and social responses occur during interaction are increasingly important questions (Nass & Moon, 2000). Exploring these questions will also expand traditional social psychology research on psychological phenomena in interpersonal interaction, such as interpersonal trust and social distance. Virtual sales agents represent a specific form of virtual agent, and research on their persona effect will help explain and answer these questions, thus holding important theoretical significance. Meanwhile, with the development of artificial intelligence (AI) and virtual reality (VR) technology, VSAs will become increasingly common in online shopping (Cassell et al., 2000). Using VSAs in shopping websites helps compensate for the lack of social cues

and interpersonal interaction in traditional shopping websites, positively influencing consumers' shopping experience and purchase intentions (Holzwarth et al., 2006). Therefore, research on the VSA persona effect holds important applied value. Both theoretical significance and applied value will drive in-depth theoretical research. Although current research on the theoretical foundations, internal mechanisms, and influencing factors of the persona effect has yielded many valuable findings, several limitations remain, necessitating further in-depth research.

6.1 Exploring the Neurophysiological Basis of the Persona Effect

Whether humans treat VSAs as real people and interact with them constitutes the foundation of the VSA persona effect. Current theories all suggest that human-like features or social cues in VSAs can evoke consumers' social perception, making them treat VSAs as social members, react to them as real people, experience co-presence, and exhibit social responses similar to human communication. Empirical research also supports this view. However, most studies have relied on subjective questionnaires to measure social perception brought by VSAs, a method lacking objectivity and stability. A few studies using cognitive neuroscience methods have confirmed these theories, showing that virtual agents are perceived as real social actors. For example, fMRI research found that viewing virtual characters' facial expressions activates the same brain regions as human-human interaction (Schilbach et al., 2006). Eye-tracking studies of virtual pedagogical agents found that learners focus more on agents' nose areas (Louwerse et al., 2009), consistent with human-human communication patterns in real environments. Therefore, future research could adopt similar techniques to verify whether adding sales agents triggers consumers' social responses by comparing brain activation patterns with and without VSAs.

6.2 Expanding the Range of Influencing Factors

Current research on VSA persona effect influencing factors has primarily focused on VSA characteristics, with limited investigation of consumer factors and industry environmental factors. In reality, numerous individual factors may moderate the VSA persona effect. For example, research shows that individuals' tendency to form parasocial relationships significantly affects social presence and social responses during interaction with non-human entities such as robots (Lee et al., 2006); individuals' level of interdependent self-construal influences the intimacy of parasocial interaction relationships with avatars (Jin & Park, 2009). Additionally, industry and service environments affect the persona effect—for instance, the importance of VSA hedonic versus utilitarian value may vary across different industries and service environments, potentially affecting customer socialization processes (Köhler, Rohm, de Ruyter, & Wetzels, 2011). Therefore, future research should increase investigation of consumer factors and industry environmental factors.

6.3 Examining Interaction Effects Among Influencing Factors

Current research on VSA persona effect influencing factors has primarily examined single-factor effects while neglecting interaction effects among different factors. In reality, the VSA persona effect relates not only to VSA characteristics but is also simultaneously influenced by other factors. Some researchers argue that businesses developing VSAs must ensure internal coordination among various elements—for example, VSA design should accurately reflect corporate image and match target user profiles. Therefore, VSA designers and companies using this technology need to collaborate. As virtual agent use becomes more complex in the future, research on interaction effects among different influencing factors should be strengthened, as this will provide theoretical guidance for designing more rational and effective VSAs.

6.4 Strengthening Research on Personalized/Customized VSAs

Constrained by current technology, most VSAs currently use a one-size-fits-all model to interact with consumers, providing identical services or answers to all consumers. However, consumers with different genders, professional backgrounds, and motivations have different needs and concerns. Providing personalized services to each consumer would have more positive effects on their online shopping experience. With the development of AI and big data technology, VSAs will have higher sensitivity and matching capability to consumers and sales environments, enabling them to provide more intelligent, personalized, and customized services based on collected consumer information (Pentina & Taylor, 2010). How these new developments affect the VSA persona effect has rarely been explored in current research. Therefore, future research should address these emerging issues affecting the VSA persona effect.

6.5 Exploring Negative Effects of VSAs

Current research on VSA effects has consistently argued that using VSAs in shopping websites brings positive influences, such as good shopping experiences, improved consumer attitudes, and enhanced purchase intentions. However, some researchers believe that VSA presence may not significantly affect consumers or may even have negative effects. In multimedia learning, based on cognitive load theory, some researchers proposed the interference theory (Moreno, Mayer, Spires, & Lester, 2001), suggesting that pedagogical agents interfere with learners' processing of core learning content, hindering learning effects. Current VSA effect research mostly uses post-hoc subjective questionnaires that cannot accurately record participants' experience processes. Therefore, whether VSA presence also brings negative effects to online shopping has not been directly confirmed. Future research should also examine potential negative effects of VSAs on online shopping to provide theoretical guidance for avoiding such effects.

6.6 Investigating Barriers to VSA Adoption

Although research has confirmed VSAs' advantages, the proportion of consumers actually using VSAs in practice is not very high. Some researchers believe this may be due to various barriers in VSA use, such as usage barriers related to information, system, and service beliefs (Cenfetelli, 2004), and reasons like limited information, slow response, and unfriendly interaction interfaces (Montgomery, Hosanagar, Krishnan, & Clay, 2004). These usage barriers hinder full VSA functionality. Therefore, future research should examine factors that negatively affect consumer experiences and barriers to VSA adoption to effectively address these obstacles.

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