

Article

Cognitive and Affective Reactions to Virtual Facial Representations in Cosmetic Advertising: A Comparison of Idealized and Naturalistic Features

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Abstract

The rise of virtual models in the digital age presents a new frontier for cosmetic advertising. Nevertheless, the comparative effectiveness of “idealized” versus “naturalistic” facial features in these models remains a topic of debate and an area of development. This study examines the impact of “idealized” and “naturalistic” facial features in virtual models on consumers’ cognitive and affective responses. Using eye-tracking and a structural equation model, we analyzed visual attention patterns and the roles of affective resonance, trustworthiness, likability, and expertise perception. The results indicate that non-homogeneous or defective naturalistic features increase visual attention and purchase intention, with consumers focusing on imperfections such as freckles. In contrast, idealized facial features mainly draw attention to areas such as the eyes and nose. Mediation analysis reveals that likability and affective resonance are primary influences on purchase intention, while expertise perception and trustworthiness are secondary. This experiment suggests that consumers prioritize socio-emotional connections over professional authority when evaluating naturalistic designs. Our findings provide a framework for virtual model design, helping brands balance aesthetics with psychological optimization, and offer insights into the interplay between visual stimuli and human cognitive and emotional processes in decision-making.

Keywords: idealized; naturalistic; virtual model; cosmetic; emotional; eye-tracking



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1. Introduction

With the rapid advancement of digital technologies, e-commerce and advertising industries are undergoing profound structural changes. Among emerging communication mediums, virtual models and virtual spokespersons have become pivotal platforms for brands to engage and interact with consumers [1]. Virtual models are typically defined as digital characters generated through computer technology in virtual environments [2,3], with one of their notable features being their anthropomorphic appearance [4]. A representative example is Shudu Gram, the world’s first “digital supermodel,” developed by photographer Cameron-James Wilson using CGI technology. She has been featured in campaigns for prominent beauty brands such as Fenty Beauty and Balmain. Compared

to traditional human models, virtual models offer advantages such as lower costs, greater controllability, and broader adaptability—which have led to widespread adoption in brand marketing practices [4].

Currently, Asia has emerged as one of the key purchasing power regions in the global cosmetics market. East Asian countries such as China and South Korea have become the world's second-largest cosmetics market [5] and East Asian consumers are now a key segment within the global cosmetics industry. Although the use of virtual models has become increasingly widespread, both academic and industrial communities continue to debate how the design of their facial features influences consumer psychology and behavior. Proponents of idealized aesthetics argue that symmetrical, refined, and nearly flawless facial features are more visually appealing [6], capable of creating a positive brand image and capturing consumer attention [7]. In contrast, some research has highlighted that overly idealized virtual faces may evoke the “Uncanny Valley Effect” [8], leading to feelings of psychological discomfort and rejection among consumers. Furthermore, some scholars suggest that overemphasizing “idealized beauty” elements in visual communication can result in aesthetic fatigue, thereby reducing consumers' interest and engagement with brand content [9].

To avoid the aforementioned negative impacts in the field of virtual models, it is necessary to incorporate elements related to interactivity and authenticity into the design [4]. Within the naturalistic paradigm, “flaw retention” design (e.g., freckles, moles, subtle asymmetries) has been shown to effectively attract consumers, a practice that deviates to some extent from idealized aesthetic norms [10]. For instance, Rozy—a highly influential virtual influencer in East Asian markets—features freckles strategically placed on the bridge of the nose and cheekbones, along with subtly textured pores. This “naturalistic” detailing subverts Korea's traditional “flawless fair skin” aesthetic standards. Within just six months, she has driven sales for over a dozen brands, including Shinhan Life and Coca-Cola, generating commercial value exceeding 10 billion won.

Although research on virtual models has increased in recent years, the existing literature primarily focuses on exploring their direct impact on consumer attitudes and brand perception [11]. For example, Gao et al. (2023) [12] employed structural equation modeling to examine how three avatar characteristics influence consumers' social presence, telepresence, and purchase intent. However, relatively few studies have systematically compared the differences between idealized and naturalistic facial features in virtual models in terms of their influence on consumers' emotional perception and purchase intent. In particular, there is a lack of empirical analysis based on refined measurements regarding consumers' visual attraction patterns and emotional cognition when faced with different types of virtual models.

Based on the aforementioned research background, this study focuses on static advertising scenarios in cosmetics product marketing in East Asian markets, employs a comparative research design, and systematically analyzes the differentiated influence mechanisms of idealized and naturalistic designs of virtual model facial features on consumers' emotional cognition and purchase intentions. Methodologically, this study employs a dual-measurement approach that integrates eye-tracking with emotional cognition analysis. Four core eye-tracking metrics—total fixation duration, average number of fixation points, average pupil size, and first fixation duration [13]—are used to uncover visual processing differences between idealized and naturalistic faces. Heatmap distribution analysis reveals that visual attention toward idealized faces is primarily concentrated on the eye and nose regions, whereas attention toward naturalistic faces tends to focus on specific imperfections such as freckles and moles.

Given the aforementioned research gaps, this study contributes in three key areas: Theoretically, by integrating dual-channel data from eye-tracking (physiological measurement) and purchase intention (survey measurement), it reveals the detailed cognitive processes consumers employ when processing facial features of virtual cosmetic models. Crucially, it finds that attention allocation in idealized faces shifts away from the skin—contrary to conventional assumptions—toward structural features, such as the nose. Methodologically, this study constructs and validates a multiple mediation model encompassing affective resonance, trustworthiness, likability, and expertise perception, clearly elucidating the underlying psychological mechanisms through which facial features influence purchase intention. Practically, this research focuses on the East Asian cosmetic market—a significant yet understudied context. Findings indicate that “likability” serves as the core mediating variable driving East Asian consumers’ purchasing decisions, providing direct and concrete empirical evidence for brands to optimize virtual model design and formulate effective marketing communication strategies within this market.

2. Literature Review

2.1. Marketing Applications of Virtual Models and Controversies in Facial Feature Design

Against the backdrop of integration between intelligence and globalization, the rise in digital humans and avatars has become an important trend in contemporary brand communication and marketing. An increasing number of brands are actively incorporating virtual models into their digital transformation processes to achieve innovative expressions of product display and sales [14]. Leveraging high-quality visual presentation technologies, virtual models can showcase highly realistic physical features, effectively stimulating consumers’ novel perceptions and immersive experiences [15]. As a medium for conveying brand value, virtual models can shape brand image perception and optimize consumers’ emotional attitudes toward products/services by comprehensively presenting personality traits, cultural symbols, and value concepts [16,17]. In the context of brand digital transformation, virtual models are becoming increasingly key marketing tools, particularly for precisely targeting young consumer groups, such as Generation Z, and expanding the boundaries of brand creative expression. Compared to real models, virtual avatars offer significant advantages in terms of controllability, risk mitigation, and cross-cultural adaptability [18], with facial feature design being particularly critical. As the first visual touchpoint, facial design directly influences consumers’ attention allocation, emotional responses, and cognitive evaluations.

Existing research has extensively explored the uniqueness and value of virtual avatars in consumer interactions [19,20] and highlighted their potential in attracting attention and stimulating engagement behaviors [21,22]. However, there remains academic disagreement regarding the optimal approach for refining facial aesthetic standards for virtual models. Idealized aesthetics emphasize the attractiveness effects of symmetry and averageness [23], arguing that perfected facial designs align with societal stereotypes of “ideal beauty” [24], thereby enhancing perceived attractiveness. Furthermore, an increasing number of studies have highlighted that overemphasizing “perfection” in visual communication can lead to aesthetic fatigue, thereby weakening emotional engagement and brand connection [9]. Lai and Perminiene [10] found that younger consumers are increasingly accepting “imperfections” in naturalism, which not only reflects a critique of appearance norms but also signifies the emergence of diverse aesthetic values. Compared to “idealized” faces, facial features traditionally deemed “unattractive” may instead attract more attention due to their emphasis on uniqueness, distinctiveness, and authenticity [25,26]. Additionally, the “Uncanny Valley Theory” highlights the potential risks associated with idealized virtual faces: when facial realism exceeds a certain threshold, it may trigger psychological rejection,

emotional detachment, or even a decline in trust among consumers [8]. Wu et al. (2024) [27] found that when the facial realism of virtual hosts was too high but not entirely realistic, viewers perceived a decrease in their approachability and experienced emotions such as suspicion, disappointment, surprise, fear, and boredom. Schwind et al. (2018) [28] noted that idealized virtual models should combine natural, healthy skin tones, clear gender identification cues, realistic facial proportions, and a vibrant lip color. In specific contexts, moderately incorporating “naturalistic” elements such as freckles may enhance the media impact and emotional authenticity of virtual models [27].

In summary, the design of virtual models’ facial features needs to strike a balance between “realism” and “attractiveness,” particularly in visually intensive contexts such as cosmetics advertising. Virtual models must not only effectively showcase the beautifying effects of products but also avoid negative perceptions caused by excessive beautification or realism, which could affect brand image and consumer behavior and decision-making.

Current research on virtual models primarily employs qualitative methods such as interviews and focus groups, or single-source data analyses (e.g., social media sentiment analysis) to explore consumer attitudes toward variables such as aesthetics and approachability. While these methods effectively capture explicit attitudinal feedback, they are limited in assessing consumers’ automatic processing of visual information at the preconscious stage, potentially overlooking underlying “cognitive–attention” biases. Notably, comparative studies of “idealized” and “naturalistic” facial presentations have lacked empirical support based on objective physiological indicators, resulting in a one-sided perception of their actual marketing effectiveness.

2.2. The Value of Visual Attention Mechanisms in Marketing Research

In the context of digital marketing, consumers’ visual attention mechanisms are recognized as key psychological processes that influence their information processing and decision-making behavior. Visual attention not only determines which objects consumers prioritize amid vast amounts of information but also directly affects their perception and memory of product attributes, brand information, and advertising content, thereby shaping their final purchasing decisions [29]. With the continuous advancement of eye-tracking technology, researchers can now objectively identify consumers’ visual attention patterns, cognitive preferences, and emotional tendencies by recording and analyzing gaze trajectories in real time [30]. This technology demonstrates high sensitivity and empirical validity in revealing the mechanisms by which visual elements influence attention allocation and behavioral intentions [31].

Existing research indicates that eye-tracking core metrics such as total fixation duration, average number of fixation points, first fixation duration, and average pupil size effectively reflect the degree to which advertising or product design elements capture consumer attention [32]. Heatmaps provide a means for visually representing the distribution of visual focus, facilitating in the identification of areas with high attentional engagement [33]. For instance, Barbosa et al. (2021) [34] used eye-tracking technology to assess consumers’ attention levels toward convenience food packaging design, thereby optimizing packaging design. Ozturk et al. (2023) [35] quantified eye movement metrics to analyze the impact of bottle shape and label position on visual attention, revealing the significant role of shape and position factors in product design. Mikalef et al. (2023) [36] further expanded understanding of consumer behavior in digital contexts by leveraging dynamic attention theory to mine eye-tracking data and identify key factors influencing visual attraction and attention allocation during online shopping.

Although eye-tracking technology has been extensively applied in areas such as webpage layout optimization, advertising visual design, and product packaging evaluation,

its application in virtual images, particularly in designing facial features for virtual models, remains at an exploratory stage. Incorporating eye-tracking methods into the research of virtual model facial visual design can help reveal consumers' actual attention patterns and distribution of attention across different facial features at a subconscious level. Moreover, combining these insights with emotional cognition indicators offers a more comprehensive understanding of the interaction mechanisms between visual processing and emotional responses, thereby providing a theoretical foundation and empirical support for the design of virtual model facial features.

2.3. Mediating Pathways of Affective Cognition

The cognitive processing of virtual models by consumers involves complex mechanisms encompassing the interaction of multiple psychological constructs. The image characteristics of virtual models, such as credibility, professionalism, cuteness, reliability and relevance, have been demonstrated to significantly influence consumers' brand attitudes and purchase intentions [16,37]. These characteristics not only serve as critical dimensions in brand image formation but also play a significant moderating role in consumers' emotional responses and purchasing behavior. Existing research has extensively explored the mediating role of emotional cognition in consumer decision-making. For example, Mackenzie et al. (1986) [38] analyzed four structural equation models, demonstrating that emotions elicited by advertisements (e.g., happiness and touching moments) transfer to brand attitudes and purchase intentions, establishing emotions as a key mediating variable in advertising effectiveness. Holbrook et al. (1987) [39] developed an advertising emotional response scale that validated the partial mediating role of emotions, such as pleasure, arousal, and dominance, in advertising effectiveness. Furthermore, Holbrook (2001) [40] found that brand trust (cognitive) and brand emotions such as attachment jointly mediate the influence of brand equity on consumer loyalty.

At the affective cognition level, affective resonance is regarded as a crucial mechanism through which consumers establish deep emotional connections with brands, and effectively enhance brand belonging and loyalty, thereby strengthening purchase intention [41]. The Emotion Reactivity Scale, proposed by Nock et al. (2008) [42], has been widely used in emotion measurement experiments. Roobina Ohanian (1990) [43] introduced the concept of source credibility, whose core dimensions include expertise, trustworthiness, and attractiveness, and validated its significant influence on audience attitudes and behaviors. Among these, trustworthiness and expertise perception, as the core dimensions of source credibility, are widely used to explain consumers' acceptance of information sources and the establishment of beliefs about product efficacy. In addition, the likability of virtual models contributes to enhancing social closeness with consumers, positively influencing brand attitude and purchase intention [44]. Notably, some studies have indicated that, compared with highly idealized facial images, moderately retaining imperfections can enhance the transmission of "authenticity" signals, thereby increasing consumer trustworthiness and emotional investment [45] and triggering stronger psychological identification.

Although existing research has preliminarily identified mechanisms by which virtual model characteristics influence consumer emotional cognition and behavioral responses from multiple dimensions, most studies tend to explain these effects through single pathways (i.e., focusing solely on trust or emotional attitudes), thereby overlooking the parallelism and synergistic effects of multiple psychological constructs in cognitive processing. In summary, virtual models, as critical touchpoints within the digital marketing ecosystem, have become an essential bridge connecting brands and consumers. Nevertheless, there remains significant scope for further investigation into how facial features jointly influence consumer purchase intentions through both visual and emotional mechanisms.

This paper constructs a “visual–emotional” dual-channel analysis framework, focusing on the distinct effects of “idealized” and “naturalistic” faces of virtual models on consumer emotional cognition and purchase intentions in the context of cosmetic products. The study employs eye-tracking experiments combined with structural equation modeling to analyze the patterns of visual attention, as reflected in total fixation duration, average number of fixation points, average pupil size, first fixation duration, and heatmap distribution, starting from the visual processing characteristics of the pre-attention stage. It also integrates four emotional variables—affective resonance, trustworthiness, likability, and expertise perception—to construct a multi-path mediation model that breaks through the limitations of traditional single-path explanations. This study not only expands the theoretical boundaries of virtual model research but also offers empirical support and practical guidance for the visual design and formulation of marketing strategies for brand virtual images.

3. Hypothesis Development

3.1. Consumers’ Visual Attention Preferences Toward Virtual Models with Distinct Facial Features

Under the influence of social media and digital communication, people have gradually formed relatively stable aesthetic definitions and aesthetic standards [46]. In marketing contexts, aesthetically pleasing designs can evoke positive emotional responses [47], thereby attracting and satisfying consumers [48]. Traditional aesthetic theories emphasize the visual appeal of symmetry and perfection [6]. However, with growing consumer awareness of authenticity and diversity, the visual expression of a single “idealized beauty” has gradually revealed its limitations. Studies have shown that overly idealized visual presentations may conflict with individuals’ psychological expectations of authenticity, thereby triggering cognitive conflicts and emotional resistance [49].

With respect to idealized aesthetic standards, Yang et al. (2023) [50] noted that idealized perfect skin is typically depicted as youthful, smooth, fair, and devoid of visible imperfections. Conversely, “imperfect” naturalistic facial features such as blemishes refer to slight deviations from aesthetic standards, including mild facial asymmetry [51], as well as birthmarks, freckles, and moles [52,53]. Therefore, based on the existing literature in this field, this paper defines “idealized” virtual models as having highly symmetrical faces, smooth and even skin texture, and no obvious textural imperfections. “Naturalistic” faces, by contrast, are defined as having slight asymmetry and visible facial texture features, including freckles and moles.

According to the theory of visual salience [54], variations in the physical attributes of facial features drive differential attention allocation. Moreover, consumers are more sensitive to novel or atypical stimuli during the early stages of visual processing [55]. Idealized facial features serve as aesthetic focal points in visual processing due to their symmetry and skin homogeneity [50,56], directing visual attention to areas such as the eyes and skin [57,58]. In contrast, naturalistic facial features such as freckles, moles, or slight asymmetry, break conventional aesthetic expectations and can effectively attract attention, stimulating motivation to explore, which in turn results in longer fixation durations and higher gaze frequencies [59].

Therefore, this study proposes the following hypotheses:

H1. *Idealized facial virtual models are more likely to evoke consumers’ emotional arousal (manifested as larger pupil size). In contrast, naturalistic facial virtual models are more likely to evoke higher levels of visual attention (manifested as longer total fixation duration and greater fixation points).*

H2. *Idealized virtual models mainly attract consumers' attention to the eye and skin areas, while naturalistic virtual models mainly attract consumers' attention to facial imperfections (such as freckles and moles).*

3.2. The Impact of Virtual Models' Facial Features on Purchase Intention

Previous studies have demonstrated that the type of models used in advertisements can influence consumers' emotional states (such as pleasure and excitement), thereby regulating their purchasing intentions [60]. The facial visual characteristics of virtual models, such as symmetry and skin texture, are not only physical variables affecting aesthetic perception but may also exert a significant influence on consumers' attitudes and behavioral intentions at both emotional and cognitive levels.

Although Yang et al. (2022) [7] noted that idealized faces are more likely to fulfill consumers' aesthetic expectations and thereby positively drive purchasing behavior, other studies have pointed out that overly idealized designs may lead to aesthetic fatigue [9] and in some cases, even cause some consumers to be dissatisfied with their body image and feel depressed [61]. The functional appeal of cosmetic products necessitates advertising imagery that conveys realistic and credible usage outcomes [47]. In this context, naturalistic faces are considered more appealing [62], as they help reduce psychological distance [63] and enhance the perception of authenticity [64], aligning more closely with consumers' expectations of the product's actual effectiveness, thereby increasing trust and willingness to purchase. Based on this, we propose the following hypothesis:

H3. *Compared to idealized virtual models, naturalistic virtual models will elicit a higher willingness to purchase among consumers.*

3.3. Mediating Effects of Affective Resonance, Trustworthiness, Likability, and Expertise Perception

The ABC Model of Attitudes decomposes consumer attitudes into three components: affect, behavioral intention, and cognition, which together form the core foundation of consumer attitude formation [65]. The affect dimension reflects an individual's emotional experience in response to a specific stimulus [66]. Behavioral intention refers to the tendency to act toward a particular object, while the cognition dimension involves subjective evaluations during the process of information acquisition and interpretation [66]. Previous studies have widely applied the ABC model to research on online consumption and advertising effectiveness. For example, Eroglu et al. (2001) [60] found that the type of model used in an advertisement influences feelings of pleasure and excitement, which in turn affect purchasing behavior. Seymour et al. (2020) [67] further noted a significant relationship between the visual appearance of virtual characters and consumers' emotional attitudes, such as preference, trust, and identification, arguing that imperfect faces may enhance affective resonance by conveying a signal of "authenticity". However, the core constructs of this model exhibit both universality and potential variations in effect weights across cultural contexts. As underlying psychological mechanisms of human decision-making, the validity of affect and cognition possesses a cross-cultural foundation [68]. For instance, collectivist cultures (e.g., East Asia) place greater emphasis on group harmony and relationship building. Consequently, we hypothesize that the affective resonance and likability pathways may exert a more dominant influence in our study sample. Conversely, individualist cultures (e.g., Western societies) prioritize individual capability and assertiveness. Thus, the expertise perception and trustworthiness pathways may carry relatively greater weight in their decision-making processes [69].

Building on this foundation, the present study introduces four key psychological mechanisms to explore the potential pathways through which the facial features of virtual models influence consumer purchase intentions: (1) affective resonance: activating con-

sumers' affective arousal and promoting emotional connections between consumers and virtual models [22]; (2) trustworthiness: enhancing positive evaluations of products and brands through perceptions of authenticity, including overall valuation and purchase attitudes [70]; (3) likability: shortening the social psychological distance between consumers and brands/products, enhancing brand identity [71]; (4) expertise perception: enhancing consumers' beliefs and evaluations of product efficacy [72].

Accordingly, we propose the following hypotheses:

H4. *Affective resonance, trustworthiness, likability, and expertise perception mediate the role of virtual model facial features in influencing purchase intention.*

H4a. *Different facial features of virtual models will directly affect consumers' purchase intention.*

H4b. *Affective resonance, trustworthiness, likability, and expertise perception play a mediating role between virtual model facial features and purchase intention.*

4. Experimental Process and Data Analysis

4.1. Eye-Tracking Experiment (Experiment 1)

Experiment 1 aimed to use eye-tracking technology to explore the differences in consumers' visual processing mechanisms between idealized and naturalistic facial features of virtual models for cosmetic products, and to further analyze the impact on consumer purchasing decisions through a questionnaire.

4.1.1. Materials and Study Design

To ensure the external validity of the materials, the research team invited three experts with over ten years of experience in the fashion industry to evaluate stimuli for realism and representativeness, ultimately selecting four model pairs for the final experiment. To ensure the scientific and representative nature of the experimental sample materials in the eye-tracking experiment, the researchers first selected the top ten best-selling cosmetic products on the four major e-commerce platforms (Amazon, Alibaba, Taobao, and JD.com) and collected 40 standardized model display images from them as a reference for visual style and presentation standards. Based on this, six sets of virtual model images (six idealized faces and six naturalistic faces) were designed and generated using the AI image generation tool Midjourney. The only difference between the two types of images was in the treatment of facial features. These "idealized faces" of virtual models were uniformly presented as having smooth skin, no visible imperfections, and high facial symmetry, while the "naturalistic faces" were presented as having clear skin texture, slight freckles or moles on the face, and slight asymmetry between the left and right eyes. Except for the differences in facial processing, all other details (such as hairstyle, products, and background) were consistent.

Considering that the realism of the images may affect the eye-tracking results, 15 independent subjects (53.33% female; Mage = 25.4) were invited before the experiment to compare and rate the Midjourney images with proportionally equivalent materials generated by three industry-standard virtual models (Zepeto, Ready Player Me, and Daz3D) (1 = extremely unrealistic, 7 = extremely realistic). The results showed that there was no significant difference in the realism ratings between the two types of materials ($p > 0.05$). Finally, after screening by three fashion industry experts, four sets of the most representative stimuli were selected for the formal experiment. The experiment used a 2 (face type: idealized vs. naturalistic) $\times$ 4 (product group) mixed design. A total of 102 participants from different countries and occupations (68.62% female; Mage = 32.12) were recruited for

this experiment. No subjects were color blind or color deficient, with myopia of less than 800 degrees.

Eye movement data were collected using the EyeLink 1000 Plus eye-tracking system (SR Research, Mississauga, ON, Canada) at a sampling frequency of 1000 Hz. The stimulus materials were edited using E-Prime Professional 3.0 software and presented on the 23-inch AcelGR235H LCD with a screen resolution of 1920×1080 pixels (Taipei City, China) purchased in Guangzhou City. 21-inch LCD monitor During the experiment, the latest version of the Data Viewer software (SR Research, Mississauga, ON, Canada) was used to identify and analyze eye movement trajectories and indicators within the AOI area, ensuring the accuracy and scientific validity of the data.

4.1.2. Procedure of Eye-Tracking Experiment

After signing the informed consent form, participants underwent approximately 10 min of scenario-based training to familiarize themselves with the experimental tasks and establish a realistic perception of the e-commerce shopping environment. Participants sat in the test position with their chins placed on a fixed chin rest. Researchers adjusted the height of the chin rest according to the participants' height to ensure that their gaze was naturally aligned with the center of the screen. To ensure the accuracy of the eye-tracking data, all participants completed a 9-point calibration procedure before the formal experiment, with gaze errors controlled within 0.5° .

Each round of the experiment began with a central fixation symbol “+” that lasted for 5 s, followed by the presentation of images of virtual models, which lasted for 10 s. After each set of stimuli was presented, participants were asked to rate the idealized and naturalistic virtual models on a 7-point Likert scale (1 = “highly dislike”, 7 = “highly like”). Participants then chose the virtual model they were more willing to purchase from the two types of virtual models in the group. The above process was repeated for four groups of different stimulus images, and the order of stimulus presentation was randomized to control for order effects. Figure 1 shows the schematic flow of the eye-tracking experiment.

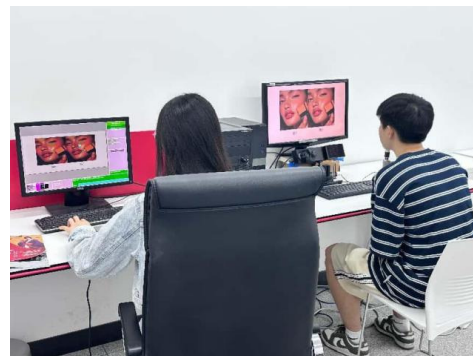


Figure 1. Eye-tracking experiment set-up.

4.1.3. Determination of the Area of Interest

In the eye-tracking experiment, areas of interest (AOIs) were defined by the researchers based on the visual attention analysis paradigm to analyze the distribution of gaze and attention tendencies of subjects in key areas [73]. Specifically, the study identified two different AOIs based on H1 and H2 for sequential analysis.

First, for H1, based on the different facial features in the four sets of virtual model display images, the idealized face (R1) and the naturalistic face (R2) were divided into two independent AOIs (see Figure 2) to compare the overall visual attention differences between different face types.

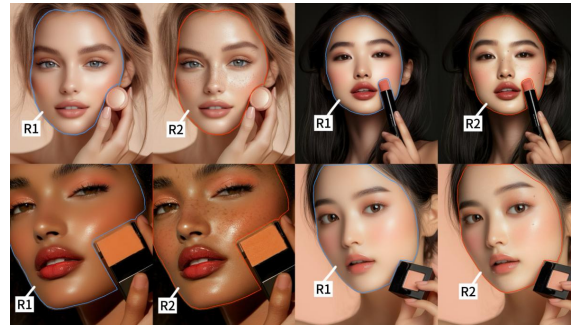


Figure 2. AOI division for comparison of different facial features.

For H2, four AOIs were divided separately in the idealized face (R1): eyes (A1), nose (A2), mouth (A3), and skin (A4). Four corresponding AOIs were also divided in the naturalistic face (R2): eyes (A1'), nose (A2'), mouth (A3'), and flaw (A4'). The AOIs in both types of faces are consistently positioned, sized, and shaped, as shown in Figure 3. The definitions of A4 and A4' are based on heatmap analysis generated by overlaying the fixation points of 102 participants in the experiment (Figure 4). To ensure the ecological validity and objectivity of AOI delineation, we selected only the regions with the highest gaze density on both sides of the midface. These regions were designated as the idealized facial skin AOI (A4) and the naturalistic facial flaw AOI (A4') in the formal analysis. This area typically spans from the cheekbones to the apple of the cheek, serving as the core application zone for cosmetic products (e.g., blush, highlighter) while also being the most prominent region for skin texture (e.g., pores, redness) and imperfections (e.g., freckles). A4 and A4' are physically identical, enabling direct comparison of gaze metrics between the idealized facial skin and the naturalistic facial flaw. This approach focuses on areas that genuinely capture consumer attention, effectively avoiding overestimation of gaze toward non-target background regions due to overly large AOIs. Consequently, interference from non-target areas in the results is minimized.

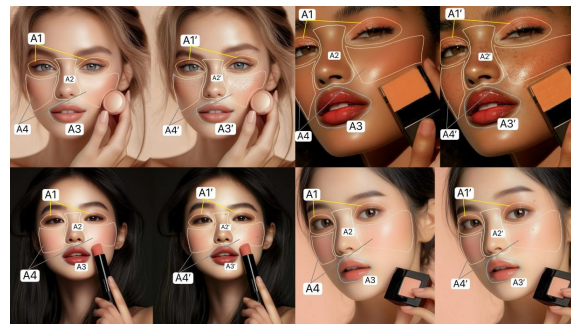


Figure 3. AOI division for comparison within the same face.

Four core eye movement indicators were selected as the basis for evaluation in the eye-tracking experiment: (1) Total fixation duration, which measures the degree of attention concentration of participants within a specific AOI. The longer the fixation time, the more attractive and attention-grabbing the area is [59]. (2) Average number of fixation points, reflecting participants' interest levels within the AOI. The more fixation points there are, the higher the attractiveness and information exploration value of the region [31]. (3) Average pupil size, which reflects participants' emotional arousal in response to stimuli [74]. (4) First fixation duration, which reflects the extent to which the AOI attracts participants' attention. A longer first fixation duration indicates that the AOI is more attractive to participants [73].



Figure 4. Heatmaps of four sets of virtual model images. (A redder color indicates a more attractive region).

4.1.4. Result 1

A paired-sample *t*-test was used to analyze differences in eye movement signals of the AOI between the two different facial categories. All data were analyzed using SPSS v.27 (IBM Inc., Armonk, NY, USA). Differences were expressed as *p*-values, with statistical significance thresholds set at $p < 0.05$ and $p < 0.01$, marked as “*” and “***”, respectively. Table 1 shows that the total fixation duration of the AOI in the two different facial categories [$t(407) = -7.69, p < 0.001$], the average number of fixation points [$t(407) = -7.10, p < 0.001$], and average pupil size [$t(407) = 20.11, p < 0.001$]. In terms of total fixation duration, the naturalistic face AOI (R2) (4031.49 ± 1187.41) ($p < 0.001$) was significantly higher than the idealized face AOI (R1) (3032.64 ± 1018.67) ($p < 0.001$). In terms of the average number of fixation points, R2 (14.98 ± 4.55) ($p < 0.001$) was significantly higher than R1 (11.67 ± 4.03) ($p < 0.001$). In terms of average pupil size, R1 (1345.54 ± 338.04) ($p < 0.001$) was significantly higher than R2 (1196.25 ± 326.08) ($p < 0.001$). The results show that the naturalistic face (R2) received more attention than the idealized face (R1), but the idealized face (R1) was more likely to evoke emotional arousal in participants.

Table 1. *t*-test results of eye-tracking experiment data for different facial features. (“***” represent $p < 0.01$).

	Idealized Faces	Naturalistic Faces	<i>t</i>	<i>df</i>	<i>p</i>
Total Fixation Duration (ms)	3032.64 ± 1018.67	4031.49 ± 1187.41	-7.69	407	0.000 **
Average of Number of Fixation Points	11.67 ± 4.03	14.98 ± 4.55	-7.10	407	0.000 **
Average Pupil Size (μm)	1345.54 ± 338.04	1196.25 ± 326.08	20.11	407	0.000 **

4.1.5. Result 2

Single-factor analysis of variance (ANOVA) was used to analyze the differences in eye movement data between the eyes, nose, mouth, and skin in the same face, and Bonferroni multiple comparisons were used for correction. The *p*-values “*” and “***” have the same meaning as in Result 1. Table 2 shows the one-way ANOVA results for AOIs in idealized and naturalistic faces. The total fixation duration of four AOIs (A1, A2, A3, A4) in idealized faces, the total fixation duration [$F = 125.93, p < 0.001$], the average number of fixation points [$F = 160.54, p < 0.001$], and the first fixation duration [$F = 14.61, p < 0.001$] were significantly different. There were also significant differences among the total fixation duration [$F = 38.91, p < 0.001$], the average number of fixation points [$F = 39.09, p < 0.001$], and the first fixation duration [$F = 19.32, p < 0.001$] of the four AOIs (A1', A2', A3', A4') in the naturalistic faces.

Table 2. One-way ANOVA of AOIs in idealized faces and naturalistic faces. (“***” represent $p < 0.01$).

		Total Fixation Duration (ms)	Average of Number of Fixation Points	First Fixation Duration (ms)
Idealized	<i>F</i>	125.93	160.54	14.61
	<i>p</i>	0.000 **	0.000 **	0.000 **
Naturalistic	<i>F</i>	38.91	39.09	19.32
	<i>p</i>	0.000 **	0.000 **	0.000 **

Figure 5A,B shows the effects of different AOIs on participants’ total fixation duration and average number of fixation points in the idealized face. Participants spent the longest total fixation duration on the nose (A2) in the idealized face and had the highest number of fixation points, showing significant differences compared to other AOIs. Figure 5C shows the effects of different AOIs on participants’ first fixation duration in the idealized face. The data in the figure indicate that the first fixation duration for the nose (A2) and eyes (A1) was significantly longer than that for the mouth (A3) and skin (A4), with the nose (A2) having the most extended first fixation duration.

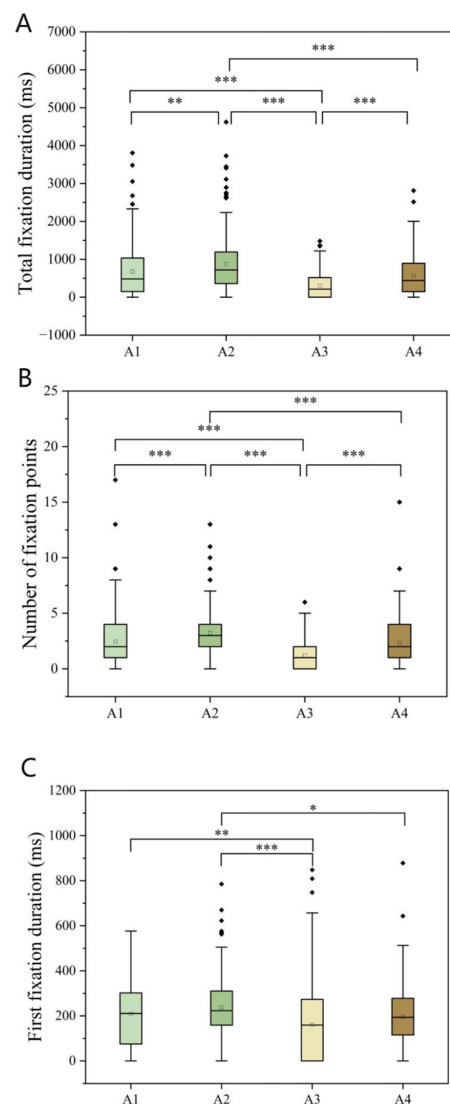


Figure 5. The effect of different AOIs in idealized faces on the eye movements of participants. (A) Total fixation duration. (B) The average number of fixation points. (C) First fixation duration. (“*”, “***” and “****” respectively represent $p < 0.05$, $p < 0.01$ and $p < 0.001$).

Figure 6A, Figure 6B, and Figure 6C shows the effects of different AOIs in naturalistic faces on the total fixation duration, the average number of fixation points, and the first fixation duration of participants, respectively. From the three types of eye movement indicators, flaw (A4') had the most significant effect on participants, while the mouth (A3') had the least effect. In terms of total fixation duration, the flaw (A4') had the longest duration and showed significant differences compared to the other three AOIs. Regarding average fixation points and first fixation duration, the nose (A2') had the second-greatest impact on participants after the flaw (A4').

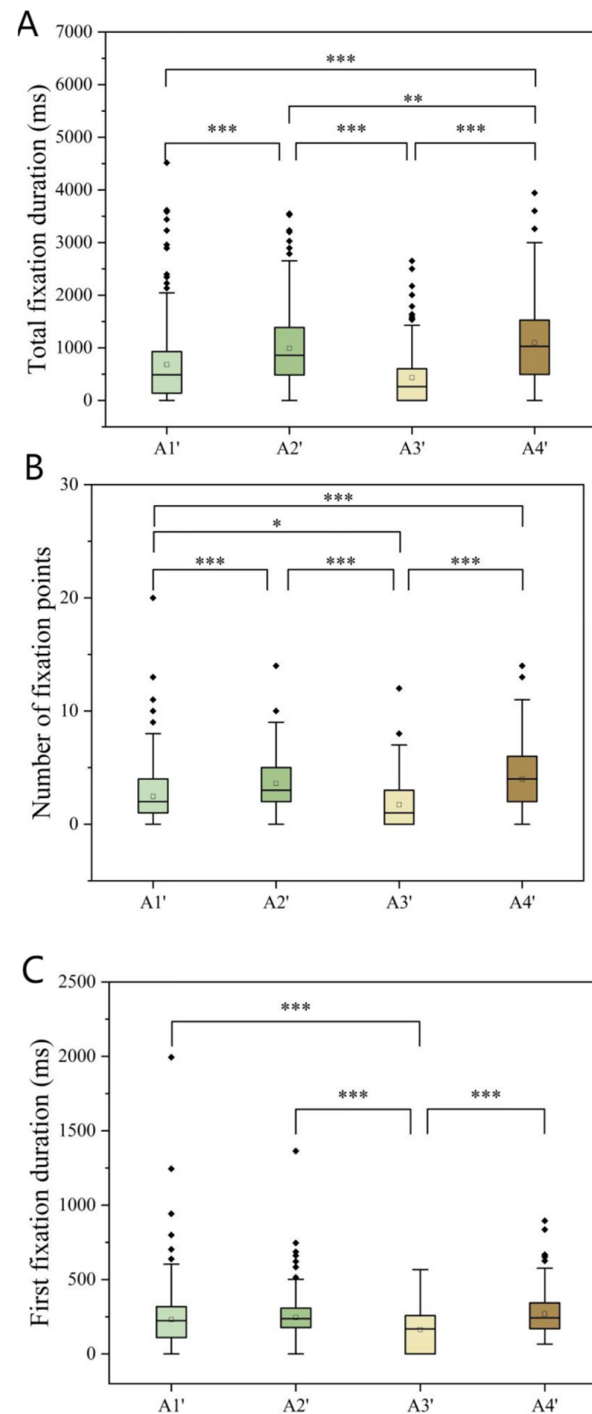


Figure 6. The effect of different AOIs in naturalistic faces on the eye movements of participants. (A) Total fixation duration. (B) The average number of fixation points. (C) First fixation duration. (“*”, “**” and “***” respectively represent $p < 0.05$, $p < 0.01$ and $p < 0.001$).

4.1.6. Result 3

Table 3 presents the results of the paired *t*-test comparing the participants' subjective scores. The participants' willingness to purchase virtual model images with naturalistic faces was significantly higher than that with idealized faces [$t(407) = 4.01, p < 0.001$]. In the forced-choice task, the binomial test results verified that more than half of the participants' decision preferences were toward naturalistic faces ($p < 0.001$).

Table 3. Paired *t*-test results of the participants' subjective scores.

	Idealized Faces	Naturalistic Faces	<i>t</i>	<i>df</i>	<i>p</i>
Purchase Intention	4.11 ± 1.61	4.80 ± 1.46	4.01	407	<0.001

4.1.7. Discussion of Eye-Tracking Experiment

The eye-tracking data obtained from the experiment indicated that virtual models with naturalistic faces significantly outperformed those with idealized faces in terms of two key metrics: total fixation duration and average number of fixation points. Prior studies have demonstrated that these indicators are positively correlated with viewer preference: objects that are observed for longer periods and receive more fixation points are generally considered more visually attractive [75,76]. This suggests that unconventional facial features, such as freckles and moles, can trigger greater cognitive engagement among viewers, thereby confirming the prediction in H1 that naturalistic faces enhance visual attention. In terms of average pupil size, participants exhibited significantly larger pupils when viewing idealized faces compared to naturalistic ones. According to previous studies, pupil size reflects the degree of emotional arousal elicited by stimuli [74], with larger pupils typically indicating stronger emotional arousal and a heightened sense of pleasure [77]. This result shows that idealized faces are more likely to elicit positive emotional responses because they meet people's expectations of ideal beauty, thus supporting H1's prediction that idealized faces enhance emotional arousal.

However, the eye-tracking results partially support and partially contradict H2. H2 predicts that virtual models with idealized faces will attract more attention to the "eye and skin areas." The empirical findings supported the prediction regarding the eye area, as participants exhibited significantly greater fixation on the eyes of idealized models. However, contrary to expectations, the fixation on the skin area was not as prominent. Instead, viewers' attention was heavily concentrated on the nose area, which—along with the eyes—became the primary visual focus.

The study offers the following explanation for this unexpected outcome (i.e., that the nose, rather than the skin, is the key area of attention). As the central structure along the facial midline, the nose is typically given greater symmetry and structural accuracy in idealized modeling [56]. This high degree of symmetry and morphological optimization may significantly enhance the visual prominence and attractiveness of the nose, giving it a more important position than expected in the overall facial assessment. Although the skin of idealized faces (such as high homogenization, removal of pores and blemishes) enhances the overall "sense of perfection," it may also inadvertently reduce the visual contrast and texture information of local areas. As a result, the skin may appear relatively "flat" or "featureless", thereby diminishing its capacity to serve as an independent focal point of attention. In contrast, facial features with more defined structural characteristics—such as the eyes and nose—may become more visually compelling. These findings suggest that in actual visual perception processes, facial attractiveness is not solely driven by the eyes and skin; other facial features, such as the nose, may also play important roles in directing consumer attention.

In addition, participants' preferences in subjective ratings and mandatory purchase choices were also more inclined toward naturalistic faces, further supporting H3, that naturalistic virtual models are more likely to increase consumers' purchase intentions than idealized ones. These findings suggest that naturalistic facial designs enhance attention engagement and play a more direct role in driving consumer decision-making.

In summary, the experimental results demonstrate that the advantage of idealized treatment of virtual models' faces in cosmetic advertisements has shifted from skin texture to structural features (nose and eyes). In contrast, naturalistic facial treatment achieves purchase conversion through the path of "attention capture → cognitive engagement → preference formation" (H1 → H3), offering physiological evidence in support of the "imperfect marketing" strategy. Accordingly, the development of virtual models needs to balance "emotional arousal" (idealized advantage) and "cognitive immersion" (naturalistic advantage), and differentiate facial features based on product positioning (e.g., luxury goods emphasize emotion/functional goods emphasize authenticity).

4.2. Mediating Effects of Affective Cognition (Experiment 2)

4.2.1. Objectives

This experiment aims to systematically explore the effect of virtual model facial feature processing (idealized vs. naturalistic) on consumers' willingness to purchase cosmetic products using a multiple parallel mediation model. The study focuses on verifying the mediating role of four psychological variables—namely, affective resonance, trustworthiness, likability, and expertise perception—in this influence mechanism.

The experiment employed a single-factor within-subject design, with the independent variable being the type of facial feature processing of virtual models (idealized vs. naturalistic), the dependent variable being consumer purchase intention, and the four mediating variables being affective resonance, trustworthiness, likability, and expertise perception. Data were collected through an online questionnaire, and a structural equation model was constructed using AMOS 26.0 software to verify the parallel path effects of the mediating variables.

The experimental stimulus materials used the virtual model images verified by experts in Experiment 1, including four idealized and four naturalistic types, for a total of eight images. An online experimental system was constructed using the Questionnaire Star platform. Attention check items and response time threshold control (<2 SD) were embedded in the questionnaire to ensure data quality.

A total of 1025 valid samples were obtained. The study sample primarily consisted of East Asian consumers (85.3% from China, 9.7% from Japan and South Korea), with a small number of Western participants (5.0% from Europe and the United States). An amount of 88.65% of the participants said they had been exposed to virtual image advertising. The sample was mainly concentrated in the 18–30 age group of young women (53.89%) and the 31–45 age group (44.83%), which is consistent with the characteristics of the target consumer group for cosmetic products. After data cleaning, 1001 valid samples were retained, with a data validity rate of 97.7%. This study employed Harman's one-factor test to examine potential common method bias effects. SPSS factor analysis revealed five factors with eigenvalues exceeding 1. The first factor explained 30.044% of the variance, falling below the 40% critical threshold. These results indicate that the questionnaire data collection method used in this study did not exhibit significant common method bias.

4.2.2. Procedure of Mediating Effect Experiment

Before the experiment began, participants were informed that they would be participating in a study initiated by a cosmetic e-commerce brand. During the experiment,

participants were asked to view two sets of virtual model cosmetic display images (idealized and naturalistic faces) in sequence. Immediately after each set of images was presented, participants were asked to evaluate the affective resonance, trustworthiness, likability, and professionalism evoked by the images, and to report their willingness to purchase the corresponding cosmetic products.

The questionnaire items used a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree), adapted according to the scale standards proposed in the previous literature. Among them, the affective resonance scale was adapted from Nock et al.'s (2008) Emotion Reactivity Scale [42] (e.g., "This model evokes my emotional resonance") to form a 3-item scale (Cronbach's $\alpha = 0.849$). The dimensions of trustworthiness, likability, and expertise perception used Ohanian's (1990) [43] source credibility scale: trustworthiness was measured using the "trustworthiness" dimension (e.g., "The information provided by this model is true and reliable"), with three items ($\alpha = 0.825$); likability was measured using the "attractiveness" dimension (e.g., "I find this model likable"), expanded to four items ($\alpha = 0.881$); expertise perception used the "expertise" dimension (e.g., "This model has expertise in cosmetics"), with three items ($\alpha = 0.849$). The purchase intention scale was adapted from Guo et al. (2022) [78] (e.g., "I would purchase the products recommended by this model"), with three items ($\alpha = 0.843$).

Data analysis used AMOS 24.0 to construct a structural equation model (SEM) to evaluate whether the path of the influence of facial feature processing type (idealized/naturalistic) on purchase intention was mediated by four psychological variables (affective resonance, trustworthiness, likability, and expertise perception) (see Figure 7). The model fit indices were used to test the suitability of the hypothetical model, thereby verifying the significance of each mediating path and its explanatory power for consumer purchase decisions [79].

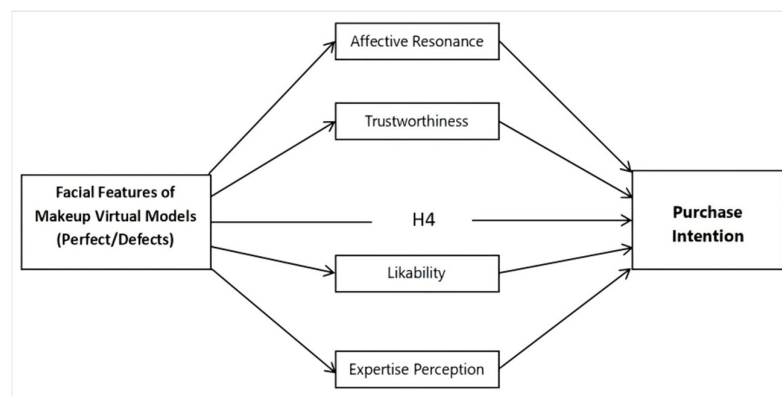


Figure 7. Hypothetical mediation model.

4.2.3. Results

In the reliability and validity testing, the Cronbach's α coefficients for affective resonance, trustworthiness, likability, expertise perception, and purchase intention were 0.849, 0.825, 0.881, 0.849, and 0.843, respectively, all of which exceeded 0.7, indicating good data reliability. Additionally, the KMO value was 0.829, and Bartlett's sphericity test yielded a significance level of less than 0.05, indicating suitability for factor analysis. Seven common factors were extracted, contributing 76.8% of the cumulative variance. After rotation, all factor loadings were greater than 0.4, and the commonality values were also above 0.4, indicating good validity.

Table 4 presents the descriptive statistical analysis of variables. Results indicate that the absolute values of skewness and kurtosis for all variables are less than 1. According to statistical criteria for assessing distribution shapes, when both skewness and kurtosis

absolute values are below 1, variables can be considered approximately normally distributed. Thus, affective resonance, trustworthiness, likability, expertise perception, and purchase intention in this study all exhibit characteristics consistent with approximate normal distribution.

Table 4. Descriptive statistical analysis of variables.

	Minimum	Maximum	Mean	Standard Deviation	Skewness	Kurtosis
Affective Resonance	1	7	4.4712	1.41655	−0.399	−0.416
Trustworthiness	1	7	4.6077	1.36202	−0.405	−0.295
Likability	1	7	4.5039	1.36846	−0.408	−0.275
Expertise Perception	1	7	4.4347	1.42177	−0.323	−0.491
Purchase Intention	1	7	4.5147	1.40365	−0.382	−0.436

Table 5 presents the model fit indices for the hypothetical model in this study. The fit indices indicate that the model has a good fit ($\chi^2/DF = 2.504$, GFI = 0.970, AGFI = 0.954, IFI = 0.982, CFI = 0.982, and RMSEA = 0.039). Table 6 presents the AVE and CR indices for the model in this study. The results show that all AVE values exceed 0.5, and all CR values are above 0.7, indicating that the data analyzed in this study exhibit good convergent validity. Figure 8 displays the results of the mediation model analysis.

Table 5. Fitness index of the hypothetical model.

	χ^2	df	χ^2/df	GFI	AGFI	IFI	CFI	RMSEA
Standard	235.329	94	1–3	≥ 0.8	≥ 0.8	≥ 0.9	≥ 0.9	≤ 0.05
Actual value			2.504	0.970	0.954	0.982	0.982	0.039
Decision			Good fitting					

Note: χ^2 = chi-square, DF = degrees of freedom, GFI = the goodness of fit index, AGFI = the adjusted goodness of fit index, IFI = the incremental fit index, CFI = the comparative fit index, RMSEA = root mean square error of approximation.

Table 6. Model AVE and CR indicator results.

Factor	Average Variance Extraction (AVE) Value	Combined Reliability (CR) Value
Affective Resonance	0.653	0.849
Trustworthiness	0.611	0.825
Likability	0.652	0.882
Expertise Perception	0.653	0.849
Purchase Intention	0.643	0.844

These findings indicate that the hypothesized model fits the test data. The results of the total effect, direct effect, and indirect effect (Table 7) show that there is a significant direct effect between the facial features of virtual models (idealized/naturalistic) and consumers' purchase intention (5000 bootstrap, 95% CI = [0.098, 0.391], $p < 0.001$), confirming H4a. In addition, perceived affective resonance, trustworthiness, likability, and expertise perception mediated the effect of virtual model facial features (idealized/naturalistic) on consumers' purchase intention (5000 bootstrap, 95% CI = [0.085, 0.362]), confirming H4b. Among these, the mediating effect of likability accounted for the most significant proportion at 30.10%, followed by expertise perception at 16.92%, affective resonance at 16.42%, and trustworthiness at 10.95%. The sum of indirect effects accounted for 74.38% of the total effect. The results of Experiment 2 supported H4.

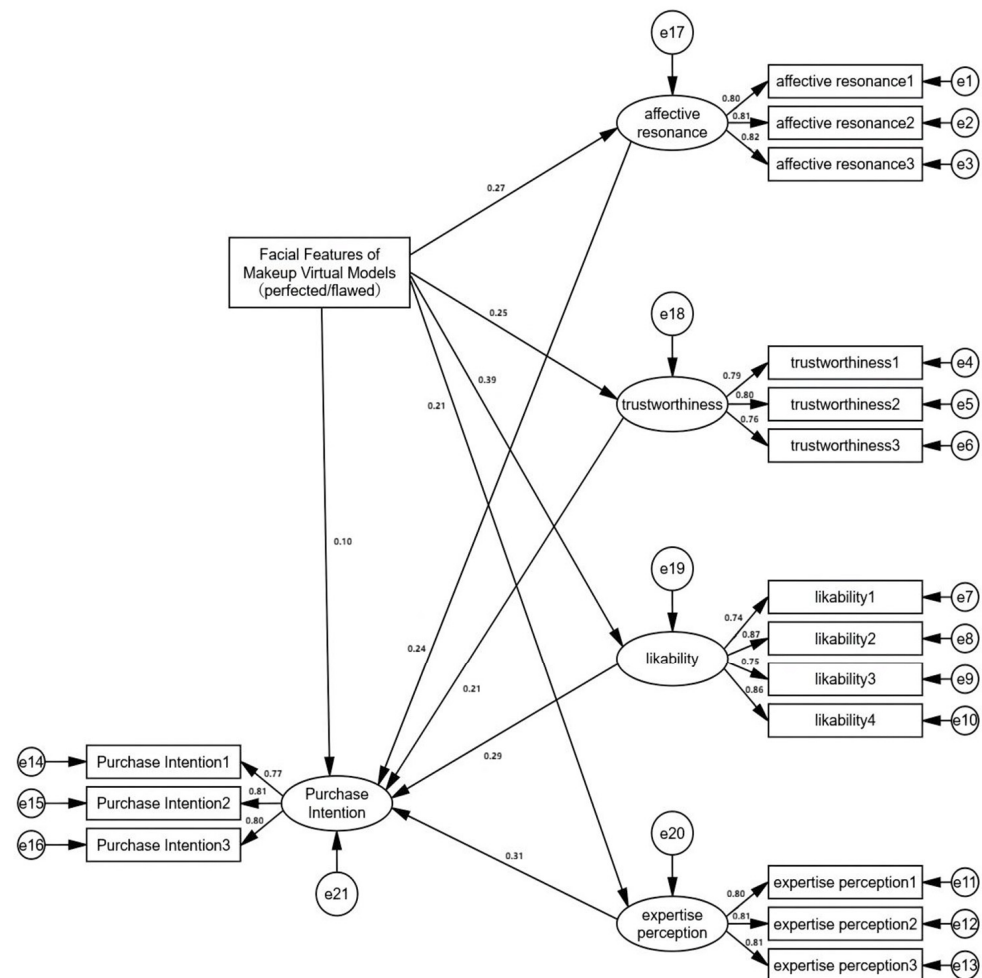


Figure 8. Results of the mediation model test.

Table 7. Path testing of the mediation model.

Model Pathway	β	SE	95%CI		Percent (%)
			LLCL	ULCL	
Total effect	0.402	0.028	0.340	0.467	100
Direct effect					
Idealized/naturalistic→purchase intention	0.103	0.027	0.048	0.165	25.623
Indirect effect					
Idealized/naturalistic→affective resonance→purchase intention	0.066	0.012	0.044	0.095	16.421
Idealized/naturalistic→trustworthiness→purchase intention	0.044	0.011	0.027	0.068	10.952
Idealized/naturalistic→likability→purchase intention	0.121	0.016	0.088	0.159	30.102
Idealized/naturalistic→expertise perception→purchase intention	0.068	0.013	0.044	0.101	16.917

4.2.4. Discussion of Mediating Effect Experiment

Experiment 2, employing a multiple mediation model, revealed that the facial features of virtual models (idealized/naturalistic) activate both the social cognitive system (likability and expertise perception) and emotional evaluation system (affective resonance and trustworthiness), thereby exerting a dual-channel influence on consumers' purchase decisions. The total mediating effect accounted for 74.38% of the total effect, indicating that this mediating effect plays a key role in explaining the relationship between virtual facial aesthetics in cosmetic advertisements and consumer purchase intention.

Importantly, the significant mediating effects demonstrate that naturalistic facial features do not influence purchase intention through a single psychological mechanism. Instead, they operate through the interaction between the social cognitive system (rational evaluation) and the emotional evaluation system (emotional connection), thereby amplifying their persuasive impact. Specifically, the mediating roles of expertise perception ($\beta = 0.068$) and trustworthiness ($\beta = 0.044$) reflect consumers' rational assessment of product efficacy, with naturalistic design enhancing trustworthiness by conveying authenticity cues (such as natural skin texture). Meanwhile, the mediating effects of affective resonance ($\beta = 0.066$) and likability ($\beta = 0.121$) highlight the importance of emotional connection in facilitating consumer acceptance of naturalistic designs beyond mere cognitive appraisal.

The differences in the effects of the four types of mediating variables (likability > expertise perception > affective resonance > trustworthiness) reveal consumers' decision-making priorities in the context of cosmetic advertising: The dominant mediating role of likability (30.10%) indicates that the "pseudo-socialization" characteristics of virtual models (such as the realism conveyed by appropriate imperfections) effectively reduce psychological distance and directly activate consumers' emotional connection needs. In contrast, the weaker mediating effect of expertise perception (16.92%) implies that in the cosmetics field, the degree to which a product matches consumers' needs (such as makeup effects) drives consumers' willingness to purchase more than the professional authority of the model image. The moderate effect of affective resonance (16.36%) indicates that while emotional arousal is present, it remains a basic underlying driver rather than a primary persuasive force. Lastly, the lowest proportion of trustworthiness (10.95%) suggests that risk control has become a necessary but not sufficient condition under the authenticity marketing paradigm.

At the same time, cultural value orientations may moderate the mediating weight of naturalistic facial features on purchase intention through different psychological pathways. Through cross-cultural comparative analysis of the sample, we found that 5.7% of Western subjects in this study attributed 56.4% of their purchase intention to naturalistic faces, primarily driven by expertise perception (compared to only 16.9% among the East Asian group). In contrast, East Asian consumers' purchase intention in naturalistic faces relied more on the likability pathway (49.8%). This divergence may be explained through the framework proposed by Markus et al. (1991) on "interdependent self" and "independent self" [80]: collectivist cultures view imperfections in naturalistic faces as clues to group identity that are "down to earth", thereby amplifying the emotional connection path; individualistic cultures are more concerned with whether imperfections convey signals of authenticity, thereby activating the rational evaluation path.

5. Discussion

This study employed a dual-channel framework combining eye-tracking data and emotional cognition analysis to explore and provide understanding for the mechanisms by which the "idealized–naturalistic" design of cosmetic virtual model faces influences consumer behavior. The results of Experiment 1 confirmed that idealized faces elicited emotional arousal through "ideal beauty stimuli" (supporting H1), while naturalistic faces effectively captured visual attention through imperfections (such as freckles), also supporting H1, and significantly increased purchase intention (supporting H3). These findings are consistent with previous studies [25,26].

However, the experimental results partially refute H2. While idealized faces did increase attention to the eye area as predicted, participants' visual focus was disproportionately concentrated on the nose, rather than the skin area. This outcome differs fundamentally from previous studies that emphasize the dominance of skin texture in the attractiveness of a perfect face [57], questioning the "skin texture first" paradigm of

cosmetic advertising design and revealing that in the actual visual perception processes, the composition of facial attractiveness is diverse. Specifically, in addition to the eyes, which are recognized as the focal point, features such as the nose, which have a high degree of symmetry and structural precision, also play a crucial role in attracting attention in idealized faces. This discovery underscores that future research on the attractiveness of virtual images needs to consider more comprehensively the synergistic effects of multiple facial features and their visual characteristics under specific treatments (such as idealization).

Experiment 2 data supported the multiple mediating effects of affective resonance, trustworthiness, likability, and expertise perception proposed in H4. However, consumers' perceptions of virtual models' facial features do not follow a single universal pathway but are systematically moderated by deep-seated cultural values. Although Western participants constituted only 5.7% of the sample, their decision-making patterns exhibited distinctly different path dependencies. This decision logic indicates that within collectivist cultural contexts, subtle facial imperfections (such as freckles) are not interpreted as "flaws," but rather perceived as relatable cues of group identity. These cues effectively reduce social-psychological distance, significantly amplifying the mediating weight of the emotional connection pathway (likability and affective resonance) [81]. Conversely, within individualistic cultures, consumers tend to evaluate information from an "independent self" perspective. They focus on whether imperfections convey "authenticity signals" regarding the model's competence or the product's efficacy, thereby relying more heavily on rational evaluation pathways (expertise perception and trustworthiness) to make decisions. This ensures their choices reflect personal capability and judgment.

In summary, Experiment 2 validated the mediating effects of four psychological variables on consumer decision-making and revealed how cultural value orientations reshape the weight distribution in consumers' cognitive processing. This suggests that international cosmetic brands should adopt a "Globally Unified, Locally Weighted" strategy for virtual model facial processing in cross-cultural marketing, while conveying "authenticity" globally, further emphasizing likability and emotional connection in East Asian markets, and appropriately strengthening professional authority endorsements in Western markets.

6. Conclusions

6.1. Theoretical Contributions

This study enriches and expands the theoretical framework related to virtual models. First, from the perspective of visual cognition, it explores the visual processing mechanism of consumers' idealized and naturalistic facial features. This supplements existing eye-tracking applications in virtual model facial design research and offers novel perspectives and methodologies for understanding consumer visual behavior. In this study, it was confirmed that naturalistic faces of virtual cosmetic models attract greater consumer attention and foster stronger positive purchase intentions compared to idealized faces.

Second, grounded in the ABC attitude model, this study verifies the mediating roles of affective resonance, trustworthiness, likability, and expertise perception between virtual model facial features and purchase intention from an emotional cognition perspective. This deepens the understanding of emotional cognition's influence in consumer decision-making and further refines the theoretical model explaining how virtual models shape consumer psychology and behavior. Additionally, preliminary cross-cultural analyses indicate that the relative strengths of the emotional and rational mediation pathways vary across different cultural contexts, providing boundary conditions for the future application of this model in multicultural markets.

6.2. Practical Implications

This study offers the following practical insights for marketing practices of cosmetic brands and digital practitioners: Firstly, when designing virtual models, brands should consider how facial features influence consumers' visual attention and emotional perceptions. If the goal is to attract consumers' attention to the core areas of the face (such as the eyes and nose), idealized facial processing can be used; if the goal is to enhance emotional resonance and purchase intent, naturalistic facial processing may be a better choice.

Secondly, brands should strategically select virtual model facial styles based on product positioning and marketing goals. For example, mass-market affordable products can prioritize naturalistic models to bridge the distance with consumers and enhance consumer trust through authenticity. High-end luxury products, on the other hand, can utilize slightly flawed designs (such as subtle textures) to convey a sense of natural beauty while maintaining a professional aesthetic.

Lastly, cultural context should guide the emphasis on naturalistic cues. Collectivist cultures respond more to likability, while individualistic cultures prioritize expertise perception, allowing brands to tailor strategies for cross-cultural effectiveness.

6.3. Limitations and Future Directions

Although this study has achieved specific results, it still has limitations. First, the experimental sample mainly focused on East Asian consumer groups, with a relatively small Western sub-sample. While this provides powerful insights for brands targeting East Asian consumer groups, it excludes broad claims about Western or other cultural contexts. Future research could further expand the sample scope to ensure a consistent proportion of consumers from different cultural backgrounds, enabling cross-cultural exploration with a sufficient sample size and enhancing the generalizability of the results.

Next, the study focused solely on static facial features of virtual models, neglecting the influence of dynamic expressions and interactive effects (such as short videos or AR makeup trials) on consumers. While static images allow precise control over facial variables, dynamic media may alter visual attention allocation patterns (e.g., dynamic changes in skin texture may attract more attention). Therefore, we plan to explore in future research how expressions, movements, and other characteristics of dynamic virtual models influence consumer psychology and behavior. Integrating virtual reality (VR) and augmented reality (AR) technologies to simulate more realistic consumption scenarios will contribute to a comprehensive and in-depth understanding of the application potential of virtual models in marketing.

Additionally, despite employing physiological measurements and self-reported measures, we did not capture longitudinal behavioral outcomes such as repeat purchases or brand loyalty. Our findings indicate a causal effect between attention and consumption preferences in controlled environments, validating emotional mediating factors across four dimensions—a crucial first step toward understanding underlying influences. We encourage future research to employ field experiments in collaboration with brands, tracking metrics such as conversion rates and customer repeat purchases following exposure to naturalistic virtual models.

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Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

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