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Computer-Aided Design AND APPLICATIONS

Computer-Aided Brand Design: Interactive Aesthetic Experience of Virtual Reality and Emotional Identification Model

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Abstract. This study aims to explore the interactive aesthetic experience of VR (Virtual reality) and emotion recognition technology in computer-aided brand design. By constructing an innovative model, this study integrates VR and emotion recognition technology to enhance the interactivity and immersion of brand design and then enhance the aesthetic experience of consumers. The experiment uses the simulation method to verify the model's effectiveness. The experimental results show that compared with the previous brand design methods, the model constructed in this study can capture consumers' emotional needs more accurately and provide more individualized and attractive brand design solutions. This research not only brings new methodology to the field of brand design but also provides valuable enlightenment for future research direction. Constantly optimizing and perfecting the model is expected to create a richer brand experience for consumers and promote innovation and development in the brand design industry.

Keywords: Computer-Aided Design; Brand Design; Virtual Reality; Emotional Recognition; Interactive Aesthetic Experience
DOI: https://doi.org/10.14733/cadaps.2024.S28.41-55

1 INTRODUCTION

In today's era of information explosion, brand image is very important for the success of an enterprise. Digitalization is reshaping the influence of retail brand design at an unprecedented pace, mainly due to modern consumers' desire for seamless integration and smooth and AI-enhanced shopping experiences. In order to deeply explore the application of artificial intelligence technology in retail brand design and its impact on consumer experience, Abed et al. [1] conducted a sampling survey of 451 consumers at sales points. During the data collection and analysis phase, we employed causal analysis using ANCOVA analysis and structural equation modelling to validate the brand design of the measurement scale rigorously. The survey targets two concept stores of the same fashion

brand, one of which is not equipped with artificial intelligence technology for brand design, while the other store has fully introduced intelligent technology tools. The research results show that consumers exhibit higher aesthetic responses in online stores equipped with artificial intelligence technology. In the field of luxury brand design, a high degree of realism and interactivity is crucial for consumers. The development of social technology, changes in human needs, and increasingly fierce market competition require brands to make changes to themselves in response to these changes. With the innovation of the Internet and other technologies, communication means and media have also changed, and brand communication design is facing diversification. One of the research objectives of Altarteer and Charissis [2] is to apply theoretical knowledge to analyze brand case communication design. It adopts personalized operations in brand texture to construct a personalized virtual reality system for users. This paper discusses the role of media, ways, platforms and means of brand communication under the Internet on brand communication, and the relationship between online and offline interaction. This paper analyzes the brand that combines the Internet and other new technologies to carry out brand communication design at this stage and explores the new form of brand communication design under the Internet. His research pondered over the role of the Internet in brand communication, combined with the author's own understanding of brand communication design, discussed some problems when brand enterprises and third-party brand design companies follow up the design of brands, and tried to think about the teaching of brand design courses in colleges and universities. The existing research on social media marketing mostly focuses on analyzing the social media marketing of enterprises based on theories such as CAD, and only studies it from the perspective of one-way behavior of enterprises. There is a lack of research on user consumption behaviour, and there is a lack of exploration of two-way behaviour between enterprises and consumers from a broader perspective. SICAS is a new consumer behaviour model in the mobile Internet era. Based on this model, Berseth et al. [3] combined social media marketing theory with the user consumption behaviour model from the perspective of marketing. It conducts research and analysis on the current situation and problems of M brand's social media marketing, providing guidance for optimizing M brand's social media marketing strategies and enriching the perspective of social media marketing.

Chylinski et al. [4] designed a complex system of brand marketing through augmented reality. A simple graphic design was carried out on the multimedia created by the client, which constructed a situational cognitive discussion in a physical environment. By stimulating or enhancing real-life environments, ARM can create a unique context that allows consumers to gain a deeper and more authentic experience in interacting with brands. Compared with traditional marketing methods, ARM has its unique advantages. It can create an immersive experience by simulating, enhancing, or changing the real environment, allowing consumers to have a more intuitive understanding of products, brands, or services. This development process reflects the close combination of technology and design, and the continuous progress of design tools. With the development of technology, computer-aided brand design not only improves design efficiency but also greatly enriches the expressive force and interactivity of design. In the actual brand design process, the ambiguity of product experience attributes often becomes a challenge for designers. To address this challenge, the model adopts the method of particle optimization of the user evaluation matrix and combines consensus group optimization algorithm to achieve consensus under non-consensus conditions. Dai and Cao [5] proposed a multi-level product modelling and evaluation model based on AutoCAD and experience. In brand design, user perception preferences often have ambiguity and uncertainty, making it difficult to accurately describe them with simple numerical values or language. Meanwhile, consensus group optimization algorithms gradually eliminate evaluation differences among users through multiple rounds of iteration and negotiation, forming more consistent evaluation results. This model not only deeply analyzes various dimensions of product experience, but also fully considers the existence of uncertainty factors. Taking the perception evaluation of brand modelling solutions as an example, they validated the effectiveness of the HFLTSS (Hesitant Fuzzy Linguistic Term Sets with Swarm Optimization) method. The combination of these two algorithms effectively improves the accuracy and reliability of product modelling and evaluation. VR technology has brought a new dimension to brand design. Designers can use VR technology to create a realistic 3D environment so

that consumers can experience the actual use effect of products in the product design stage. Virtual reality (VR), as an immersive multisensory experience, has gradually become a new driving force for brand-consumer interaction in contemporary business environments. For brands and retailers, VR technology brings both potential risks and enormous opportunities during the shopping process. Farah et al. [6] delved into the actual impact of brands and consumers accelerating the adoption of head-mounted VR devices on traffic in retail stores. The research results show that with the continuous development and popularization of VR technology, consumers have an increasing expectation of integrating VR experience into the shopping process. This expectation gap is mainly reflected in the comparison between the high expectations of consumers for VR technology and certain limitations in the actual experience. This new shopping experience can attract more consumer attention and interest, thereby enhancing brand awareness and sales. The application of this technology not only enhances the participation of consumers but also makes brand design more accurate and effective. At present, many well-known brands have begun to try to integrate VR technology into product design and display to enhance consumers' desire to buy and brand loyalty.

Emotion recognition technology has been a hot spot in the field of artificial intelligence in recent years. It can analyze human facial expressions, sounds and so on, so as to identify people's emotional state. Hajarolasvadi and Demirel [7] proposed an innovative method aimed at extracting representative frames from videos that can represent their emotional changes. These intrinsic frames not only contain key emotional information in the video but also effectively reduce redundant data and improve processing efficiency. This dynamic change is a crucial factor in emotion recognition, as it can reflect the true emotional state of the character in the video. By applying PCA to a single emotional video, researchers are able to extract the most important intrinsic frames of temporal motion variance embedded in the video. The experimental results show that the proposed method outperforms state-of-the-art databases by 8% and 4% on RML and eINTERFACE'05 databases, respectively. By mapping changes in the time domain to the intrinsic space, researchers can more accurately capture and analyze these emotional changes, thereby providing more accurate and useful information for brand design [8].

The purpose of this study is to explore the application of VR and emotion recognition technology in computer-aided brand design and analyze its influence on interactive aesthetic experience. Specific innovations include:

Technology integration and innovation: This article combines VR technology with emotion recognition technology and applies it to brand design, providing consumers with a brand-new and immersive brand experience.

Innovation of model construction: A computer-aided brand design model is built, which can capture and analyze consumers' emotional reactions in real-time, provide instant feedback and optimization suggestions for brand design, and realize real-time interaction between design and consumers' emotions.

Chapter arrangement: This article first introduces the research background and significance of computer-aided brand design and then expounds on the construction process of the model in detail, including the combination of VR and brand design, the application strategy of emotion recognition in brand design, and the design of interactive aesthetic experience model. Subsequently, the effectiveness of the model is verified by simulation experiments. Finally, the research results are summarized, and the future research direction is presented.

2 THEORETICAL BASIS AND TECHNICAL OVERVIEW

The rapid development of digital technology has not only changed every aspect of our daily lives but also greatly reshaped the way we interact with consumers and art. Especially in the fields of brand design and art exhibitions, advanced computational imaging solutions provide unprecedented digital replication possibilities for artworks. This interactive approach breaks the limitations of traditional brand design, allowing consumers to interact and experience the brand in a more intuitive and immersive way, thereby enhancing the emotional connection between the brand and consumers.

Jonauskaite et al. [9] invited 75 participants to explore brand design artworks replicated through digital technology in a laboratory environment. When it comes to brand design, the high-definition and detailed display of digital replicas can attract consumers' attention, thereby increasing their interest and engagement in the brand. Kumar et al. [10] delve into how AR technology effectively transforms users into loyal advocates of the brand. And how these effects gradually translate into strong user attachment and high involvement in the brand, ultimately leading to effective brand dissemination. Through this framework, we systematically analyzed the multiple roles of AR technology in the user shopping experience. This high degree of autonomy and interactivity allows consumers to feel an unprecedented sense of control during the shopping process, greatly improving their shopping satisfaction and loyalty. The traditional shopping model is often dominated by merchants, and consumers are often in a passive acceptance position. However, the introduction of AR technology has completely changed this situation. In terms of research design, they adopted the powerful statistical analysis method of structural equation modelling and constructed a comprehensive research framework based on the actual experience data of 502 AR users. This deep emotional connection and identification make users more willing to become loyal advocates of the brand, actively recommending and sharing their shopping experience with others. Virtual fitting rooms (VFR), as an innovative technology in the fashion industry, have brought unprecedented shopping experiences to consumers. To address these issues, Lee and Xu [11] conducted an in-depth analysis and classification of existing VFR technologies from the perspective of consumer experience, particularly focusing on cognitive and emotional experiences. Consumer concerns about VFR are not unfounded. The core of the fashion industry lies in the appearance and wearing experience of products, and VFR technology needs to accurately simulate these elements in order to win the trust of consumers. By comparing the differences in realism, usability, interactivity, and innovation of different VFRs during the simulation process, we have identified seven different types of VFRs available on the market. Some VFR technologies adopt advanced 3D scanning and rendering technology, which can highly reproduce the appearance and wearing effect of products, providing consumers with a realistic try-on experience.

A deep understanding of computational design strategies in the form of branded products requires the digitization and intelligence of the design process. Manavis et al.'s [12] research provides us with a systematic perspective, utilizing modern digital tools to deeply explore the creation, evolution, and transformation of industrial products. This theory combines the flexibility of computational design with the uniqueness of brand elements, enabling designers to quickly generate a large number of customized products that match the brand image. With the advent of the Internet era, the digital user consumption model has added active search and share, but it is still a linear consumption behaviour. The SICAS model is a non-linear, multi-point, and bidirectional user consumption model, allowing for two-way interaction between businesses and consumers. In summary, the explanation of social media marketing theories and user consumption behaviour models, combined with the issues that need to be studied in this article. The strategies of content marketing, interactive marketing, and word-of-mouth marketing in user consumption behaviour and social media marketing are applicable to solving the marketing problems of M brand's social media. In view of this, Marín et al.'s study [13] is based on social media marketing theories and the SICAS model of user consumption behaviour. It attempts to construct a SICAS model for social media marketing of the M brand to conduct in-depth research on the marketing issues of the M brand. When spreading brands, they use the Internet to spread their influence, mainly through online platforms, third-party media and other publicity and reports on brand activities. Many brands under the Internet use the Internet as an intermediary to expand the influence of online communication. Among them, the Hermes brand itself uses the Internet to link offline physical products with products in online brand websites, so that participants can experience online and offline services at the same time and increase potential brand consumers. Coca-Cola is one of the brands with strong communication strength through the Internet. Major sports events are covered by media from various countries. This form of brand communication through the Internet will become more and more common. The rapid changes in the internet pose challenges to brand communication, and frequent information updates make it extremely challenging for brands to leave a deep impression on their audience [14]. This is

particularly important in today's consumer-dominated market environment. Consumer inspiration may become an important converter, transforming the novel experiences brought by AR technology into a positive attitude and loyalty towards the brand. This is not only an important supplement to existing marketing theories but also provides a new perspective on how brands can more effectively utilize AR technology. This refers to the creative thinking, emotional resonance, and behavioural motivation that consumers generate after exposure to AR applications. This concept serves as an intermediary structure that cleverly connects the benefits of AR applications with changes in brand attitudes. Not limited to visual shock, but also allowing consumers to truly feel unprecedented convenience, entertainment, or educational value in the fusion of virtual and reality. The study by Smink et al. [15] reveals how augmented reality (AR) brand design applications influence consumer purchasing decisions and persuasive effects through specific psychological processes. When virtual products can cover the face or surrounding environment of consumers, their spatial perception will change, as if these virtual items really exist in the real world [16]. The enhancement of spatial presence helps consumers form positive evaluations and purchase intentions towards the product. If virtual products appear too abruptly or inappropriately in consumers' lives, they may make them feel disturbed or invade their private space. When virtual products can accurately reflect consumers' personal preferences and styles, the perceived personalization of consumers will be significantly improved. When consumers can see how virtual products integrate into their actual environment through AR technology, they will have a clearer understanding of whether the products are suitable for their lifestyle and spatial layout [17].

Brand language is often used in specific contexts, which means that understanding brand language requires considering the context in which it is used. Emotion is the key to establishing an emotional connection between a brand and consumers [18]. By triggering resonance and stimulating emotional resonance, a brand can leave a deep impression in the minds of consumers. The close coupling between these elements not only brings rich levels and dimensions to the brand but also provides consumers with opportunities for deep understanding and resonance. Most existing brand language design work has not fully considered these challenges, especially the lack of clear utilization and modelling of the relationships between related tasks. Zhang et al. [19] proposed a multi-mode and multi-task learning model based on encoder-decoder architecture, called M2Seq2Seq. In the decoding stage, they designed two types of Multi-Task Learning (MTL) decoders, namely single-stage and multi-level decoders, to explore their potential to handle different tasks. This model can effectively fuse the information of these patterns through an encoder by introducing a multimodal joint framework. Digital brand design art, as a new force in contemporary media and mass art forms, is increasingly receiving people's attention. Digital brand design and innovation under virtual reality technology not only break through the boundaries of traditional design but also elevate the artistic experience to a new level. The biggest feature of VR works is that they can provide audiences with a new experience of participating and interacting with "real" works. The significant enhancement of graphic and image expression ability and the continuous innovation of processing methods have brought unprecedented expression space to brand design and creation. In traditional artworks, gender and emotions are often reflected through the artist's shaping of images and rendering of emotions. In the field of digital brand design, the application of VR technology has brought revolutionary changes to brand communication and marketing [20].

3 COMPUTER-AIDED BRAND DESIGN MODEL CONSTRUCTION

Brand design is an important means to convey brand image and value. Traditional brand design theory emphasizes the unity and recognition of visual elements, while modern brand design pays more attention to emotional connection and interactive experience with consumers. In practice, brand designers need to constantly explore new methods and technologies to create a unique and attractive brand image. VR technology creates a highly realistic 3D virtual environment by simulating human senses such as audio-visual, tactile, etc. Users can interact in this environment and get an immersive experience [9]. In brand design, VR technology is widely used in product display, scene simulation, and user experience optimization. Emotion recognition technology is mainly based on

computer vision and machine learning algorithms, which can judge people's emotional state by analyzing their facial expressions, voices, and gestures. In brand design, this technology can help designers capture the subtle emotional changes of consumers so as to meet their needs and expectations more accurately. The characteristics of VR technology and brand design are shown in Table 1:

Characteristic dimension	*VR technology*	*Brand design*
Interactivity	Provide an immersive interactive experience that enables users to interact with the virtual environment.	Communicate with users through visual elements and communication strategies to build a brand impression.
Sense of reality	Create a highly realistic 3D environment so that users seem to be there.	Create the uniqueness and recognition of the brand through design elements and styles.
Novelty	Technology is constantly innovating to provide users with a richer virtual experience.	Innovative design concepts and techniques make the brand stand out in the market.
Emotional connection	Through the immersive experience, the user's emotional response is triggered.	Establish an emotional connection between brands and users and enhance brand loyalty.
Adaptability	It can be used in many fields, such as games, education, medical care, etc.	It needs to be flexibly adjusted according to the needs of different markets and consumers.
Story	Rich story situations can be told through VR technology.	Incorporate brand stories into brand design to increase brand appeal and memory.

Table 1: Comparison table of VR technology and brand design characteristics.

The interactive aesthetic experience emphasizes the dynamic interaction between the audience and works of art. In brand design, this means that consumers are no longer passive recipients but can actively participate in and influence the construction of brand image. Through technologies such as VR and emotion recognition, brand designers can create more attractive interactive aesthetic experiences.

In the field of computer-aided brand design, although much research has involved the application of VR and emotion recognition technology, it is still a relatively new research direction to integrate these technologies into a model to realize more intelligent and individualized brand design. This research is carried out under this background, aiming to build a computer-aided brand design model that can integrate VR and emotion recognition technology so as to improve the efficiency and quality of brand design and provide consumers with a better and more individualized brand experience.

The fusion formula of emotion recognition and VR is as follows:

$$C = \frac{1}{2} \cdot Q + V + \frac{1}{2} \cdot \sum_{r=1}^{s} \alpha_r \cdot E_r - A_r \tag{1}$$

Where: C is the output of the fusion model, Q is the consumer's behaviour data score, V is the average of VR environment scores, E is the r emotional state score, A_r is the r emotional attitude score, α_r is the weight of the r emotional state, and s is the number of emotional states.

Using computer-aided brand design models and VR technology, designers can create a realistic 3D environment so that consumers can experience the actual use effect of products in the product design stage. This combination is mainly reflected in the following aspects: ⊖ VR technology can provide an immersive brand display environment so that consumers can have a deeper

understanding of brand culture and product characteristics; Through VR technology, designers can simulate real usage scenarios and help consumers better understand the functions and advantages of products; ⊛ VR technology can also provide individualized design experience to meet the different needs and preferences of consumers. Figure 1 shows the computer-aided brand design model constructed in this study.

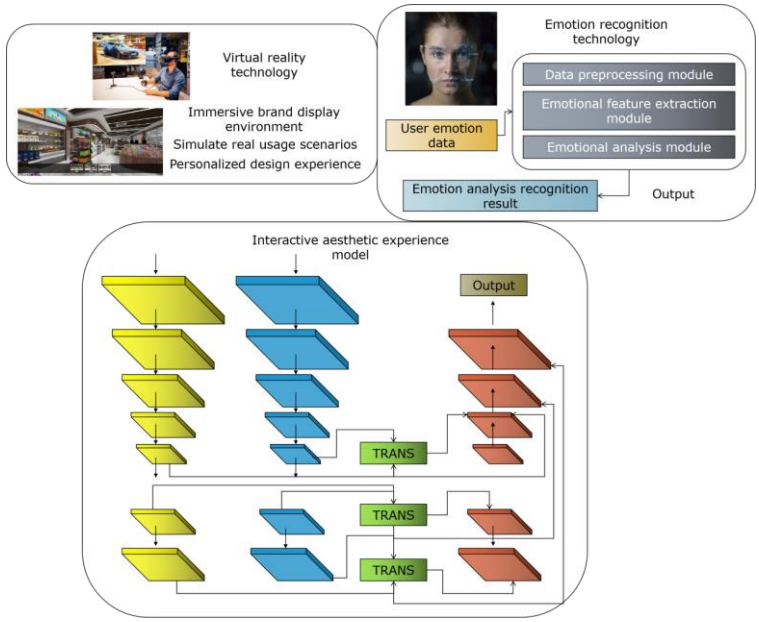


Figure 1: Computer-aided brand design model.

Emotion recognition technology can analyze the emotional state of consumers and provide strong data support for brand design. In the computer-aided brand design model, the application strategies of emotion recognition mainly include ⊖ Understanding consumers' emotional attitudes and demands for brands through emotion recognition technology so as to design a brand image that is more in line with consumers' expectations. The calculation formula for the emotional attitude score is as follows:

$$A = \frac{\sum_{i=1}^{n} w_i \cdot X_i}{\sum_{j=1}^{m} w_j \cdot Y_j} \tag{2}$$

Among them, A are the score of emotional attitude, X_i the score of the i emotional index, Y_j is the score of the j demand index, w_i and w_j are the weights of emotional index and demand index respectively, and n and m are the numbers of emotional index and demand index respectively.

⊖ After understanding consumers' emotional attitudes and needs, the next step is to use these data to evaluate and optimize brand image and products. Emotion recognition technology can provide objective and quantitative evaluation indicators to help brands find their own image and the advantages and disadvantages of products more accurately. Based on the data of emotion recognition, brands can improve product design, adjust marketing strategies or optimize service processes. Among them, the formula for calculating the brand appeal index is:

$$B = \sqrt{\sum_{k=1}^{p} S_k - E_k^{\ 2}} \tag{3}$$

Among them: B is the brand attraction index, S_k the score of the k brand image characteristics, E_k the expected value of the k emotional attitude score, and p the number of brand image characteristics. Product optimization is calculated according to the following formula:

$$O = \frac{1}{1 + e^{-\sum_{l=1}^{q} c_l \cdot P_l - E_l}} \tag{4}$$

Where O is the output of optimization suggestions, p_l is the score of the l product feature, E_l is the expected emotional state score of the l, c_l is the optimization weight of the l feature, and q is the number of product features. By solving this formula, an optimal product mix can be obtained, which can maximize the overall satisfaction of consumers, thus guiding enterprises to optimize products and adjust market strategies. However, in practical application, the above formula needs to be combined with historical data of consumers, market research, product characteristics and other information to be specific.

Combine VR technology to provide consumers with an individualized shopping experience, and adjust product display and recommendation methods according to consumers' emotional changes. Individualized recommendation system formula:

$$R = \arg\max_{x \in X} \sum_{i=1}^{n} \lambda_i \cdot g_i\ x \tag{5}$$

Where R is the recommendation result, X is all possible recommendation sets, λ_i is the weight of the i preference factor, $g_i\ x$ is the score of the i preference factor on the recommendation x, and n is the number of preference factors.

By collecting and analyzing consumers' behavioural data and emotional data in the virtual shopping environment, brands can more accurately predict market trends and consumer demand, thus making more effective marketing strategies and product planning. The dynamic tracking calculation method for emotional changes is as follows:

$$D = \frac{\Delta A}{\Delta T} \tag{6}$$

Among them D is the dynamic tracking data of emotional change, ΔA the change of emotional attitude, and ΔT the change of time.

The interactive aesthetic experience model aims to provide consumers with an immersive brand experience through VR and emotion recognition technology. The design of the model includes the following parts: ⊖ Establish a 3D virtual environment, and the modelling formula is as follows:

$$\text{Virtual environment} = f_{VR}\begin{pmatrix}\text{Brand information}\\ \text{Shopping scene parameters}\end{pmatrix} \tag{7}$$

f_{VR} is a function that transforms brand information and shopping scene parameters into a 3D virtual environment that users can explore freely. This environment not only simulates real shopping scenes but also includes detailed brand displays. Using advanced 3D modelling technology and high-resolution texture mapping, a lifelike virtual world can be created, which makes consumers feel as if they are there. In this virtual environment, brands can design unique display spaces according to their own characteristics and positioning. Whether it is the exquisite display of fashion clothing stores or the futuristic booth of high-tech products, it can be perfectly presented in this virtual world.

⊜ Capture the emotional changes of consumers through emotion recognition technology, and adjust the product display and recommendation methods in the virtual environment in real-time. Once the emotional changes of consumers are captured, the model will immediately process these data and adjust the product display and recommendation methods in the virtual environment in

real-time according to the processing results. Emotion recognition is calculated by the following formula:

$$\text{Emotional state} = \mathrm{f}_{\mathrm{ER}}\begin{pmatrix}\text{Facial expression}\\ \text{Pronunciation and intonation}\\ \text{Physiological signal}\end{pmatrix} \tag{8}$$

Among them f_{ER} is a function, that identifies the emotional state of users by analyzing facial expressions, voice intonation and physiological signals.

⊛ Provide an interactive interface so that consumers can freely explore the virtual environment and interact with brands. Interactive interface design:

$$\text{Interactive interface} = f_{UI}\begin{pmatrix}\text{User behavior}\\ \text{Brand interaction rules}\end{pmatrix} \tag{9}$$

Among them f_{UI} is a function, that designs an interactive interface according to the user's behaviour and brand interaction rules, so that users can interact with brands in the virtual environment.

Figure 2 shows an example of designing with a computer-aided brand design model.

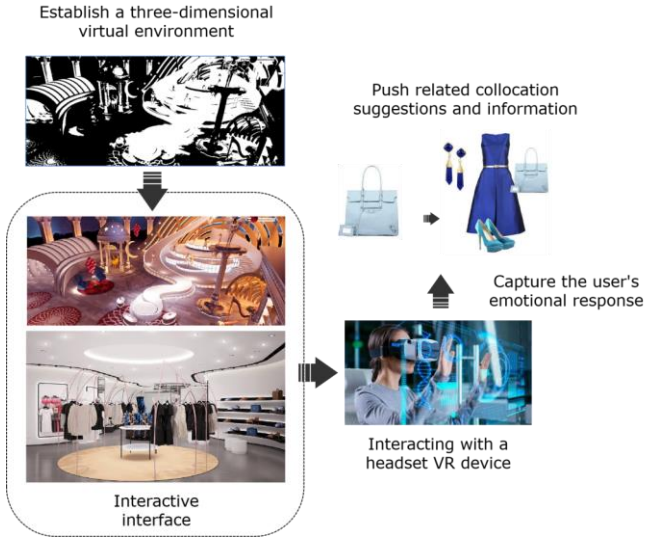


Figure 2: Examples of computer-aided brand design.

In this example, we can see the virtual exhibition space of a fashion brand. The interior layout of the space is exquisite, displaying all kinds of new clothes and accessories. Consumers can freely browse and select products by entering this virtual space through head-mounted VR devices. When consumers approach a product, the model will capture their emotional reactions through emotion recognition technology. If consumers show strong interest in a certain dress, the model will automatically adjust the display mode, such as putting the dress in a more conspicuous position and pushing relevant matching suggestions and preferential information. Furthermore, consumers can also participate in the interactive activities of the brand through the interactive interface.

By introducing new technology, the model can provide enterprises with more efficient and accurate brand design solutions, thus promoting the continuous innovation and development of the brand design industry. Specifically, the computer-aided brand design model proposed in this article has the following innovations: first, it integrates VR and emotion recognition technology to provide

consumers with an immersive brand experience; Secondly, through emotion recognition technology to understand the needs and preferences of consumers, to achieve individualized brand design; Finally, an interactive interface is provided to enhance the interaction between consumers and brands. The following research also carried out simulation experiments to verify the effectiveness of the model.

4 DESIGN OF SIMULATION EXPERIMENT AND IMPLEMENTATION OF RESULT ANALYSIS

4.1 Experimental Results and Analysis

Figure 3 shows the modelling accuracy of the algorithm. The results show that the computer-aided brand design model proposed in this study is highly accurate in the modelling process. This provides a reliable basis for the generation and optimization of subsequent design schemes.

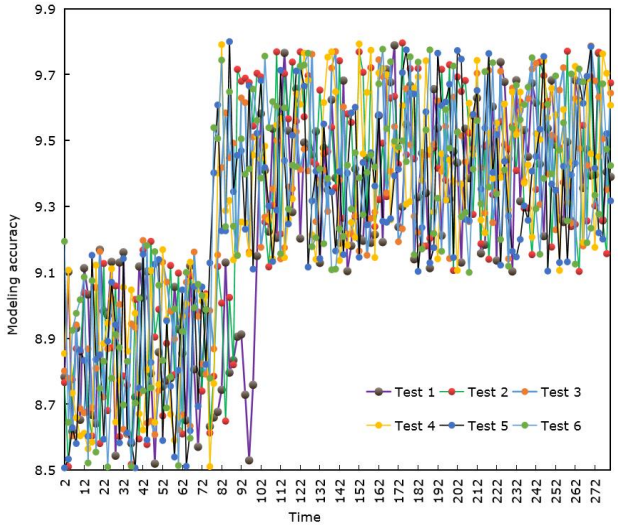


Figure 3: Modeling accuracy of the algorithm.

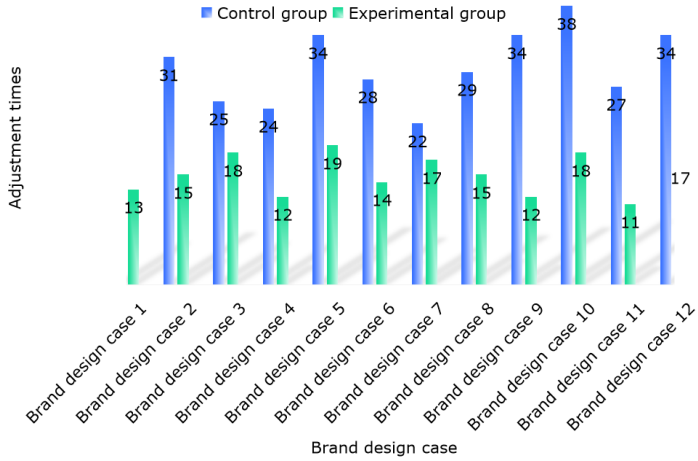


Figure 4: Adjustment times of design schemes with different methods.

The adjustment times of different design schemes are shown in Figure 4. Figure 4 shows that the experimental group is obviously superior to the control group in the number of design scheme adjustments. This shows that the experimental group using this model can find a suitable design scheme more efficiently and reduce unnecessary adjustment and optimization steps.

The emotional reactions of the participants are shown in Table 2. Participants in the experimental group showed more positive emotional responses, and higher pleasure and satisfaction during the design process.

Group	*Number of people*	*Pleasure (1-10 points)*	*Satisfaction (1-10 points)*
Experimental group	15	8.5	9.0
Control group	15	6.8	7.5

Table 2: Comparison table of participants' emotional responses.

Note:

Experimental group: There are 15 participants. In the process of designing with a computer-aided brand design model, their average pleasure reached 8.5 points (out of 10 points) and their average satisfaction reached 9.0 points (out of 10 points).

Control group: There are also 15 participants who use traditional design methods to design. The average pleasure of this group of participants is 6.8 points, and the average satisfaction is 7.5 points.

The above data that the participants in the experimental group are significantly higher in pleasure and satisfaction than the control group. This further verifies that the computer-aided brand design model can effectively improve the work experience of designers and make them feel more happy and satisfied in the design process. This improvement mainly comes from the intuitive and efficient design tools provided by the model and the design burden it can reduce. Figure 5 shows the efficiency of brand design.

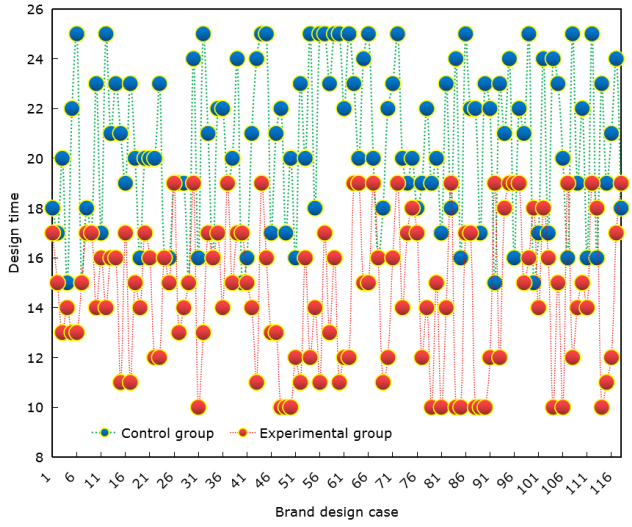


Figure 5: Efficiency of brand design.

The design completion time of the experimental group is shorter. This shows that the computer-aided brand design model can significantly improve the design efficiency, reduce unnecessary modification and adjustment, and thus save time and cost. Figure 6 shows the quality of brand design.

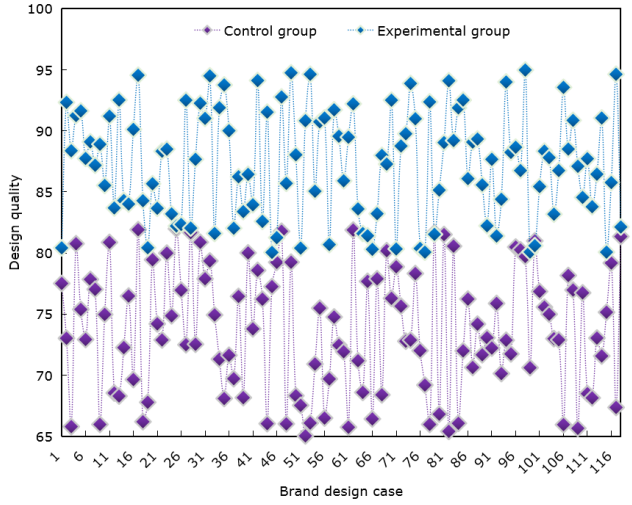


Figure 6: Quality of brand design.

4.2 A Survey of Consumers' Satisfaction With Brand Design

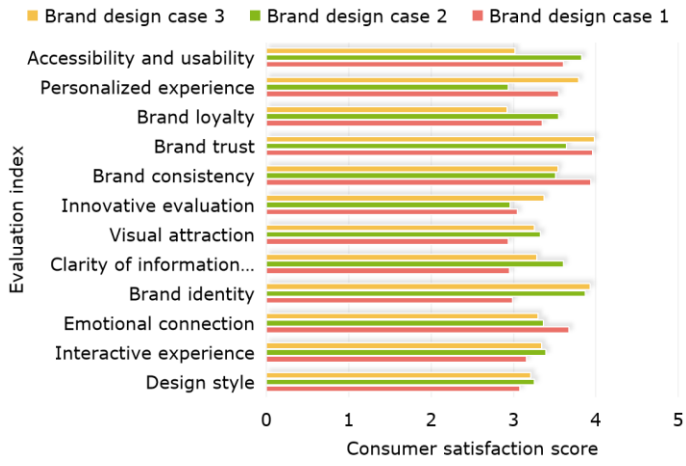
In order to deeply understand consumers' acceptance and satisfaction with the application of new technology in brand design, we conducted a survey on consumers' satisfaction with brand design. The respondents selected a group of representative consumers from different age groups, occupations and income levels to ensure the diversity and extensiveness of the sample. This article designs a detailed questionnaire survey, which includes many aspects of brand design, such as design style, interactive experience, emotional connection, and so on. The questionnaire uses a five-point scale, which allows consumers to rate each aspect from 1 (very dissatisfied) to 5 (very satisfied). The experiment group is as follows: consumers are divided into two groups. One is consumers who have been exposed to brand design with new technologies (VR and emotion recognition) (experimental group), and the other is consumers who have not been exposed to these new technologies (control group). After consumers completed the questionnaire survey, this article collected and sorted out all the data for subsequent analysis. Figure 7 shows the survey of consumer satisfaction with brand design.

According to the survey results shown in Figure 7, the following analysis can be drawn:

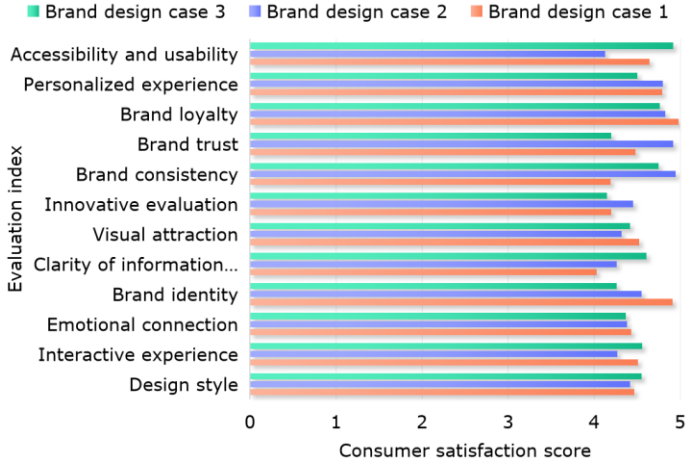
Satisfaction increased significantly: after adopting new technology, consumers' satisfaction with brand design increased significantly.

5 CONCLUSIONS

This study successfully constructed a computer-aided brand design model. Through rigorous simulation experiments, this model has shown remarkable results in improving brand design efficiency and consumer aesthetic experience. This model combines VR and emotion recognition technology to capture and analyze consumer emotional responses in real time, providing designers with more accurate design guidance. In the experimental results, we can see that the experimental group using this model is superior to the control group using the traditional method in many key indicators.



7(A) Control group



7(B) Experimental group

Figure 7: Consumer satisfaction with brand design.

More importantly, the positive changes in consumers' emotional responses have proved the remarkable effect of this model in improving consumers' aesthetic experience. This not only helps to improve the accuracy of design but also better meets the personalized needs of consumers. This is thanks to the immersive environment provided by VR technology, which allows designers to more intuitively understand consumer needs and feedback, thereby adjusting design direction faster. This model has significant advantages in improving brand design efficiency and quality. In the traditional design process, designers need to repeatedly modify and improve the design scheme, which consumes a lot of time and energy.

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