The Impact of Sensation-Seeking Tendency on Advertising Attitudes: Focusing on the Dual Serial Mediation Effects of Virtual Human's Human Similarity and Attractiveness

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ABSTRACT

The purpose of this study was to investigate whether there was a dual serial mediation effect of virtual humans' human similarity and attractiveness on the impact of users' sensation-seeking tendency on advertising attitudes. To achieve this, data were collected from adults aged 20 to 40 using a Google Online Form, and 180 participants were analyzed using the SPSS Process Macro. The results of this research indicate significant positive correlations (+) between sensation-seeking tendencies and human similarity, sensation-seeking tendencies and advertising attitudes, human similarity and attractiveness, and attractiveness and advertising attitudes. Secondly, while users' sensation-seeking tendencies may directly influence advertising attitudes, the validation of a dual mediation effect sequentially mediating virtual humans' human similarity and attractiveness confirms the existence of a dual serial mediation effect. Such findings offer valuable insights for advertising and marketing activities utilizing virtual humans, emphasizing the importance of effectively creating and using them.

Keywords: Virtual Human, Sensation-Seeking Tendency, Advertising Attitude, Human Similarity, Attractiveness, Dual Serial Mediation Effect

INTRODUCTION

The history of Artificial Intelligence (AI), emerging from the imaginations of philosophers and science fiction writers, is a culmination of decades of ideas and technological advancements. This includes breakthroughs in image recognition and analysis, speech recognition, natural language processing, and deep learning inspired by the human brain. Recently, innovations such as OpenAI's Chat GPT model have propelled AI development rapidly. Consequently, the evolution of AI is highly dynamic and transformative, significantly impacting future society and human lifestyles (Korea Lecturer News, 2023). Virtual humans, created using advanced AI algorithms and breakthrough technologies (Baik, 2023), are actively used without time and space constraints. They are designed in various forms and methods, including types for interacting with digital humans, highly realistic 3D models resembling humans, and doppelganger versions of celebrities.

Various types of virtual humans are being extensively utilized across diverse industries, including advertising, education, healthcare, entertainment, and luxury brands, as well as active marketing strategies on social media (Lee, Hong Park 2021; Shin & Park, 2022; Amin & Lim 2021). Virtual humans' appearance is evolving to resemble real humans closely, leading to their widespread use in various marketing fields. The reasons for the expanding use of virtual humans include their ability to manage personal exposure more effectively than celebrities, freedom from time and space constraints, ease of crisis management concerning negative rumors and evaluations, and the minimization of potential risks and cost savings in handling unpredictable negative situations (Korea Lecturer News, 2023).

The influence of virtual humans, created through AI technology, digital culture, and social media, rapidly expands. In particular, companies are actively utilizing virtual influencers as marketing tools. These influencers are highly familiar and likable to the MZ generation, digital natives unaffected by temporal or physical constraints, and reflect current trends (Hwang & Lee, 2021). Additionally, they are emerging as key players with significant influence across various platforms and industries, including social media markets,

YouTube, dramas, OTT services, entertainment shows, TV, magazines, luxury brands, advertising, and even the financial sector.

The rapid evolution of virtual humans has drawn significant consumer interest and expanded their applicability across various industries, prompting numerous studies within academia (Lee, 2022; Lee & Kim, 2022; Park et al.,2022; Yi & Shin, 2022). However, most research has focused on the characteristics of virtual humans and consumer responses to them. Consequently, there is a growing need for greater diversity and expansion in research topics related to virtual humans.

Therefore, this study diverges from the aforementioned trends in various types of previous research and focuses on exploring one of consumers' psychological characteristics: sensation-seeking tendency. Individual psychological characteristics include impulsivity, attachment, innovation, innovation resistance, self-efficacy, and self-construal. These traits have been utilized in market segmentation strategies and as key factors in predicting consumer attitudes and behaviors through the Priming Effect (Ju & Kim, 2020). Therefore, Zuckerman(2014) demonstrated that individuals with a high sensation-seeking tendency, which influences personal preferences and traits, are more likely to engage in new experiences and stimuli, readily enjoying various types of stimuli and experiences. Therefore, individuals with a high sensation-seeking tendency may have a high level of curiosity and engagement toward new types of advertising featuring virtual characters, leading to a favorable attitude toward advertising. From this perspective, this study aimed to verify attitudes towards advertising utilizing virtual characters by setting the sensation-seeking tendency of users as an independent variable, a psychological characteristic variable. Additionally, in the research process, the study aimed to empirically verify the dual serial mediation effect of perceived human similarity and attractiveness perceived by users regarding virtual characters to elucidate consumer attitudes towards advertising.

Theoretical Background

Virtual Humans and Marketing

Generally, most people perceive digital humans as realistic 3D representations of actual humans. Consequently, in various fields such as advertising, beauty, education, and corporate social media marketing, many digital humans are being utilized, showcasing the potential for "Authentic Performance" (Hankookilbo, 2022). These digital humans resemble real humans in appearance and express human emotions naturally. From the latest technological trends, virtual humans can be categorized as follows: Figure 1, Table 1: Digital humans are computer-generated representations of humans created using advanced 3D modeling and animation technologies. These digital humans include two main types: virtual humans, which interact with digital humans in virtual reality, video games, and simulations, and digital doubles, which are highly accurate replicas of specific individuals that copy external traits such as gestures and facial expressions and are primarily used in visual effects, gaming, and media. Therefore, these digital humans are structured data packages embodying advanced technology for versatile applications. However, deepfakes also involve creating fake humans, which differ because they are 2D outputs from trained neural networks, producing frame-by-frame results. Deepfake technology can create virtual humans by combining several real faces and synthesizing them onto existing models' faces through AI learning (Apple-economy, 2023).

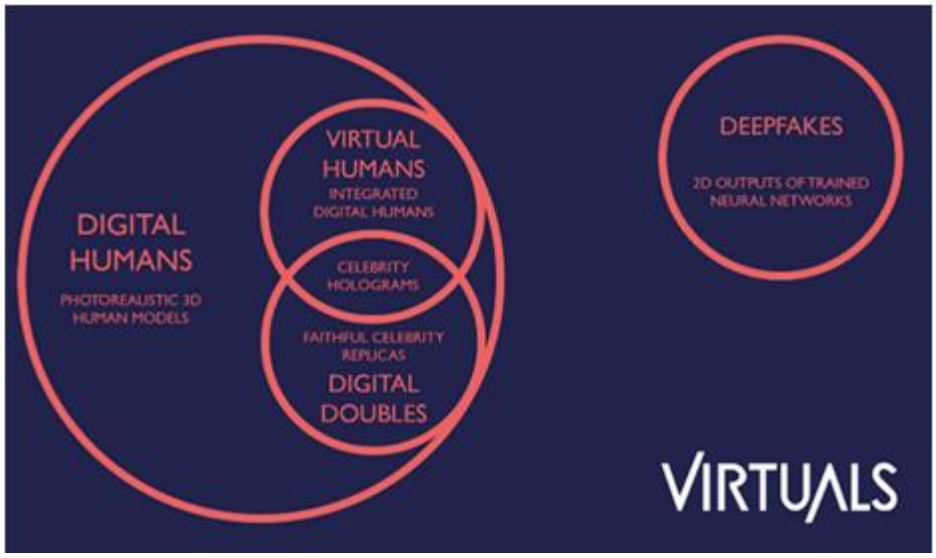

Fig. 1: A visualization of how we define digital humans, virtual humans, digital doubles, and deepfakes about one another (Toloza, 2020)

Table 1: Differentiation based on Digital Human Technology (Toloza, 2020)

Digital Humans	Virtual Humans	Digital Doubles	Deep Fakes
 Digital Emily; structured 3D model (Wiki human project)	 Roman, a virtual human by Soul Machines	 -Digital double of Peter Cushing as Grand M off Tarkin in Star Wars: Rogue One -Digital doubles in VFX and games.	 Pinscreen deepfake exhibition at the World Economic Forum

Marketing strategies utilizing virtual humans represent an innovative method that surpasses traditional marketing strategies, marking a paradigm shift. These strategies enhance and promote interactions between brands and consumers between companies and consumers. Therefore, virtual humans, a new visual element in the digital environment, are highly effective in delivering brand messages (Iconsumer, 2023). For example, in July 2021, Japan's Shionogi & Co., Ltd. introduced Shionogi Kanade, a digital animation and AI-generated virtual YouTuber (Virtuber), who effectively increased the company's awareness and proved cost-efficient in delivering promotional messages through company advertising activities (Chosun Media, 2023; Fortune, 2021; Lee, 2022; Lu et al., 2022; Shionogi, 2023).

In addition, various industries and national institutions in South Korea also employ virtual humans as advertising models and corporate promoters. Examples include Sidus's Rozy, Lotte Homeshopping's Lucy, LG Electronics's Reah Keem, Smilegate's Han YuA, Neptune Games's Sua, and Rui, a Virtuber created by Dob Studio. These virtual influencers are active in gaming, entertainment, electronics, automotive, home shopping, finance, luxury brands, and more, performing roles surpassing traditional human influencers. As shown in Table 2, their roles can be classified based on the level of interaction with humans into "Influencer," "Virtual Assistant," "Intelligent Assistant," and "Companion". The performance and dissemination of these virtual humans are rapidly advancing.

Table 2: Types and Roles of Virtual Humans

Virtual Influencer	Virtual Assistant	Intelligent Assistant	Companion
			
Sidus's Rozy	Samsung's Sam	NVIDIA - contact center	Zoom(Team Chat)
Roles as brand and corporate promotional models	Replacements for humans in customer service	Advanced roles as leaders (e.g., in fitness/education) beyond virtual assistants	Facilitators of highly interactive communication with humans

The features of using virtual humans in marketing are as follows: First, they can increase emotional interaction. Second, they allow for diversity and creative expression. Third, they enable real-time interaction and chat capabilities. Fourth, they are effective for promotion on social media platforms. To elaborate, virtual humans optimized for companies and brands can enhance brand characteristics through direct and personalized consumer interactions. With their diverse characters and unique styles, these virtual humans excel at expressing emotions and communication. They can engage in real-time chats with consumers, strengthening the relationship between consumers and brands. Additionally, brands can expand their reach through various social media platforms, achieving effective advertising and promotion (Iconsumer, 2023). Consequently, consumers develop stronger interest and brand loyalty through emotional interactions with engaging virtual humans. Companies can gain a competitive edge by offering differentiated experiences to a broader range of consumers.

According to a report by the global influencer marketing platform MarketsandMarkets, while the human influencer market is expected to grow from 7.6 trillion KRW to 13 trillion KRW, the virtual human influencer market is projected to grow from 2.4 trillion KRW to 14 trillion KRW, surpassing the human influencer market by 2025 (The JoongAng, 2023). This indicates that virtual humans are rapidly expanding their roles across various industries due to their numerous advantages, such as cost savings, convenience in overcoming time and space constraints, and reduced risk, making them increasingly valuable.

Sensation-Seeking Tendency

Sensation-seeking tendency refers to an individual's inclination to seek new and exciting stimuli and experiences to satisfy their senses. Consequently, various studies have been conducted on the acceptance of new products (Vishwakarma et al., 2020) and services (Kim et al., 2017) using sensation-seeking tendencies. Zuckerman (2014) defined sensation-seeking tendency as the inclination of people to seek immediate gratification and fresh stimuli. He explained how sensation-seeking tendencies influence individual traits and behaviors by categorizing them into 'Behavioral Tendencies,' 'Cognitive Traits,' and 'Psychological Effects.' First, the influence on behavioral tendencies indicates that individuals with high sensation-seeking tendencies prefer more dangerous activities and stronger stimuli, which increases the risk of mental and social problems. Second, individuals with high sensation-seeking tendencies are more likely to discover various aspects of them and develop personally through new experiences. However, they may also need help forming relationships and managing their work. Third, while sensation-seeking individuals may feel a greater sense of achievement through more stimuli and challenges, they also tend to experience higher stress levels than the general population.

Based on Zuckerman's Sensation-Seeking Tendency theory, numerous prior studies have been conducted across various fields. Baik (2023) empirically verified that higher sensation-seeking tendencies among recipients positively influence their perception of the human similarity of virtual humans. Cho & Youm (2023) confirmed that consumers with higher sensation-seeking tendencies favor advertising using virtual influencers. In the sports field, Park & So (2023) found that among high-risk scuba diving participants, those with higher sensation-seeking tendencies could improve safety awareness, which is crucial for effective

coping behavior in potential risk situations. In the field of life sciences, Lee & Choi (2023) revealed that higher sensation-seeking tendencies correlate with a greater motivation to use therapeutic metaverse applications and improved therapeutic outcomes through metaverse utilization.
These findings suggest that sensation-seeking tendencies have been continuously researched across various domains, including high-risk sports, advertising, branding, and life sciences. Individuals with high preferences for new technologies, stimuli, and risks show positive results in accepting innovative technologies. In a similar context, this study aims to examine attitudes towards advertising through the dual serial mediation effect of human similarity and attractiveness of virtual humans, which are the epitome of the latest AI technologies based on individual sensation-seeking tendencies.

Sensation-Seeking Tendency

The trends in prior research on virtual humans have focused primarily on the causal relationships involving various characteristics of virtual humans, such as attractiveness, expertise, credibility, similarity, and authenticity. Many of these studies have concluded that attractiveness and similarity are the defining features of virtual humans. Generally, 'attractiveness' encompasses appearance and aspects of social interaction, psychological traits, and economic considerations. In other words, attractiveness can refer to the appeal felt from a virtual human's appearance or the positive emotions generated through interactions, as well as feelings of satisfaction with the cost-effectiveness, diverse functionalities, and services the virtual human offers.
Regarding research on attractiveness, Park & Kim (2023) demonstrated through a study on the effects of virtual influencers' CSR activities that the external attractiveness of virtual influencers positively influences the authenticity of CSR activities. Lee (2022) showed that the attractiveness of virtual influencers has a positive impact on brand attitudes. Additionally, Zhao et al., (2022) found that the attractiveness and similarity of virtual influencers positively affect brand attitude, brand attachment, and purchase intention. Moreover, Lee et al., (2021) proved that the attractiveness of virtual influencers positively impacts brand attitude and mediates the relationship between brand attitude and purchase intention. Jeong et al., (2023) also confirmed that virtual influencers' physical and social attractiveness significantly influences self-identification, attachment, trust, and behavioral intentions. In conclusion, the results of these prior studies confirm that the characteristic of 'attractiveness' has been used as a variable in research across various fields, including advertising, branding, broadcasting, and content.
'Human Similarity' refers to an advanced level of anthropomorphism, encompassing not only the appearance but also the capability for interaction with humans. The higher the level of anthropomorphism, the more a virtual human is considered a socially similar entity to actual humans. To elaborate, highly sophisticated virtual humans, such as those created by OpenAI's 'SORA (Scalable Object Retrieval Architecture),' exhibit an appearance and behavior so refined that they can be mistaken for real humans, accurately depicting human emotions appropriate to various situations.
According to Byrne's (1997) 'Similarity-Attraction Theory,' people feel more comfortable with others who resemble them in appearance (such as gender and age), and this comfort leads to a greater sense of attraction toward those similar individuals. Further research on human similarity includes Lee & Kim (2022), who found that virtual influencers' perceived external and internal similarity positively influences psychological distance. Lee (2022) revealed that as the perceived humanness of virtual influencers increases, the negative effect of unpleasantness on brand attitude decreases. Kim (2022) concluded that recognizing human similarity in aspects such as realism, voice, tone, and gestures of virtual influencers significantly affects likability. Additionally, Cha & Youm (2023) identified that the attractiveness and similarity of virtual influencers significantly impact mind perception and psychological dysphoria. In conclusion, numerous studies have used the characteristic of 'Human Similarity' in virtual humans as a variable across various fields, including e-commerce, information systems, advertising, public relations, and knowledge information.
The ultimate goal of advertising is to increase consumer loyalty to a company and its brand and to shape a

positive attitude through advertisements. Advertising attitude is a variable to measure advertising *effectiveness, reflecting the positive or negative response tendency that recipients exhibit toward specific advertising stimuli during exposure. Im & Park (2020) defined advertising attitude as the selection bias of recipients to react with liking or disliking to advertising content. They explained that recipients form different advertising attitudes based on their traits and the unique experiences through advertisements. Kim & Park (2012) also found that recipients who have favorable feelings from advertisements tend to form a favorable advertising attitude. Therefore, advertising attitude is a frequently used variable to measure the effectiveness of advertising, evaluating whether recipients view the advertising positively or negatively (2019).*

From this perspective, this study aims to empirically verify the relationship between consumers' sensation-seeking tendencies and virtual humans' human similarity and attractiveness by setting advertising attitude as a key variable for measuring the effectiveness of advertising and marketing activities that utilize virtual humans.

RESEARCH QUESTIONS AND MODEL

Based on the above previous studies, research questions were formulated regarding the relationship between consumers' sensation-seeking tendency and advertising attitudes and between the sensation-seeking tendency and the perceived human similarity and attractiveness of virtual humans. The research model is shown in Figure 2.

***Q**: In the relationship between consumers' sensation-seeking tendency and advertising attitude, do the human similarity and attractiveness of virtual humans have a dual serial mediation effect?*

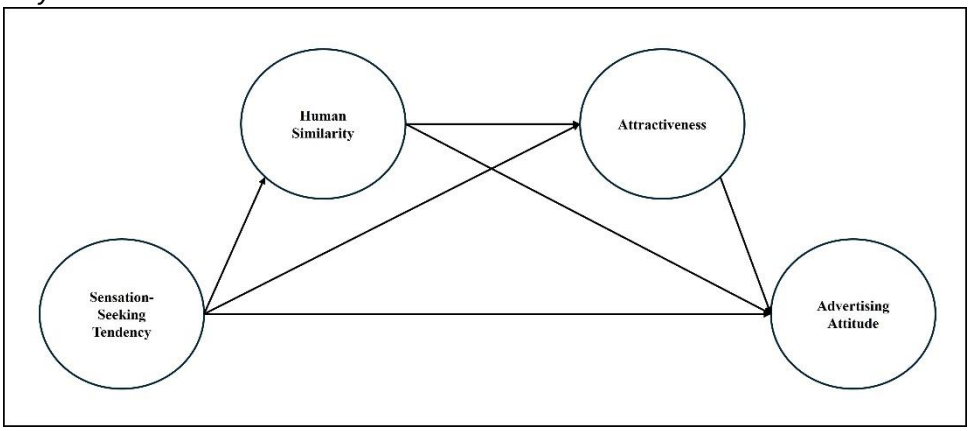

Fig. 2: Research Model

RESEARCH METHODOLOGY

Survey Participants and Data Collection

The subjects of this study were selected from adults aged 20 to 40 who had experience with advertising and marketing using virtual humans and had a high level of awareness about virtual humans. Data collection was conducted through a structured questionnaire using a Google Online Form. A total of 180 responses were analyzed, taking into account gender and age distribution. Specifically, 60 participants (33.3%) were evenly distributed across their 20s, 30s, and 40s. The gender distribution was 51.7% male (93 participants) and 48.3% female (87 participants).

Measurement Tools

4.2.1. Sensation-Seeking Tendency

In this study, the tool used to measure sensation-seeking tendency was adopted directly from the scales used in the research by Baik (2023) and Chang & Youm (2017). Specifically, it included four items: "I easily get bored with things that are repetitive," "I like fresh and thrilling experiences," "I enjoy adventures," and "I like exciting and thrilling experiences." These were measured using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree).

4.2.2. Human Similarity and Attractiveness of Virtual Humans

In this study, the tool used to measure the human similarity of virtual humans was adopted directly from the scale used in by Baik 's research (2023). Specifically, it included the following five items measured on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree): "The virtual human seems to think and speak like me," "The virtual human does not feel physically distant," "The virtual human seems capable of communicating like a real person," "It would not feel awkward to be with the virtual human," and "It is hard to distinguish the virtual human from a real person."
The tool used to measure attractiveness was adapted and refined from the scales used in the research by Cho & Youm (2023). The items were as follows: "Virtual humans are attractive," "Virtual humans are beautiful," "Virtual humans are cool," and "Virtual humans are sexy." These were measured using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree).

4.2.3. Advertising Attitude

The tool used to measure advertising attitudes was adapted and refined from the scales used in the research by Baik (2023) to suit this study. It included five items: "I like advertising featuring virtual humans," "I feel favorable towards advertising featuring virtual humans," "I find advertising featuring virtual humans interesting," "I am pleased with advertising featuring virtual humans," and "I have a positive attitude towards advertising featuring virtual humans." These were measured using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree).

Data Analysis

To analyze the data used in this study, SPSS/PC+ Windows 21.0 software was employed. Frequency analysis and descriptive statistics were conducted to confirm demographic characteristics, and the reliability of the scales was assessed using Cronbach's alpha coefficient. Additionally, exploratory factor analysis was performed for validity testing, and Pearson's product-moment correlation coefficient was used to analyze relationships between variables. Finally, the research questions were validated using the Bootstrap method of the Process Macro (Hayes, 2012, 2017). The model used for analysis was Model 6, with Bootstrapping conducted 5,000 times and confidence intervals verified at 95%.

RESEARCH RESULTS

Validity and Reliability of Measurement Tools

The validity and reliability verification results of the measurement tools used in this study are presented in Table 3. Exploratory factor analysis showed that all items exceeded the criterion of initial communality and factor loading of 0.4. Additionally, the Kaiser-Meyer-Olkin measure of sampling adequacy was .912, and the Bartlett test yielded $\chi 2=2522.238(df=153, p<.001)$, confirming no issues with validity. Furthermore, the reliability verification by the factor indicated Cronbach's α coefficients of 0.946 for advertising attitudes, 0.912 for attractiveness, 0.882 for

human similarity, and 0.856 for sensation-seeking tendency, demonstrating that all variables maintained good reliability.

Table 3: Validity and Reliability Validation Results

Item	Factor 1	Factor 2	Factor 3	Factor 4	Commonality
Advertising Attitude 3	.843				.819
Advertising Attitude 1	.841				.865
Advertising Attitude 4	.838				.823
Advertising Attitude 2	.807				.822
Advertising Attitude 5	.783				.780
Attractiveness 2		.837			.810
Attractiveness 3		.797			.809
Attractiveness 4		.757			.759
Attractiveness 1		.757			.795
Human Similarity 4			.830		.806
Human Similarity 5			.752		.690
Human Similarity 2			.731		.763
Human Similarity 3			.709		.696
Human Similarity 1			.474		.568
Sensation-Seeking Tendency 2				.871	.765
Sensation-Seeking Tendency 3				.866	.789
Sensation-Seeking Tendency 4				.861	.754
Sensation-Seeking Tendency 1				.731	.581
Eigen value	8.565	2.711	1.299	1.118	-
% of Variance	47.586	15.060	7.215	6.209	-
Cumulative %	47.586	62.645	69.860	76.069	-
Reliability	.946	.912	.882	.856	
KMO(Kaiser-Meyer-Olkin) =.912, Bartlett test χ^2=2522.238(df=153, p<.001)					

Correlation Analysis

The results of measuring the correlations between sensation-seeking tendency, human similarity, attractiveness, and advertising attitudes used in this study are presented in Table 4. Significant positive correlations were found between sensation-seeking tendency and human similarity (r=.168, p<.05), advertising attitudes (r=.234, p<.01), human similarity and attractiveness (r=.681, p<.01), advertising attitudes and attractiveness (r=.681, p<.01), and attractiveness and advertising attitudes (r=.652, p<.01). However, statistically significant correlation was not found between sensation-seeking tendency and attractiveness of virtual humans.

Table 4: Validity and Reliability Validation Results

Variables	Sensation-Seeking Tendency	Human Similarity	Attractiveness	Advertising Attitude
Sensation-Seeking Tendency	1			
Human Similarity	.168*	1		
Attractiveness	.125	.681**	1	
Advertising Attitude	.234**	.681**	.652**	1
*p<.05, **p<.01				

Verification of Research Questions Using Process Macro

The verification results regarding the dual serial mediating effects of virtual human's human similarity and attractiveness in relation to consumers' sensation-seeking tendency and advertising attitudes are presented in Table 5. The results in Table 5 indicate the following: Firstly, the regression model for advertising attitude concerning sensation-seeking tendency was statistically significant (F=10.305, p<.01), with a proportion of variance explained of 5.5% (R^2=.055). Specifically, the sensation-seeking tendency of the customers had a positive effect on advertising attitude (B=.254, p<.01). This indicates that the higher the sensation-seeking tendency of the customers, the higher their advertising attitude.

Second, the regression model for human similarity concerning sensation-seeking tendency was statistically significant (F=5.177, p<.05), with a proportion of variance explained of 2.8% (R^2=.028). Specifically, the sensation-seeking tendency of the customers positively affected human similarity (B=.191, p<.05). This indicates that the higher the sensation-seeking tendency of the customers, the higher their perception of human similarity.

Third, the regression model for attractiveness, including both sensation-seeking tendency and human similarity, was statistically significant (F=76.748, p<.001), with a proportion of variance explained of 46.4% (R^2=.464). Specifically, human similarity positively affected attractiveness (B=.677, p<.001). At the same time, the sensation-seeking tendency did not have a statistically significant effect (B=.012, p>.05). This indicates that the higher the perception of human similarity, the higher the perception of the attractiveness of virtual humans, but the sensation-seeking tendency does not influence attractiveness.

Finally, the regression model for advertising attitude, including sensation-seeking tendency, human similarity, and attractiveness simultaneously, was also statistically significant (F=70.022, p<.001), with a proportion of variance explained of 54.4% (R^2=.544). Specifically, sensation-seeking tendency (B=.129, p<.05), human similarity (B=.404, p<.001), and attractiveness (B=.334, p<.001) all positively affected advertising attitude. These results indicate the presence of a dual mediation effect, suggesting that higher levels of consumers' sensation-seeking tendencies lead to a higher perception of human similarity in virtual humans. This increased perception of human similarity, in turn, enhances the attractiveness of virtual humans, ultimately

resulting in more favorable advertising attitudes.

The verification of the previously mentioned findings can be expressed through the following regression equations:

M1=1.724+(.191) X

M2=1.257+.012 X+(.677) M1

Y=.294+.129 X+.404 M1+(.334) M2

Table 5: Validation Results of Dual Serial Mediation Effects

Dependent variable	Independent variable	B	S.E.	t	*p*	F/*p*	R^2
Advertising Attitude (Y)	Constant	1.799	.271	6.629	.000	10.305 (.002)	.055
	Sensation-Seeking Tendency (X)	.254	.079	3.210	.002		
Human Similarity (M1)	Constant	1.724	.289	5.969	.000	5.177 (.024)	.028
	Sensation-Seeking Tendency (X)	.191	.084	2.275	.024		
Attractiveness (M2)	Constant	1.257	.235	5.358	.000	76.748 (.000)	.464
	Sensation-Seeking Tendency (X)	.012	.063	.197	.844		
	Human Similarity (M1)	.677	.056	12.178	.000		
Advertising Attitude (Y)	Constant	.294	.224	1.315	.190	70.022 (.000)	.544
	Sensation-Seeking Tendency (X)	.129	.056	2.305	.022		
	Human Similarity (M1)	.404	.067	6.056	.000		
	Attractiveness (M2)	.334	.067	5.013	.000		

Based on these results, the statistical significance of the mediating effects was verified using Bootstrapping. According to the information presented in Table 6, the total effect fell within a 95% confidence interval of [.098 to .409]. The direct effects of sensation-seeking tendency on advertising attitudes, independently through human similarity and attractiveness, ranged from [.019 to .239], none included zero, indicating statistical significance. Furthermore, consumers' sensation-seeking tendencies sequentially mediated perceptions of human similarity and attractiveness towards virtual humans, influencing advertising attitudes through a dual serial mediating effect within a 95% confidence interval of [.011 to .086], which also did not include zero, demonstrating statistical significance. Therefore, it was confirmed that consumers' sensation-seeking tendency directly influences advertising attitudes and exerts a dual serial mediating effect through perceptions of human similarity and attractiveness towards virtual humans, impacting advertising attitudes.

Table 6: Results of Significance Testing for Mediation Effect

Path	Effect	S.E.	95% confidential interval	
			LLCI	ULCI
Total Effect (Sensation-Seeking Tendency → Advertising Attitude)	.254	.079	.098	.409
Direct Effect (Sensation-Seeking Tendency → Advertising Attitude)	.129	.056	.019	.239
Total Indirect Effect	.125	.054	.020	.235
Sensation-Seeking Tendency → Human Similarity → Advertising Attitude	.077	.035	.019	.153
Sensation-Seeking Tendency → Attractiveness → Advertising Attitude	.004	.022	-.039	.048
Sensation-Seeking Tendency → Human Similarity → Attractiveness → Advertising Attitude	.043	.019	.011	.086

CONCLUSION AND DISCUSSION

This study aimed to verify whether there is a dual mediating effect of human similarity and attractiveness of virtual humans on consumers' sensation-seeking tendency and advertising attitudes. To conduct this study, data were collected through structured surveys using Google Online Forms from adults aged 20 to 40 who had experiences with advertising and marketing using virtual humans and had a high level of awareness about virtual humans. The collected data, totaling 180 responses, were analyzed using SPSS 21.0. Additionally, Bootstrap Process Macro was utilized to verify the research hypotheses, and the findings are as follows:

Firstly, correlation analysis was examined the relationships among sensation-seeking tendency, human similarity, attractiveness, and advertising attitudes. The analysis revealed statistically significant positive correlations between sensation-seeking tendency, human similarity, and advertising attitudes. However, no

significant correlation was found between attractiveness and these variables. These results indicate that higher levels of sensation-seeking tendency correspond to higher perceptions of human similarity towards virtual humans and more positive advertising attitudes. Additionally, significant positive correlations were observed between human similarity, attractiveness, and advertising attitudes. This suggests that perceiving higher human similarity towards virtual humans enhances attractiveness perceptions and positive advertising attitudes.

Secondly, it was confirmed that consumers' sensation-seeking tendency directly influences advertising attitudes. This finding supports previous research (Cho & Youm, 2023), which shows that higher sensation-seeking tendencies lead to more positive attitudes toward advertising, underscoring the importance of consumers' trait of sensation-seeking tendency in forming positive attitudes toward advertising.

It was also confirmed that there is a dual serial mediating effect where consumers' sensation-seeking tendency sequentially mediates perceptions of human similarity and attractiveness towards virtual humans, impacting advertising attitudes. These results indicate that consumers' higher sensation-seeking tendency enhances perceptions of human similarity towards virtual humans, amplifying perceptions of attractiveness and forming positive advertising attitudes. Therefore, considering consumers' sensation-seeking tendency is crucial for fostering positive advertising attitudes towards virtual humans in advertising and marketing activities. Strategies should focus on creating virtual humans that resemble real humans as closely as possible to maximize attractiveness. Additionally, tailored strategies reflecting industry-specific characteristics, such as fashion, beauty, and travel sectors, where aesthetic and sensory appeal are prominent, could enhance the effectiveness of advertising and marketing campaigns utilizing virtual humans. Moreover, ensuring that virtual humans are intricately designed to be indistinguishable from real humans and capable of active interaction is essential to maximize the effects of advertising and marketing efforts using virtual humans, allowing both external appearance and inner appeal to manifest effectively.

The results of this study have several implications. Previous research on virtual humans has primarily focused on their characteristics and consumer responses, often examining direct effects with virtual human traits as predictive factors. However, this study expands the research area on virtual humans by considering consumers' characteristics, verifying the direct effects on advertising attitudes, and further examining the indirect effects by setting virtual human traits as mediating variables. This provides academic significance. Practically, the study offers useful insights for creating and utilizing virtual humans in advertising and marketing activities.

Despite these results and their significance, this study utilized only the variable of sensation-seeking tendency among various personal characteristics of consumers. Therefore, it can be argued that future research should expand by incorporating other variables. Additionally, data collected through online surveys using Google Forms rather than face-to-face experiments may only partially eliminate issues such as respondent bias or limitations in representativeness. Hence, it is recommended that future follow-up studies address these factors to overcome the limitations in generalizing the research findings.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Declaration of Conflicts of Interests

Authors declare that they have no conflict of interest.

Availability of data and materials

Not Applicable

Use of Artificial Intelligence

Not applicable

Declarations

Authors declare that all works are original and this manuscript has not been published in any other journal.

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