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Alone or Mixed? The Effect of Digital Human Narrative Scenarios on Chinese Consumer Eco-Product Purchase Intention

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Abstract: Digital human narrative transportation has proven to be an effective green brand marketing strategy. However, there is still a lack of in-depth research on the relationship between the role of different digital human narrative scenarios in consumer perceptions and behaviors. This research examined the impact of digital human narrative scenarios on eco-product purchase intention through four studies. Study 1 found that anime-like (vs. human-like) digital human narratives led to more positive emotional arousal and higher eco-product purchase intention through the use of encephalography (EEG) experiments. Studies 2–4 examined the effect of digital human narrative scenarios on eco-product purchase intentions and explored the mediating role of narrative presence and the moderating role of narrative type. The results showed that mixed (vs. single) narratives lead to more positive consumer purchase intentions. In addition, sharing-oriented (vs. persuasion-oriented) narratives also led to a more positive perception of narrative presence. These findings provide insights for marketers using digital human narratives to promote eco-product consumption.

Keywords: digital human; eco-product; narrative scenarios; narrative presence; narrative type



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1. Introduction

Researchers are now investigating the extensive capabilities of digital humans across several domains. Previous research has proven the efficacy of digital humans in product endorsements [1], customer service [2], social media marketing [3], tourism marketing [4], and corporate social responsibility [2]. Studies have indicated that the attributes of digital humans—such as aesthetic appeal [5], professionalism [6], credibility [7], entertainment value [8], anthropomorphism [3,9], and sensory capabilities [10]—have a substantial impact on the consumer’s brand attitudes. In addition, many scholars have explored the role of digital humans in eco-product marketing [11,12]. Digital humans excel in green marketing due to their ability to reduce brand reputation risks, show increased agility, and offer cost-effectiveness [11].

Digital humans are computer graphics with anthropomorphic physical characteristics [13]. Digital humans vary in realism, ranging from abstract anime-like digital humans to highly anthropomorphic human-like digital humans [1]. Research shows that different types of digital humans influence consumers’ brand perceptions in distinct ways [8,14,15]. Human-like digital humans may accrue greater credibility owing to their close resemblance to humans [11]. However, consumers may need clarification regarding their genuine intentions and emotions, which may affect their marketing effectiveness [9,12]. Conversely, anime-like digital humans may prove more effective in eco-product promotion due to their abstract characteristics and ability to deliver information unbiasedly. These benefits help to reduce consumers’ expectations and evaluations of authenticity with anime-like digital humans [14]. Meanwhile, as virtual social platforms that combine physical and virtual experiences continue to develop, it is clear that the prevalence of mixed digital human narrative scenarios is on the rise [3]. For example, the interaction between virtual celebrity Lil

Miquela and real celebrities on social media demonstrates the marketing opportunities that arise from combining digital humans with the natural world [3]. Consequently, there is no consensus in the research on the impact of digital human narrative scenarios on consumers.

Based on the theory of mind perception, it is anticipated that consumers engaging with digital humans will attribute human-like thoughts and intentions to them. Anthropomorphism augments consumers' assessment of the intentional capacities of digital humans [16]. However, anime-like digital humans, due to their lack of highly human characteristics, can alleviate consumers' suspicion regarding their ulterior motives, thereby facilitating a more direct conveyance of product information and fostering consumers' acceptance of marketing information [17,18]. Consequently, this study hypothesized that anime-like digital humans may be more able to evoke positive consumer emotions towards eco-products. Previous research has indicated the marketing potential of digital humans, particularly when aligned with specific product categories, due to their novelty and innovative appeal [19]. Therefore, in mixed scenarios, the perceived authenticity of human-like digital humans may be challenged.

In contrast, integrating anime-like digital humans with real individuals can establish them as a social reference point, thereby bolstering consumers' overall acceptance of digital humans [3]. Mixed scenarios of anime-like digital humans may enhance the narrative presence through innovative interaction types and experiences, while the abstract characteristics of anime-like digital humans may foster positive consumer attitudes [14]. Hence, the mixed scenarios provide a heightened immersive experience. However, the mechanism by which the mixed narrative scenarios influence eco-product purchase intention remains to be further investigated.

To bridge the research gap, this study explored the effects of different digital human narrative scenarios on consumers' eco-product purchase intentions. Specifically, we focused on the impact of both individual digital human narrative scenarios and mixed narrative scenarios on consumers' inclination toward eco-product adoption. Furthermore, looking at the interactive features of new media, the audience is not simply passive viewers but active participants engaging in the bilateral communication process [20,21]. Digital human narrative scenarios offer innovative forms of interactive marketing. The narrative presence perceived during these interactions enhances immersion, significantly impacting consumers' perception of realism [22]. This study also explored the mediating role of narrative presence. Third, considering the influence of narrative type on consumer attitudes [23,24], this study applied different narrative types to digital human narrative scenarios and explored the moderating effects of different narrative types using dual-system processing theory and level-of-interpretation theory.

The main contributions of this study are as follows: we employed EEG experiments and scales to investigate the disparities in consumers' emotional perceptions and sustainable purchase intentions when exposed to eco-product narratives delivered by cartoon-like (vs. human-like) digital humans. Secondly, we explored how digital humans' narrative scenarios influence consumers' eco-product purchase intentions. Finally, we deliberate on our findings and provide insights for marketing practice.

The subsequent sections of this paper cover different aspects. Section 2 thoroughly examines the literature concerning narrative scenarios, narrative presence, and narrative types used by digital humans. Additionally, we discuss the primary theories. Section 3 explains the technique, including the experimental design and data-collecting process. Furthermore, it shows the empirical findings obtained to evaluate the hypotheses. The conclusion provides a concise overview of the theoretical and practical contributions, limits, and potential areas for further study.

2. Literature Review and Hypothesis Development

2.1. The Effect of Digital Human Type on Consumer Attitudes

Avatars are defined as interactive digital entities with anthropomorphic appearances that are controlled by a human or software [25]. Digital humans can be considered a subset

of avatars, focusing specifically on a human-like appearance. This distinction highlights the different applications of digital humans and avatars in virtual environments [25]. Digital humans emphasize realistic representations and immersive experiences, while avatars prioritize interactive functions and user representation. This paper will further explore digital human narrative scenarios, examining how their realistic portrayal and immersive qualities influence audience perception.

As social media influencers, digital humans offer significant advantages for brand marketing [1,5,26–28]. Firstly, digital humans are not constrained by geographic location or time and can efficiently perform tasks at any moment, in any area, across various platforms, delivering cost efficiencies for brands [1,26]. Secondly, brands can shape unique digital humans based on core brand values and cultural elements [29] that may not only represent the brand but may also go beyond the traditional role of brand ambassadors [30]. Furthermore, they can be used to integrate various digital technologies into brand building and management to promote brand digitalization [31]. Thirdly, digital humans' online presence can accurately calibrate their 'behaviors' and images in the background, thus minimizing the risk of missteps [32].

Digital humans can convey a brand's green concept and avoid ethical scandals, reducing reputational risk in a green market [11]. The advantages mentioned above align with the expected qualities of green eco-products. Marketing eco-products requires conveying a logical message and involves professional and relevant endorsers [33]. Incorporating the image of digital humans into a brand's culture can effectively showcase innovative green concepts [11,12]. Research shows that the sincere messages delivered by digital humans in environmental promotions, along with their credibility as experts, have the potential to positively influence audiences [12]. The virtuality and flexibility of digital humans provide wider communication channels for eco-products [2], and this integrated marketing strategy can help build a strong and lasting environmental image for a brand and lead consumers to be more active in supporting environmental causes.

The uncanny valley theory states that when robots look too close to humans, negative attitudes increase [34]. In order to identify this effect, we discuss two types of digital humans: anime-like digital humans and human-like digital humans. Anime-like digital humans are clearly not human and represent what Mori (1970) [34] termed the "Toy Robot" end of the spectrum; however, in one case, an influencer who appeared human enough gave rise to suspicion about her virtual vs. human nature [1]. Numerous empirical studies indicate that human-like digital humans are less favored than their anime-like counterparts [1,7]. Nevertheless, in green product promotion, human-like digital humans are endowed with more human characteristics due to their high authenticity [11]. However, with increased greenwashing behaviors [35], consumers now expect digital humans to communicate environmental ideas objectively and authentically, surpassing mere anthropomorphic traits [12]. The theory of mind perception suggests that individuals first acknowledge another's thoughts before interaction, subsequently inferring their emotions and intentions [36]. Eco-product promotional messages blend commercial and environmental elements [37,38]. However, real humans may be viewed as profit-driven, diminishing the authenticity of eco-messaging [35,37]. Like real people, human-like digital humans diminish marketing effectiveness due to perceived intentionality bias. Anthropomorphism enhances consumers' perception of AI agents' intentional capabilities, often attributing human-like selfish intentions, thereby impacting attitudes toward AI-provided services [16]. When confronted with human-like digital humans as agents, consumers perceive them as possessing an "intentional stance", embodying purpose and consciousness [9,39]. Consumers doubt the authenticity of intentions and emotions in human-like digital humans, impacting their emotional reception to the product information they convey. Conversely, anime-like digital humans are perceived with lower intentionality and can convey information neutrally. Additionally, as green eco-products primarily communicate abstract rational details, including energy saving, environmental protection, and sustainability [40], and anime-like digital humans present a similarly abstract and unfamiliar image [14], con-

sumers' cognitive processing of them aligns well. When encountering unfamiliar objects, individuals often experience greater psychological distance, leading to a deeper level of interpretation and a holistic understanding [14,41]. Therefore, this study proposed H1.

H1. *In eco-product narrative scenarios, anime-like digital human (vs. human-like digital human) narratives will lead to more positive emotional arousal and higher purchase intentions.*

2.2. The Effect of Digital Human Narrative Scenarios on Eco-Product Purchase Intention

Current research lacks consensus regarding the disparities in brand communication and consumer behavior between digital and real humans [1,5,6,17,42]. Some scholars argue that digital humans lack credibility compared to real humans, thus exhibiting limited marketing effectiveness [1,43]. According to source credibility theory, credible endorsers are more persuasive [44,45]. However, a digital human's "fictional" identity may hinder trust formation [3]. Furthermore, studies suggest that interactions with digital humans are perceived as more tedious and less sincere than human interactions [46]. Meanwhile, digital humans are becoming increasingly human-like through visual cues and cognitive abilities. However, evidence suggests that consumers may feel uncomfortable with the striking resemblance of digital humans to real people [47]. Nevertheless, scholars have highlighted the advantages of digital humans in terms of novelty and brand innovation in advertising. They have also stressed the positive impact of aligning digital humans with specific product categories on communication effectiveness [19]. For instance, anime-like digital humans are favored in product marketing targeting older people [14]. Digital humans offer distinct advantages in marketing, including low cost, 24/7 operation [48–51], and controllable behaviors [25].

Considering the distinctive advantages and controversies surrounding digital humans, coupled with the acknowledgment that they do not directly compete with real individuals, it becomes imperative to investigate the impact of mixed narrative scenarios. Digital human narrative scenarios are defined as the context of a social media-based environment and VIs' coexistence with real-world attributes [3]. Previous studies have indicated that social cues play a significant role in shaping individuals' perceptions and evaluations [52,53]. Consequently, mixed narrative scenarios enriched with additional social cues have the potential to generate a more authentic and engaging consumer experience, thereby improving the market acceptance of digital humans [3]. Furthermore, eco-product purchase intention is a multifaceted concept encompassing consumers' cognitive, affective, and behavioral intentions [54,55]. Narrative scenarios, serving as an effective communication strategy, have the potential to improve consumers' comprehension and acceptance of core product concepts.

The computers-as-social-actors (CASA) framework suggests that digital humans have the potential to elicit a sense of reciprocity in human–computer interactions, thereby enriching users' social experiences [56,57]. Research has pointed out that digital humans can not only appeal to consumers but also influence their purchasing decisions by mimicking human behaviors and emotional responses [11]. Additionally, the presentation of digital human scenarios can effectively enhance the audience's sense of presence and emotion through their intimacy, vividness, and responsiveness [58,59]. Further, mixed narrative scenarios featuring both digital humans and real humans integrate the innovation of digital humans with the credibility of real humans. Such scenarios are likely to enhance consumers' interest and emotional connection [12]. According to social identity theory [60,61], individuals are inclined to imitate and identify with members of their social group. Therefore, a real human endorsement within a mixed narrative scenario fosters a sense of social connection, thereby enriching the audience's social engagement [40] and enabling consumers to identify with their social identity more effectively. Meanwhile, mixed narrative scenarios further enhance consumers' purchase intention by delivering authentic and immersive experiences [25]. Hence, we proposed H2.

H2: *Compared to single narrative scenarios, mixed digital human and real human narrative scenarios have a more significant impact on consumers' purchase intention.*

2.3. The Mediating Role of Narrative Presence

Social presence refers to “the extent to which a medium allows users to experience others as being psychologically present” [62]. It indicates the capacity to transmit social cues [63]. Social presence is central to computer-mediated communication because it enhances information richness by reducing ambiguity [64,65] and increases the frequency and intimacy of online interactions [66]. Social presence has been explored in the realm of digital human marketing [67]. Digital humans, through their anthropomorphic appearances and behaviors, enhance users' psychological sense of presence, thereby increasing their social presence. Their interactivity and emotional expressiveness further strengthen the social connection between users and digital humans, making it easier for users to build trust and emotional resonance in virtual environments [67].

However, past research on presence has primarily focused on individual experiential perceptions, lacking exploration of deeper sensations like engagement, inclusion, or transcendent observation within narrative scenarios [68]. Through a deeper exploration of narrative presence, we can enhance our comprehension of how digital human narratives influence the audience's perceptual experience, thereby delving into the “deep structure of virtual worlds” [68]. Narrative presence refers to the sensation that allows the audience to immerse themselves in a narrative environment, departing from reality [69]. It functions as an affective–cognitive framework delineating the perceived connection between the audience and the narrative [58]. Narrative presence emphasizes the impact of narrative content and presentation on the audience's cognitive and emotional processes, surpassing traditional presence [68].

According to the Transportation-Imagery Model of narrative transmission [69], full audience engagement in a story increases the likelihood of accepting the conveyed values and positively impacting perceptions of trust. In particular, within eco-products, a heightened perception of narrative presence among the audience facilitates the effective communication of ecological information. It enhances consumers' perceptions of product authenticity, subsequently influencing their purchasing decisions [22]. Additionally, Green [70] suggests that viewers tend to engage in less critical analysis of the content when immersed in a narrative. Therefore, a robust sense of narrative presence can mitigate consumer skepticism regarding the ‘greenwashing’ of eco-products and enhance the acceptance of digital human eco-product narratives [68,71,72].

Rowe [68] proposed three sets of factors for narrative presence, narrative-centered, user-centered, and interpersonal factors, providing a comprehensive analytical framework for examining narrative presence in scenarios involving digital humans.

Initially, digital humans inject drama into the narrative with their unpredictable behavior. Moreover, mixed scenarios blur the boundary between the virtual and the real [3]. The inclusion of real humans further enriches the narrative by adding layers of realism, resulting in a more coherent and compelling plot [3]. Real humans not only compensate for the sensory limitations of digital counterparts but also help consumers form better sensory detail memories [10,73], enhancing the story's depth.

Secondly, including real humans may ignite consumers' intrinsic motivations, such as curiosity and fantasy, which are closely linked to the narrative presence. Concurrently, real humans serve as anchors to ground the narrative in familiar reality, augmenting its authenticity. In addition, authenticity may bolster consumers' self-efficacy within the scenario, enhancing their belief in their ability to engage with and actively influence the narrative. Elevated self-efficacy encourages consumers to view themselves as spectators and active participants in the narrative [74].

Third, the genuine emotional expressions and non-verbal cues exhibited by real humans in mixed scenarios, including facial expressions and body movements, offer consumers abundant social cues that foster emotional resonance and social identification [75].

Consumers' connection with actual humans in narrative scenarios heightens their sense of personal involvement and reinforces their sense of identity and presence within the product narrative [5,6]. Additionally, interactions between digital and real humans can bolster the credibility of the characters [3,15] as the responses of real humans validate the social and emotional authenticity of the digital persona's behavior. Such interactions also evoke consumer empathy and engagement, fostering deeper immersion in the narrative and consequently enhancing the perception of narrative presence.

In summary, mixed narrative scenarios involving both digital and real humans can evoke consumers' perceptions of narrative presence more comprehensively compared to scenarios featuring digital humans alone. Therefore, we proposed H3.

H3: *Narrative presence mediates the relationship between digital human narrative scenarios and consumer purchase intention. Specifically, consumers perceive narrative presence more strongly in mixed scenarios than in digital human narrative scenarios alone*

2.4. The Moderating Effect of the Narrative Type

In the domain of green advertising research, the persuasiveness of advertisements depends not only on the subject and mode of communication but is also influenced by the narrative type [33,76–78]. Depending on the degree of persuasive intent revealed in the narrative content, the narrative type of advertisements can be categorized into highly revealing persuasion-oriented narratives and low-revealing sharing-oriented narratives [23,24,79].

Sharing-oriented narratives integrate product promotion into everyday social interactions using an implicit and natural approach aimed at emotional stimulation and an enriched viewing experience to capture the audience's attention [24]. This type of narrative aligns with the peripheral route in Dual-Processing Theory (DPT), wherein consumers rely on emotion and intuition for decision-making [80,81]. In digital human narrative scenarios, sharing-oriented narratives engage consumers' peripheral routes by delivering non-directive messages, thereby augmenting the perception of narrative presence. Seymour et al. [82] suggest that the involvement of real humans elicits a more authentic and lifelike emotional response, thereby effectively influencing consumers' purchase intentions via the peripheral route.

Comparatively, persuasion-oriented narratives are more direct and explicit in presenting information about product efficacy, price, etc. [23]. This type of narrative prompts consumers to process information through the central path, i.e., exhaustively. However, this strategy is a push-marketing tactic designed to overwhelm consumers until they give in [81]. Such a direct narrative may lack emotional resonance and lived experience, leading consumers to feel that digital humans are presented more coldly and mechanically. Seymour et al. [82] suggest that viewers tend to perceive digital humans as members of an out-group regardless of whether they are powered by a real person or an AI [82], indicating that digital humans are less effective than real individuals in establishing trust and credibility [5,6], which could potentially diminish the effectiveness of persuasion-oriented narratives.

Construal Level Theory (CLT) states that people interpret information differently based on psychological distance [83]. Sharing-oriented narratives mitigate consumers' detachment from digital humans and reduce psychological distance through emotional messaging, enhancing narrative presence perception [84]. Conversely, persuasion-oriented narratives may widen the psychological gap between consumers and digital humans and diminish narrative presence perception due to their direct and logical nature. In essence, there exists a positive correlation between sharing-oriented narratives and narrative presence perception. In digital human narrative scenarios, sharing-oriented narratives can evoke consumers' emotional responses more effectively and foster a sense of social presence, thereby enhancing narrative presence perception. Conversely, persuasion-oriented narratives may weaken consumers' perception of narrative presence by lacking emotional resonance and real-life elements. Consequently, we proposed Hypothesis 4.

H4: *Compared to a persuasion-oriented narrative, the perception of narrative presence is stronger when the digital human adopts a sharing-oriented narrative.*

3. Methods

3.1. Study 1: The Effect of Digital Human Type on Consumer Attitudes

3.1.1. Experiment Design and Procedure

Before conducting our primary empirical investigation, we conducted an exploratory study to collect neurophysiological measurements. This study aimed to examine how different types of digital humans influence the marketing effectiveness of eco-products and to demonstrate the scientific compatibility between anime-like digital humans and eco-products. Electroencephalography (EEG) data are useful in revealing the impact of stimuli on brain activity [85]. Since the marketing process encompasses various facets such as attentional focus, emotional response, and imagination [22,69], our study employed real-time monitoring of brain waves to analyze the specific effects of different digital human types on consumers' emotions (α -wave), cognitive processing, and imagination (β -wave) [15,85]. This approach offers more profound insights into consumer reactions in digital human narrative communication. According to Cabanac [86], emotions encompass transient conscious experiences marked by intense mental activity and elevated levels of pleasure or unhappiness. In marketing, consumer emotions play a pivotal role in shaping purchase intentions [87]. Reduced alpha wave activity in the EEG spectrum typically correlates with heightened attention [88,89]. Similarly, cognitive processing and imagination, essential for creative thinking, are fundamental for knowledge comprehension and application [13]. Our investigation gauged participants' imaginative capacity by analyzing beta wave activity in the right parietal lobe. Prior research has indicated that beta wave patterns are linked to imaginative processes [90,91].

In this investigation, the stimulus material featured organic tea, an ecological product, which was selected to mitigate individual subjects' personal preferences or preconceptions about the brand and avoid infringing upon actual brand owners' commercial interests, thus minimizing potential experimental bias. Two digital human characters were employed, anime-like and human-like, which resembled each other in appearance and attire. The product information content mirrored real-world ecological product marketing materials, with consistent video dialogue across conditions. The experimental materials are detailed in the Appendix A. Brain wave measurements were conducted using a Credamo portable EEG device ($N = 48$) under two conditions (A = anime-like digital human, B = human-like digital human; see Appendix A). Prior to video viewing, the participants underwent baseline and resting brain wave measurements during a 5 s interval to ensure data synchronization. As depicted in the Appendix A, participants were seated before a computer screen during the EEG data collection. Upon completion, the participants responded to the purchase intention scale ($\alpha = 0.793$), addressing their inclination to purchase, learn more about, and recommend the ecological product introduced by the digital human [92]. The ratings were made on a seven-point Likert scale (1 = "strongly disagree", 7 = "strongly agree"). As a manipulation check, the participants evaluated the attractiveness of the digital human ($\alpha = 0.791$), providing ratings based on perceived physical appeal [44]. Additionally, the participants provided relevant demographic information.

3.1.2. Results

For manipulation checking, we conducted an ANOVA using SPSS Statistics 29, and the results showed that the difference in perceived attractiveness between the human-like and anime-like digital human groups was not statistically significant ($M_{HDH} = 3.83$, $SD = 0.78$; $M_{ADH} = 4.11$, $SD = 0.84$; $F(1,48) = 0.06$, $p = 0.81$), suggesting that the difference in perceived attractiveness between the digital human images did not significantly affect the results of the study.

For each digital human narrative scenarios video, we utilized the power spectral density data provided by the Credamo platform and extracted the overall values for the

α and β bands. Following the methodology outlined by Gordon et al. [85], we conducted frequency analysis using a moving window approach, varying the duration of the window (i.e., 2 and 10 s). EEG analysis was conducted across two key segments: firstly, during the period when the identity of the digital human becomes discernible in each video, marked by the introduction of the product, and secondly, during the narrative segments in each video [85], corresponding to the time when the digital human reinforces the introduction of the ecological attributes of the eco-product and strengthens viewer engagement. Initially, the EEG data in the alpha band exhibited a non-normal distribution (Shapiro–Wilk test, $p < 0.05$), prompting the researchers to conduct a non-parametric analysis in SPSS Statistics 29.0 software. Statistical examination revealed a statistically significant difference in the alpha band EEG activity during narrative scenes between the two types of digital humans (Mann–Whitney test, $p < 0.001$). Subsequently, the EEG data in the β -band also showed a non-normal distribution (Shapiro–Wilk test, $p < 0.05$), necessitating non-parametric analysis in SPSS Statistics 29.0 software. Statistical analyses indicated a significant difference in beta band EEG activity during the narrative scenes of the two types of digital humans (Mann–Whitney test, $p < 0.001$).

Following the approach used by Vecchiato et al. [93], Z-scores of the EEG data were employed to compare emotional responses across different viewer subgroups in MATLAB 2021b software. Figures 1 and 2 illustrate the average Z-score time series plots for all the participants while they were viewing the two narrative videos, demonstrating distinct patterns of EEG activity between the groups. Specifically, the anime-like experimental group exhibited significantly higher emotional responses than the human-like group across both alpha and beta waves.

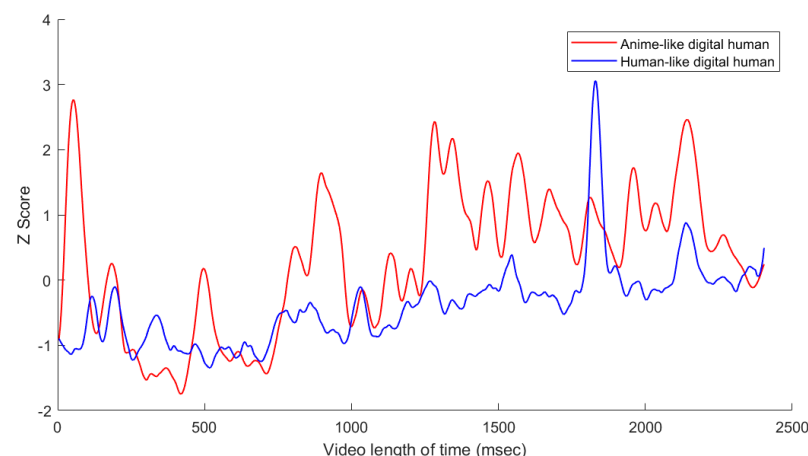


Figure 1. Z-score time series of alpha power during product introduction in video EEG.

We conducted a one-way analysis of variance (ANOVA) with “consumer purchase intention” as the dependent variable and “type of digital human” as the independent variable to assess the differential effect of digital human type on consumer purchase intention. The results revealed a statistically significant positive effect of the digital human type on consumers’ purchase intention ($F(1, 41) = 13.226$, $p < 0.001$). Specifically, in the narrative scenario featuring anime-like digital humans ($M_{ADH} = 4.89$, $SD = 0.70$), there was a stronger positive effect on consumers’ purchase intention compared to the scenario with human-like digital humans ($M_{HDL} = 4.08$, $SD = 0.72$). Therefore, H1 is supported. In essence, the presence of anime-like digital humans for eco-products elicited a more favorable impact on consumer attitudes and purchase intentions compared to human-like ones.

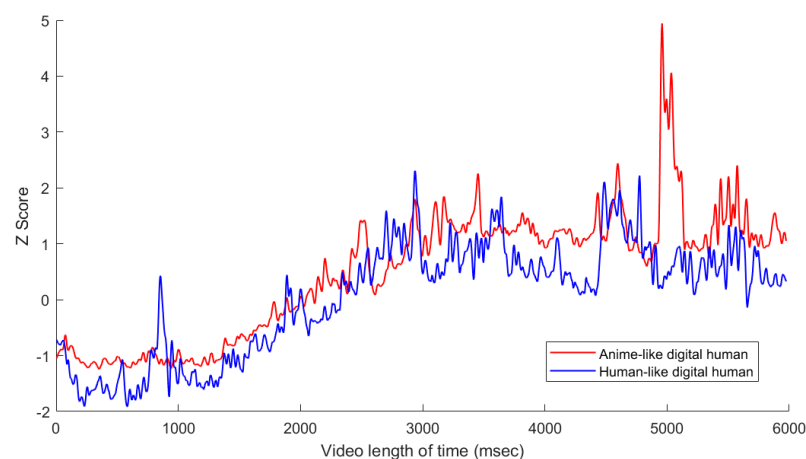


Figure 2. Z-score time series of beta power during narrative phase in video EEG.

3.2. Study 2: Impact of Digital Human Narrative Scenes on Consumer Purchase Intention

3.2.1. Experiment Design and Procedure

Study 2 aimed to explore the different effects of narrative scenarios on consumers' purchase intention. We recruited 300 participants from Credamo (<https://www.credamo.com>, accessed on 31 March 2024), China's most professional questionnaire platform. The participants were randomly allocated into two groups, and each group received a payment of RMB 2 after completing the experiment. After excluding the 42 people who did not pass the attention test, the effective sample size was 258 (45% female, $M_{age} = 32.0$). Given the gradual increase in the interest of young people in eco-products and the younger demographic's inclination towards digital human audiences, the sample collected exemplifies the characteristic attributes of both digital humans and eco-products [11]. Thus, this sample is quite representative. The participants' demographic information is included in Appendix A.

In this experiment, the research situation was replaced with an ecological agricultural product, organic rice, as the experimental product content to test the robustness of the theoretical framework. By creating a fictional brand name for the product, we aimed to minimize the influence of individual preferences or prior perceptions of the brand and to avoid any conflicts with the commercial interests of the genuine brand owner. This approach helped to reduce biases in the experimental results.

The manipulation of digital human narrative scenarios involved presenting different characters in the video materials. Drawing from real-life eco-product marketing video content, subjects viewed either the digital human alone promoting the organic rice or the digital human accompanied by a real person promoting the product in a mixed narrative scenario. The video dialogue remained largely consistent across conditions. The experimental materials are provided in the Appendix A. Subsequently, the participants were required to complete a seven-point scale on their opinion of purchase intention ($\alpha = 0.793$), assessing statements such as "I would like to purchase this eco-product from the anchor", "I would like to learn more about the eco-product introduced by the anchor", and "I would consider recommending this ecological product presented by the anchor to others" [92]. Finally, the participants provided relevant demographic information.

3.2.2. Results

We conducted a one-way ANOVA analysis with "consumer purchase intention" as the dependent variable and "digital human narrative scenarios" as the independent variable to investigate the differential impact of digital human narrative scenarios on consumer purchase intention in SPSS Statistics 29.0 software. The results revealed a significant positive effect of the digital human narrative scenario on consumer purchase intention ($F(1, 258) = 58.524, p < 0.001$).

As illustrated in Figure 3, mixed narrative scenarios ($M_{\text{mixed}} = 5.99$, $SD = 0.51$) exhibited a more substantial positive effect on consumer purchase intention compared to single narrative scenarios ($M_{\text{alone}} = 5.35$, $SD = 0.82$) ($F(1, 258) = 58.524$, $p < 0.001$). Thus, Hypothesis 2 was confirmed.

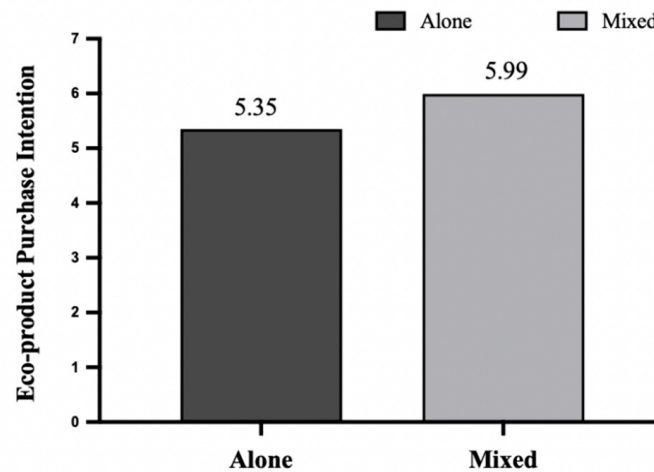


Figure 3. The impact of narrative scenes on purchase intention.

3.3. Study 3: The Mediating Role of Narrative Presence

3.3.1. Experiment Design and Procedure

In Study 3, we modified digital human narrative situations to examine the mediating effect of narrative presence in various story scenarios. We enrolled a total of 260 participants (51.2% female, $M_{\text{age}} = 31.8$) from Credamo. All of the participants were randomly divided into two groups and were compensated with RMB 2 at the conclusion of the trial. In this experiment, the researchers substituted the research scenario with an environmentally friendly computer as the experimental product. The aim was to minimize the bias caused by the influence of product category factors on consumers' psychological perceptions. This was carried out to assess the strength and reliability of the theoretical framework. By fictionalizing the product brand name, we tried to minimize the impact of personal preferences or preconceived notions about the brand held by individuals. This approach also ensures that we do not violate the business interests of the actual brand owner, hence minimizing any bias in the experimental findings.

The experimental steps were consistent with those in Study 2, and in each set of contexts, the subjects were asked to watch a promotional video of digital humans introducing eco-friendly computers. Following this, they were required to give their opinion of narrative presence ($\alpha = 0.794$) [69] on a seven-point scale, in terms of four items: "During the viewing period, the narrative scenes in the video felt closer to me than the real world", "My attention was more focused on the digital human narrative scenario than on my surroundings", "The digital human narrative scenario created a new world, and when the video ended, the narrative scenario abruptly vanished", and "During the viewing period, my body was in the room, but my mind was immersed in the narrative scenario". Simultaneously, they gave their opinion of purchase intention ($\alpha = 0.793$) [92] on a seven-point scale, which included items such as "I would like to purchase this eco-product from the presenter", "I would like to learn more about the eco-product introduced by the presenter", and "I would consider recommending this ecological product presented by the presenter to others". Finally, the participants provided relevant demographic information.

3.3.2. Results

Using SPSS Statistics 29.0 software, a one-way ANOVA analysis with "narrative presence" as the dependent variable and "digital human narrative scenarios" as the independent variable showed that the participants perceived significantly more narrative

presence in mixed narrative scenarios than in single narrative scenarios ($M_{\text{mixed}} = 6.02$, $SD = 0.4$; $M_{\text{alone}} = 5.36$, $SD = 0.92$; $F(1, 260) = 56.369$, $p < 0.001$), see Figure 4). This suggests that mixed scenarios featuring digital and real humans evoke a stronger narrative presence than scenarios with only digital humans.

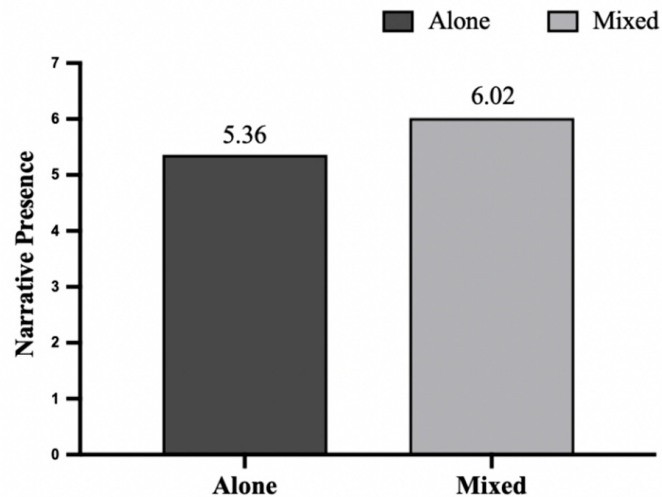


Figure 4. The mediating role of narrative presence.

Furthermore, a mediation analysis was conducted using the bootstrap method with a sample size of 5000 and a 95% confidence interval. The narrative scenario type served as the categorical independent factor, consumer purchase intention as the dependent variable, and narrative presence as the mediator. The results supported the hypothesis that differences in narrative presence mediate the effect of narrative scenario type on consumer purchase intention (indirect effect = 0.386, $SE = 0.084$; 95% CI = [0.193, 0.323]). Specifically, the narrative scenario type significantly predicted the sense of narrative presence ($\beta = 0.655$, $SE = 0.087$; 95% CI = [0.484, 0.826]), and the sense of narrative presence significantly predicted consumer purchase intention ($\beta = 0.59$, $SE = 0.048$; 95% CI = [0.496, 0.684], see Table 1).

Table 1. Mediation analysis of narrative presence.

	b	t	p	95% CI
Digital human narrative scenarios → Narrative presence	0.655	7.508	<0.001	[0.484, 0.826]
Narrative presence → Eco-product purchase intention	0.59	12.31	<0.001	[0.496, 0.684]
Digital human narrative scenarios → Eco-product purchase intention (total effect)	0.26	3.508	<0.001	[0.405, 3.508]
Digital human narrative scenarios → Eco-product purchase intention (direct effect)	0.386	11.688	<0.001	[0.193, 0.323]
Digital human narrative scenarios → Narrative presence → Eco-product purchase intention	0.646	7.65	<0.001	[0.481, 0.812]

3.4. Study 4: The Moderating Effect of the Narrative Types

3.4.1. Experiment Design and Procedure

A 2 (digital human narrative scenarios: single/mixed) $\times$ 2 (narrative type: sharing/persuasion) between-groups experimental design was used to verify the moderating effect of the narrative mode, i.e., H4. We recruited 252 subjects (46.4% female, $M_{\text{age}} = 31.3$) from Credamo. All of the subjects were randomly assigned to the four groups of scenarios, and at the end of the experiment, each person was given RMB 2. This experiment replaced

the research context with an ecological organic cantaloupe as the experimental product to test the robustness of the theoretical framework.

The experimental procedure was consistent with Study 2, in which subjects were asked to watch a promotional video of digital humans presenting an organic cantaloupe in each context. In the sharing-oriented narrative group, subjects watched product promotional content based on sharing daily life experiences. They were entertaining, with only a slight hint of the product's efficacy being provided. In contrast, subjects in the persuasion-oriented narrative group received product-specific information, detailing product efficacy, etc., with a high degree of demonstrated persuasive intent. Subsequently, the subjects were required to give their opinion, using a seven-point scale, of narrative presence ($\alpha = 0.794$) [69] and purchase intention ($\alpha = 0.793$) [92]. In addition, the narrative type scale of the manipulation test was filled out to test the degree of persuasive intention revealed through the statement, "I think that the information in the video is trying to persuade me to buy the product" [24], and the level of persuasive intention was further judged to differentiate between sharing-oriented and persuasion-oriented narratives. The questions were asked on a seven-point Likert scale, with 1 being "completely disagree" and 7 being "completely agree". Finally, the participants provided relevant demographic information.

3.4.2. Results

An independent sample t-test was employed to conduct a manipulation test of narrative types in SPSS Statistics 29.0 software. The results revealed a significantly higher perceived content persuasion intention score in the persuasion-oriented narrative group compared to the sharing-oriented narrative group ($M_{\text{sharing}} = 4.53$, $SD = 0.22$; $M_{\text{persuasion}} = 5.52$, $SD = 0.21$; $t(58) = -56.49$, $p < 0.001$). These findings indicate the effectiveness of interaction style manipulation.

Referring to the moderating effect test proposed by Hayes (2013), the PROCESS procedure in SPSS was utilized to analyze the results at a 95% confidence interval (Model 7, $n = 5000$), with consumer purchase intention as the dependent variable, type of narrative scenario as the independent variable, and narrative type as the moderating variable. The results demonstrated a significant moderating effect of narrative type on the relationship between digital human narrative scenarios and perceived narrative presence ($\beta = 0.26$, $SE = 0.074$; 95% CI = [0.115, 0.405], not including 0).

The sample was categorized based on the type of digital human narrative scenarios into mixed digital human scenarios and single digital human scenarios. In the mixed scene group, a one-way ANOVA analysis was conducted with "narrative presence" as the dependent variable and "narrative type" as the independent variable. The results revealed that participants perceived significantly higher narrative presence in the mixed narrative scenarios using sharing-oriented narrative type compared to those using persuasion-oriented narrative type ($M_{\text{sharing}} = 6.08$, $SD = 0.37$; $M_{\text{persuasion}} = 5.19$, $SD = 0.51$; $F(1, 124) = 122.19$, $p < 0.001$; see Figure 5).

Similarly, a one-way ANOVA analysis was performed in the single scenario group with "narrative presence" as the dependent variable and "narrative type" as the independent variable. The findings indicated that participants perceived significantly more narrative presence in individual narrative scenarios with a sharing-oriented narrative compared to those with a persuasion-oriented narrative ($M_{\text{sharing}} = 5.52$, $SD = 0.73$; $M_{\text{persuasion}} = 5.04$, $SD = 1$; $F(1, 124) = 9.107$, $p < 0.001$; see Figure 5).

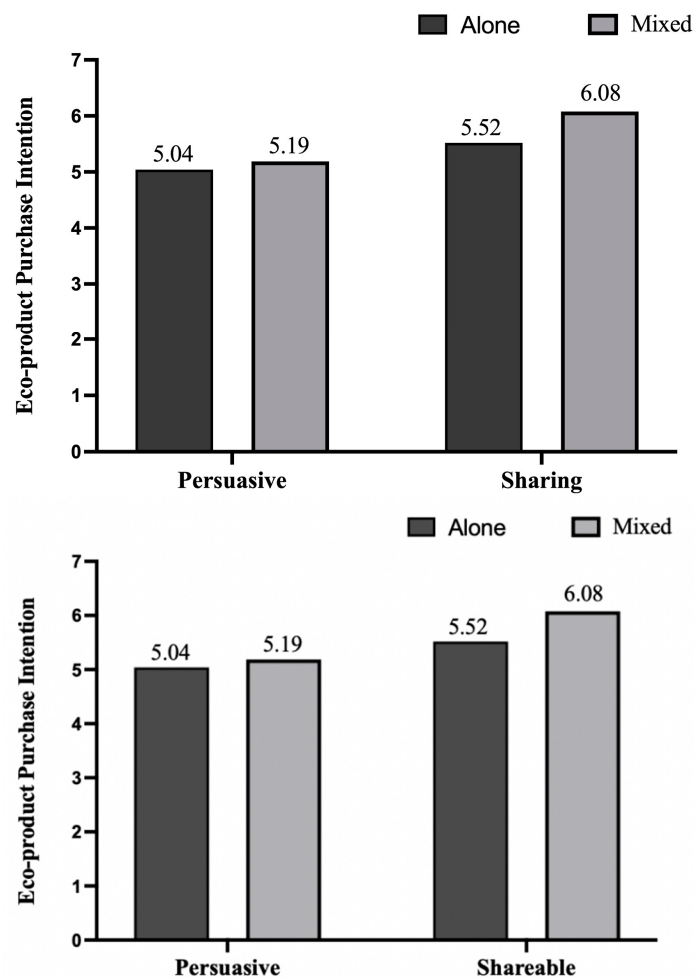


Figure 5. The moderation effect of narrative types.

3.5. Discussion

Study 1 leveraged empirical evidence to elucidate the alignment between anime-like digital humans and eco-products, showcasing their heightened emotional impact. Study 2 showed that narrative scenarios featuring digital humans positively influence consumer purchase intention. Moreover, the impact of mixed narrative scenarios involving digital humans and real humans surpassed that of scenarios featuring digital humans alone, thus affirming H2. Study 3 established that perceived narrative presence acts as a mediator in the relationship between narrative scenarios of digital humans and consumer purchase intention. Additionally, audiences perceive a stronger narrative presence in mixed narrative scenarios, further validating Hypothesis 3. Finally, Study 4 verified that narrative type moderates the impact of digital human narrative scenarios on narrative presence. Specifically, viewers perceived a heightened narrative presence when anchors employ sharing-oriented narratives, thereby validating Hypothesis H4.

Figure 6 depicts our conceptual model. We used one EEG experiment (Study 1) and three online experiments (Studies 2–4) to validate our hypotheses. Study 1 assessed the differential communication effects of anime-like and human-like digital humans on eco-products, i.e., H1. Study 2 investigated the impact of narrative scenarios on consumer purchase intention (H2). Study 3 substantiated the proposed mechanism by examining the mediating role of narrative presence (H3). Study 4 served as additional validation for the moderating effect of interaction type, i.e., H4.

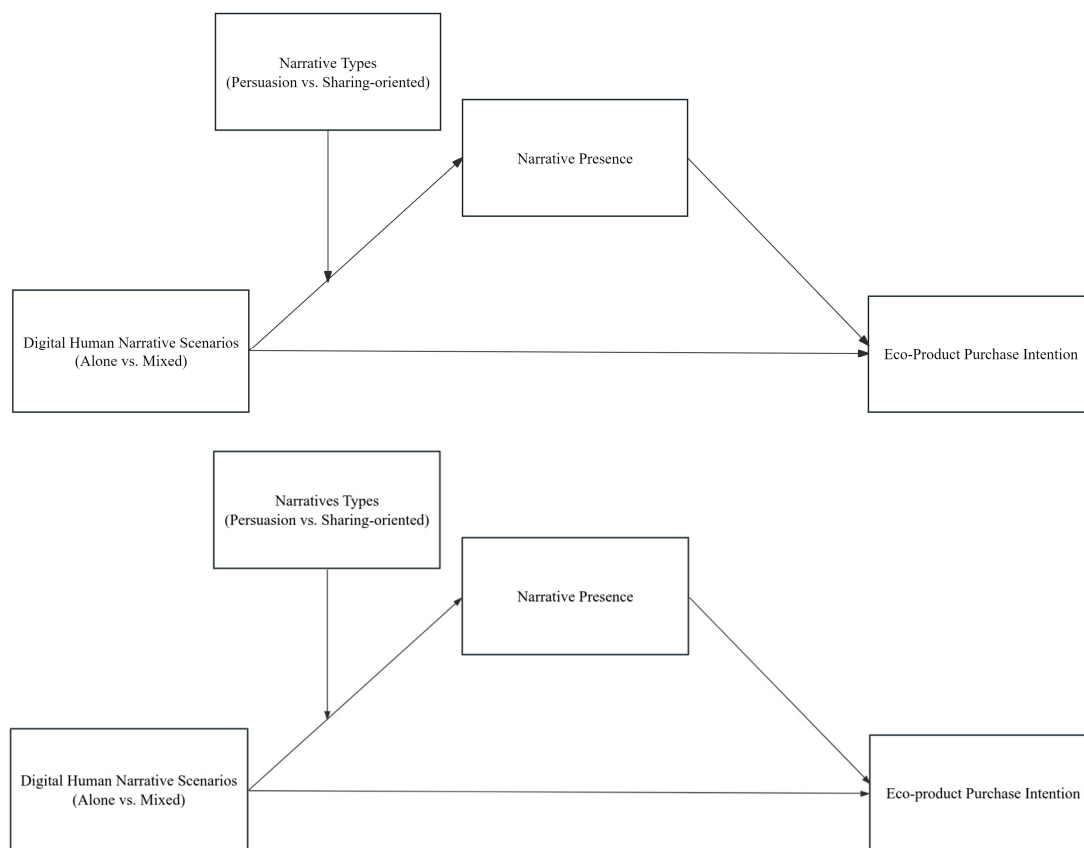


Figure 6. Conceptual model.

4. Discussion

4.1. Findings

This study explored the application of digital humans in eco-product marketing and uncovered their significant influence on consumer purchase intentions. Notably, narrative scenarios integrating digital humans with real humans substantially bolstered consumer purchase intentions, underscoring the considerable potential of mixed reality experiences in enhancing consumer engagement and trust. Additionally, our investigation unveiled the mediating role of narrative presence in scenarios featuring digital humans, suggesting that augmented perceptions of narrative presence can effectively guide consumers' purchase decisions. Furthermore, we demonstrated that employing sharing-oriented narratives in mixed scenarios is more conducive to heightening consumers' perceptions of narrative involvement, thereby further stimulating their purchase intentions. These conclusions were substantiated by an EEG experiment (Study 1) and three online experiments (Studies 2–4). Our study adds something important and insightful to the theoretical advancement of this field and provides practical guidelines for or stimulates future research [94].

4.2. Theoretical Contributions

Firstly, prior research has primarily focused on investigating aspects such as the anthropomorphism and authenticity of digital humans [3,25]. Some studies have affirmed that human-like digital humans are more effective in advertising green products compared to anime-like digital humans from an anthropomorphic perspective [11]. However, when it comes to conveying abstract rational messages about eco-products, aligning anime-like digital humans with these messages can further improve the audience's perception of the products and increase marketing effectiveness. In order to ensure the scientific rigor of the conclusions, EEG experiments were conducted to gather scientific data. These experiments aimed to elucidate the alignment between anime-like digital humans and eco-products. As

a market research analyst, We expect that the use of anime-like digital humans will enhance the audience's connection and interest in environmentally friendly products. This will provide valuable insights into the varying levels of marketing effectiveness across different types of digital humans.

Secondly, our research adds to the field of eco-product communication by suggesting the use of digital human narrative scenarios. These scenarios have been proven to greatly improve consumers' willingness to purchase eco-products, especially when a combination of digital and real humans is used. Research has shown that digital humans can mimic human social interactions, leading to increased emotional resonance and social engagement among consumers [56,57]. By combining the novelty of digital humans with the credibility of real humans, mixed scenarios have effectively enhanced consumers' perceived behavioral control, ultimately increasing their purchase intention [3]. In addition, integrating digital humans into narrative scenarios improves consumers' understanding of eco-products by creating emotional and cognitive connections. A deep understanding of consumer behavior can be used to influence their likelihood of purchasing, especially when they are feeling fully immersed and emotionally connected. This has been shown in studies by Sun et al. [58] and Xu et al. [59], highlighting the importance of promoting environmental awareness and driving behavioral change. This study adds to the existing research on narrative presence in digital human marketing, particularly in mixed scenarios. It suggests that the presence of a narrative in digital human scenarios plays a crucial role in enhancing the impact of these scenarios on consumer purchase intentions. When presented with different situations, viewers tend to feel a stronger sense of narrative presence, which in turn boosts their level of engagement and their likelihood of making a purchase.

Thirdly, this study utilized different narrative types to analyze the verbal narrative of digital humans. It also incorporated dual-system processing theory to investigate the relationship between these narrative types further. According to the dual-system processing theory, consumers have the option to take either a central or peripheral path when they process information and make decisions [80]. Sharing-oriented narratives emphasize peripheral pathways and highlight emotional and social connections, resulting in a stronger impact on consumers' purchase intentions through emotional resonance and social connections. However, narratives that focus on persuasion are more effective when it comes to providing detailed information and justifications through the central path. However, they may not be as effective in standalone digital human scenarios.

4.3. Managerial Implications

At the forefront of green eco-product marketing, the integration of digital humans has forged a path of innovation for companies, with their distinctive advantages reshaping the landscape of marketing strategies [11,12]. Digital humans possess exceptional capabilities in comparison to conventional human spokespersons. They not only avoid the potential risks to reputation [95,96] but also outperform in the field of green marketing due to their enhanced adaptability and cost efficiency [11,12]. As a result, the use of digital people in marketing efforts, especially in promoting eco-friendly goods, has become a significant trend that deserves more investigation.

In addition, when considering using digital people in eco-product marketing and using them as a single marketing tool, it is important to consider including blended scenarios that include both digital humans and real humans. With the growing overlap between virtual and physical domains [3], the strategic combination of digital and real human marketing is expected to provide several benefits and achieve a more powerful marketing result. By incorporating genuine components into the digital world of digital humans, marketers may increase customers' emotional connection and involvement. In addition, blended situations may effectively solve the perceived shortcomings of digital humans in terms of warmth, trust, and originality. The presence of real humans increases the legitimacy and familiarity of artificial beings in the audience, reducing their sensation of alienation and discomfort. Therefore, marketers may enhance the efficiency of eco-product marketing

and strengthen the emotional connection and trust between companies and customers by including a combination of digital humans and real people in their strategies.

Moreover, when creating digital human story material, firms must carefully plan and create the immersion and narrative presence of the content. This absorption acts as a channel for spreading information and is crucial in creating emotional connection and trust. This research confirmed that organizations could increase customers' understanding and confidence in a product by improving the way digital human tales are presented, which in turn leads to a greater likelihood of purchase.

Notably, sharing-oriented narratives engage customers' emotions and intellect by creating emotional resonance and fostering social relationships. In contrast, persuasion-oriented narratives influence consumers' logical thinking processes using reasoning and arguments. Marketers should carefully choose and combine different kinds of stories, taking into account the characteristics of the target audience and the specific needs of the marketing goals, in order to obtain the best possible outcomes.

4.4. Limitations and Directions for Future Research

This research has made significant progress in investigating the use of digital humans in eco-product marketing and their influence on customer purchase intent. However, numerous limitations present opportunities for further study. First, although this research used a mix of EEG and online tests, the experimental environment may differ from real-world buying settings. Future studies might be carried out in settings that closely resemble real-life shopping experiences, such as monitoring customers in actual retail venues or using virtual reality technologies to model shopping situations. This would increase the external validity of the results. Second, most participants in this study were Chinese, which might introduce some limitations due to cultural differences. To improve the generalizability of our findings, future studies could examine our conceptual model and hypotheses in other cultural contexts. Third, this research focused exclusively on short-term changes in customer purchase intentions, with minimal investigation into the long-term consequences of digital human marketing methods. Future research might follow customers' long-term behavioral patterns and examine how digital human marketing methods affect brand loyalty and repeat purchase behavior. Such endeavors allow for a more thorough evaluation of the long-term impacts of digital humans in eco-product marketing, as well as a basis for firms to develop long-term marketing plans.

Future studies could look at the complex connections between digital humans and customers. For example, voice recognition and sentiment analysis technology can be incorporated to improve digital human engagement skills and personalized service levels. These technology breakthroughs enable digital humans to intelligently comprehend and react to customers' requirements, more effectively influencing their purchase choices and increasing the market competitiveness of eco-products. Furthermore, the study might look at how digital humans can build emotional ties between customers and goods by communicating social signals and personality characteristics and how these emotional connections can influence purchasing behaviors. These studies will help us better understand digital human marketing tactics while also introducing new viewpoints and means of eco-product marketing.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Wuhan Textile University (protocol code 20240219 and 17 February 2024).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original data generated in the study are included in the article.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Demographic information of the participants.

		Study 1 (N = 48)		Study 2 (N = 258)		Study 3 (N = 260)		Study 4 (N = 252)	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Gender	Male	22	45.8%	142	55.0%	127	48.8%	135	53.6%
	Female	26	54.2%	116	45.0%	133	51.2%	117	46.4%
Age (years)	18–25	48	100%	79	30.6%	72	27.7%	83	32.9%
	26–35	0	0.0%	96	37.2%	114	43.8%	91	36.1%
	36–45	0	0.0%	54	20.9%	48	18.5%	59	23.4%
	>46	0	0.0%	29	11.2%	26	10.0%	19	7.5%
Education level	Junior High School	0	0.0%	6	2.3%	5	1.9%	8	3.2%
	High school	0	0.0%	7	2.7%	10	3.8%	5	2.0%
	Undergraduate	32	66.7%	181	70.2%	187	71.9%	149	59.1%
	Postgraduate	16	33.3%	40	15.5%	41	15.8%	53	21.0%
Profession	Doctorate	0	0.0%	24	9.3%	17	6.5%	37	14.7%
	Student	48	100%	52	20.2%	61	23.5%	59	23.4%
	Employee	0	0.0%	198	76.7%	186	71.5%	183	72.6%
	Freelancer	0	0.0%	8	3.1%	13	5.0%	10	4.0%

Table A2. The stimulus used in studies.

	Anime-Like Digital Humans (those who are clearly not human and represent what Mori [34] termed the “Toy Robot” end of the spectrum).	Human-Like Digital Human
Study 1		
	https://b23.tv/WTjyUrs	https://b23.tv/WeVXsDV
	Single Narrative Scenarios	Mixed Narrative Scenarios
Study 2		
	https://b23.tv/DC5H9yq	https://b23.tv/BULUsyr

Table A2. Cont.

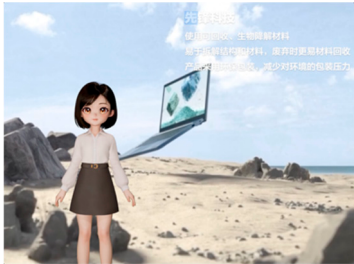
Study 3		
Study 4		
		



Figure A1. Electroencephalography experiment.

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