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Retraction

Retracted: Application of Virtual Reality Technology in Visual Optimization of Product Appearance Design

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Security and Communication Networks has retracted the article titled "Application of Virtual Reality Technology in Visual Optimization of Product Appearance Design" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

The authors do not agree to the retraction.

References

[1] X. Yan, F. Liu, and K. Mojtahe, "Application of Virtual Reality Technology in Visual Optimization of Product Appearance Design," *Security and Communication Networks*, vol. 2022, Article ID 2921116, 11 pages, 2022.

[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

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Research Article

Application of Virtual Reality Technology in Visual Optimization of Product Appearance Design

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Virtual reality technology is used in this research to perform an in-depth investigation and the analysis of visual optimization of product appearance design, as well as to adapt evolving technology to practical design. The breadth of virtual display technology may be further investigated, and software abilities can be enhanced by studying the virtual display of intelligent goods. The performance indicators of the product may be exhibited in an all-around manner via the virtual display, giving customers an intuitive experience and thereby stimulating consumers' desire to purchase. To achieve the research objectives of this paper, we first researched the professional positions of designers, operators, and product planners in related industries, and used the survey analysis method to compile valid data from the research results. And we conducted research and analysis on consumers of different age levels to derive different functional requirements of wearable products for different age levels, and compare and analyze the advantages and shortcomings of various types of smart wearable products in terms of their product presentation. The method refers to the product appearance design, making the product's functional attributes, user emotions, and other factors as the starting point, and taking the visual effect of color as the center of the design scheme conception, the designer first conceives the visual effect of color to meet the requirements of function and structure, constructs a three-dimensional form that echoes it, and then explores the comprehensive effect of color and form, and further considers and designs the color, material, and so on from the perspective of users, product function, and structure. Then, we explore the comprehensive effect of color and form, and further think and design color and form from the perspective of users, product function, structure, and material, and finally get the color and form matching and reasonable product appearance. This design method can break through the limitation of "filling colors with shapes" and design a new, individual, and emotional product image.

1. Introduction

Virtual reality is a relatively new technological sector that, like other emerging technologies, is continually growing and improving its technology as time goes on. This virtual technology based on new media methods has steadily been interwoven into many parts of our life, and we may now experience more diversified and new things as a result of it [1]. The virtual reality technology that has emerged as a result of this commercial climate is gaining traction. Its arrival has rendered old kinds of display outdated, resulting in the rise of new types of display. It has also made a disruptive shift from the traditional method of presenting changes in objects through data such as text and photographs. The user can manipulate the system in a virtual state of each object while enjoying the multiple senses of hearing, sight, and smell. Its display principle is to create a three-dimensional environment through the computer to simulate the reality of the entity and the performance of the movement of things changes, and the user can manipulate the system in a virtual state of each object while enjoying the multiple senses of hearing, sight, and smell. However, we should recognize due to the vast audience groups and reflect the difference in the degree of acceptance of virtual reality technology; today, information is the focus of our most attention and display design

as a form of art, and it is not only according to its value of spreading information and creating wealth but also to enhance the pursuit of good things; nowadays, we can say that the way to master the total letter [2]. We can say that there are various ways to grasp the total information, and the display platform is undoubtedly the fastest and most intuitive way to grasp the total information. Technology development to today human beings have not only satisfied with the pursuit of material, but emotional support also seems more important, and display design can be said to a certain extent. We can reflect the degree of the pursuit of a country's people. How to strive for the maximum attention and the transmission of the maximum amount of information in the exhibition process is now the central theme of the public exhibition designers.

Color concept is one of the core tasks of the product design method with color visual effect as the core, and its status is crucial, whether it can conceive a good visual effect that depends on the success of the design. The good color concept has the following two characteristics: the effect of the concept is three-dimensional, and although there is no clear form, there is still a spatial relationship, with product attributes, the user's esthetic needs, market demand, and other qualities; the effect of the concept is colorful and organized, different characteristics of the color in space in a certain order combined, forming a strong color relevance, and full of the visual impact of the color visual effect [3]. AR technology gives the product packaging more diversified forms of expression and can effectively express the characteristics of Chinese style packaging through a more scientific and reasonable expression. AR technology and modern culture organic integration to form a unique identification of Chinese style packaging will be an important direction to enhance the influence of national brands. The scope of visual identity design esthetics research is divided into three levels of content: theoretical visual identity design esthetics with the concept and composition of visual identity design, the esthetic properties, and characteristics of visual identity design, and the value of visual identity design esthetics as the main content; historical visual identity design esthetics with the influence of art style schools on visual identity design, the historical origin of visual identity design, and its influence on China; and the evolution of visual identity design beauty factors as the main content [4]. The esthetics of historical visual identity design and the esthetics of practical visual identity design, which aim to reflect esthetic creation and communication, include the basic elements of visual identity design esthetics and the judgment basis of visual identity design esthetic application. Theoretical esthetics refers to the general esthetic rule properties of esthetics, while practical esthetics is the study of how to practice specifically in the application situation, and theoretical esthetics has guiding significance to practical esthetics [5].

Brand visual identity design esthetics is the esthetic study of visual identity design practice activities following the concept and theory of branding and the esthetics of visual identity design beauty as the object of study, and it is the object of study, which is the relationship of esthetic creation and esthetic communication between the audience and visual identity design, that is, the esthetic interaction between the esthetic subject and the object. It is an applied esthetics theory that realizes the esthetic creation and esthetic communication and communication of visual identification design through the visual symbolization experience between the audience and visual identification design. Intelligent product display is very different from traditional product, no matter how to display images or text form of propaganda, cannot let people to establish a comprehensive product knowledge, even if the booth, according to the physical limited the range of its target consumers, while consumers can direct access to the product, the product has certain understanding, but for consumers is very limited. And there is an important issue to consider that this will increase the cost of sales of products. The virtual display is perhaps the best solution to this problem; the product display process can be completed on the full range of product display using virtual reality technology, allowing consumers to have a more intuitive and three-dimensional understanding of the product, and even design and customize their personalized products in the virtual environment, lowering or eliminating product design costs. For example, the number of items produced may be correctly forecasted, so product inventory can be controlled. For both businesses and customers, the virtual product display platform is a win-win situation.

2. Current Status of Research

The curve control method uses the coordinates of the key points of the two-dimensional contour for the quantitative mathematical description of the modeling, and its data acquisition method is simple and direct, but the obtained data only contain the local position information of the contour and lack the overall grasp of the modeling information [6]. The analysis and processing of the data are also limited to the position information, rather than based on the generalization of the overall modeling characteristics. Therefore, the technique suffers from a lack of ability to distill stylistic features. Cognitive psychology research has found that people have the observation and cognitive characteristics of recognizing objects before details, and their imagery cognition of modeling also shows the overall priority law [7]. The curve control method focuses on the local position information, so it cannot extract the overall modeling information associated with the imagery. As a technique of quantifying the overall shape of a product as a combination of local shape features of several different items and categories, morphological analysis is widely used in the design of two-dimensional imagery of products. Based on this technique, an imagery design system method for product 2D modeling is proposed and the feasibility of the method is verified by using a bicycle as an example [8]. Therefore, in the highly competitive global product market, applying cultural features to product design is becoming

increasingly important, and therefore, higher requirements are placed on the interpretation, extraction, and application of cultural elements in the design process [9]. From the consumer's point of view, consumers no longer focus solely on the form and function of a product in the process of purchasing it but include a series of cultural examination behaviors such as the cultural recognition of the product form and the consideration of the cultural value behind the product and the pursuit of its social value. From the designer's point of view, this also puts forward new requirements on the entry angle and design method of product design.

The wearable gear market continues to be separatist. In the smart space, pure technology giants will not succeed, and it will be difficult to unify the market in a short period [10]. However, as the virtual reality market will not impose limitations on the virtual reality design and technology space, wearables will develop uniquely. Their products evolve in multiple forms not only limited to single forms such as bracelets, watches, and glasses but also institutional layouts of products such as smart clothing and smart shoes, which enter the user landscape [11]. This type of research is mostly seen in studies designed for different specific things, such as the Web, product image, and city image. Because brand image design and visual identity design are similar in concept and are often used interchangeably, the search was conducted from both aspects to derive a more rigorous picture of the research results in the literature, and the search results also showed an overlap of literature. The top 20 most cited articles in the search for "brand image design" show that both brand image design and visual identity design are studied from the perspective of design processes and development methods as well as case studies of works, or are general summaries of design practices [12].

At the moment, there is still a lot of room for growth and research in the cloud application of smart wearable devices, and the smart terminal is not that old compared with many other nations. Wearable gadgets are more conducive to the interaction and transmission of information, which may speed the sharing of information readers, and if cloud technology can be created, the processing of information will be more convenient.

Wearable devices can achieve interaction with users through mobile phones and watches, rather than simply holding the hardware in the hands, so the industrial planning of passenger sets of equipment should not only consider the development and design of hardware but also add people to the layout of the public research and application so that consumers have a sense of pleasure of real-time interaction. The designer should not only grasp the external form and function of the product but also understand, consider, and review the cultural characteristics of the target group, to accurately grasp its cultural connotation, and re-evaluate, define, and innovate with the product, to adapt to the market demand, enhance the product recognition, and improve the consumer experience.

3. Virtual Reality Technology in Product Appearance Design Visual Optimization and Application

3.1. Analysis of Virtual Reality Technology for Product Design. VR technology allows designers to observe the work from different angles, discover the shortcomings of the product design, and optimize it [13]. At the same time, the virtual model created in the computer can also be used for prototype testing to verify the visual effect of the product appearance and the interactive operation of the product. The product appearance can be modified based on the evaluation results to improve the efficiency of the modification of the design scheme and reduce the risk of product development, and the finalized modeling data can also be directly applied to processing and manufacturing. Mainly for the production process of products with a relatively complex layout, it is a virtual assembly system. Using VR technology to visualize the layout of the product, we explore the reasonable layout and use the simulated design and manufacturing system for virtual production to verify the conjecture. Finally, we can obtain a scientific and reasonable product layout to guide the production steps to work closely together and improve the production efficiency and product quality. It mainly refers to the use of VR technology and 3D technology to create virtual roaming effects, and users can freely browse the appearance and structure of the product in the virtual environment, but also through the interactive experience of the functions provided by the product, without leaving home to get the experience in the mall or store, intuitive and comprehensive understanding of the product, to promote the sale of the product and enhance the image value of the enterprise. This study is an exploration of the application of VR technology to product design. As we all know, the three main elements of product design are demand research, solution design, and effect evaluation. The current VR technology is mainly applied in the evaluation stage, using virtual products, environment, and feedback sense instead of the traditional hand-board model for testing to optimize and improve the design. In this process, VR technology is only used as a platform for display, and its powerful immersive experience and high flexibility of interactivity still have a lot of room for exploration. The integration of VR technology into the construction of product design solutions will have a disruptive impact on today's product design methods.

$$D(i) = \frac{h(i)}{N}, \quad i \in [0, M-1],$$
$$\overrightarrow{ML} = \sum_{0}^{n} \mathrm{ml}. \tag{1}$$

VR technology has an unparalleled advantage in the presentation of spatial sensations, helping designers to quickly conceptualize color visuals and provide references to their corresponding forms; the computer-aided design is the last step before production [14]. Computer-aided design is the last step in the production process, and the accurate data model it creates can compensate for the roughness of Tilt

Brush's work and the lack of direct data output; the flexibility of hand-drawing allows designers to record their inspiration at anytime and anywhere, providing information for color conception in Tilt Brush. It is also the primary means of exploring the effects of color and shape. The combination of the three complements each other in a product design approach focuses on the visual effects of color as shown in Figure 1.

In Tilt Brush, the user experiences realistic light effects, allowing him or her to mobilize the body's light, kinetic, and three-dimensional perceptions to synthesize the perception of the virtual world, while VR technology provides the user with a four-dimensional world, including three-dimensional space, four-dimensional time, and personal interaction with the virtual world, where the user experiences realistic light effects, allowing him or her to mobilize the body's light, kinetic, and three-dimensional perceptions to synthesize the perception of the scheme [15]. The color concept is to be based on meeting the function and structure of the product. In the author's previous design practice, because of personal color perception and spatial imagination and other reasons, the use of hand-drawn color effects is almost always flat, and the function and structure of the consideration are not enough to build out the color effect, which is difficult to turn into the corresponding three-dimensional form and cannot continue to promote the design. Figure 1 is a series of color ideas of the author in the design of the appearance of the humidifier for the cafe, most of which are too diffuse, away from the consideration of product function, structure, materials, etc., and even some are purely flat color, such color ideas can only be used to explore the combination of color, for the real appearance of the design is weak.

$$J = M\left(x, \{w_i\}\right) + x,$$
$$\partial_1 \|c\|^2 \le \int_{t_0}^{t_0+T_0} \left|S^T(\tau)c\right|^2 \mathrm{d}\nu(\tau) \le \partial_2 \|c\|^2, \quad \forall_{t_0} \ge 0,\ c \in R^n. \tag{2}$$

Projection holographic displays are a technology that uses interferometry and diffraction to record and reproduce realistic three-dimensional images of objects. Holographic projection technology can not only produce three-dimensional aerial illusions but also enable illusions to be performed together with performers to produce amazing performance effects such as application range product display, car clothing launch, stage performance, interactive, bar entertainment, and interactive projection. Holographic projection technology has brought revolutionary changes to the choreography effect, which can show the audience a gorgeous and colorful stage effect, with the performance of the actors to bring the audience the ultimate viewing embodiment. The application of this holographic technology allows the audience to have a live experience in the world, as if crossing the boundaries of time and space. The movie industry adopts holographic projection technology to bring the audience a live embodiment of 3D technology, the picture becomes more realistic, as if in the world constructed by the movie to go, combined with sound and light information can create an immersive viewing experience [16]. The sales and service industry can also use holographic projection technology to bring unprecedented changes, and holographic projection of publicity will bring consumers into the world of products so that products and services stimulate consumers' desire to buy, as shown in Figure 2.

Product styling imagery is the user's emotional response triggered by the styling part of product appearance, and its positioning aims to determine the typical representative emotional response formed by the user to the overall styling sample of the target product and to quantify the output of the positioning results with several styling target imagery adjectives and their perceptual imagery evaluation data matrix. The scientific positioning of styling imagery is important for user-oriented perceptual product imagery styling design, and its output data can faithfully reflect the diverse emotional needs of consumers for product styling and provide reliable styling imagery data and clear design goals for data-driven product appearance imagery design. The positioning approach relies too much on the subjective experience evaluation of respondents, ignores the use of target product styling data in the process of styling imagery positioning, and suffers from loss of perceptual imagery information in the process, and results of clustering analysis cannot guarantee the coverage of multiple target imagery and cannot reflect the difference in importance between different target imagery. To better achieve the goal of stylized imagery localization, this section incorporates the mathematical models of 2D modeling and 3D modeling quantification into the stylized imagery localization process, and uses the objective data obtained after modeling quantification to participate in the construction of a comprehensive evaluation model of stylized imagery, and then finally achieves stylized imagery localization.

3.2. Product Appearance Design Visual Optimization Application. The evolution and development of visual identity design did not occur in isolation; the use of graphic systems in public places and transportation, in addition to corporate identity design and sporting events, was an important part of visual identity design at a time when art and design were undergoing great change. Visual communication design is a means of awareness and communication, a new way of being able to enhance the communication of human ideas [17]. The relevance of developing a graphic design system that incorporates graphics for the benefit of society as a whole advocates the use of symbolic graphics to communicate difficult economic and social concerns to the general audience. The Aesop System, short for International Graphic Education and Graphic Design System, is a graphic-centered visual communication system. The system was a collaboration between the Dutch government and designers and Neurath, who worked on the graphics they designed to find the best ones that conveyed the best function and were known and understood by most of the public.

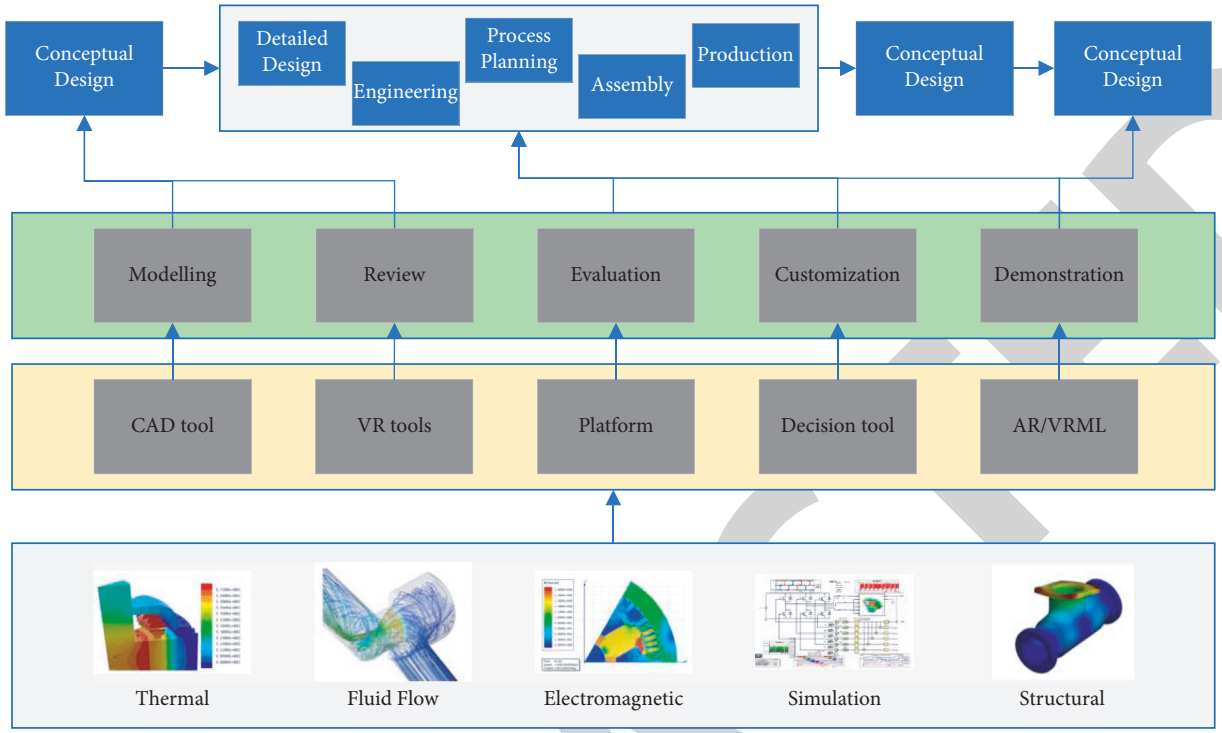

Figure 1: Product design process combining VR technology and common presentation methods.

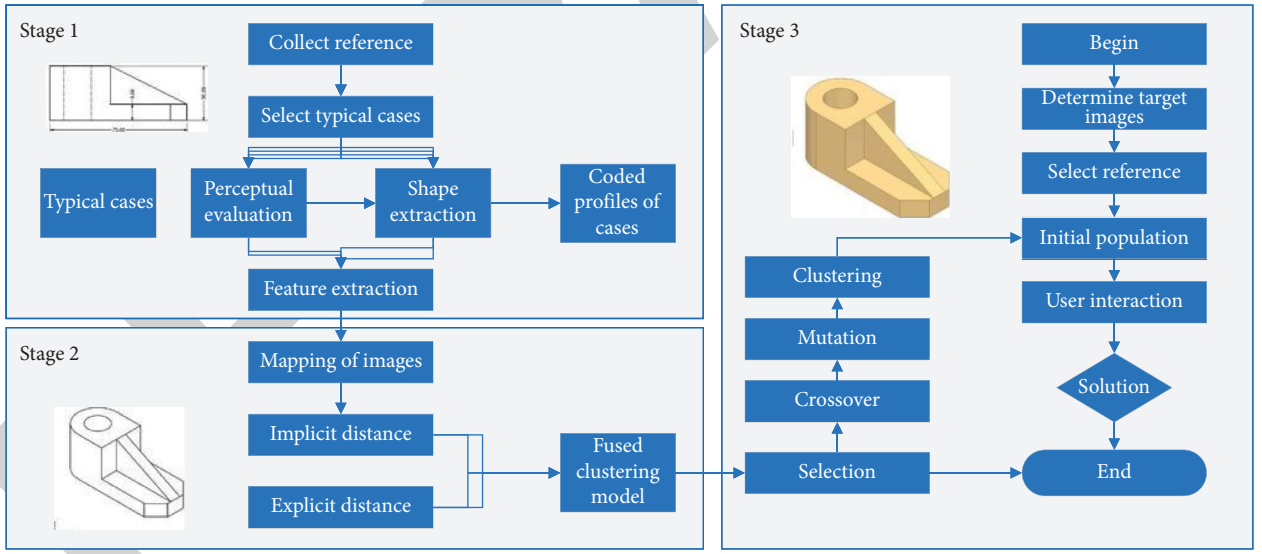

Figure 2: The process of positioning the imagery of the product shape.

$$P_{ij}^{N} = 1 - P_{ij},$$

$$ {}_{a}^{G}D_{t}^{v} f(t) = \lim_{h \longrightarrow 0} \frac{1}{h^{v}} \sum_{m=0}^{[t-a/h]} (-1)^{m} \frac{\Gamma(v+1)}{m!\Gamma(v-m+1)} f(t-mh). \tag{4}$$

The visual effect of VR technology is mainly composed of three main features: virtual reality, real-time interactivity, and 3D positioning. First, virtual reality can be the real environment in the computer monitor to get an effective display, after the user's physical operation can be virtual three-dimensional image presented in the current field of vision, the virtual environment, and the integration of the real scene high matching restore the virtual image in the real world of three-dimensional sense. Second, real-time interactivity can be developed from simple face-to-face computer single communication to put the user in the virtual environment, and virtual image for real-time interaction, from one-way interaction to extend the effect of two-way

interoperability communication. Finally, 3D positioning can complement the real scene in real time. For example, in video-based augmented reality systems, the video captured by the camera can be directly displayed on the monitor, so that users can identify the real scene in real time. The virtual video is shot by the virtual camera and transmitted to the monitor, and then through the virtual camera and physical camera all-round focus shooting, in the three-dimensional virtual space to freely track the positioning of virtual objects, and the visual effects extended to the entire virtual reality environment, to achieve the unified integration of the virtual world and the real environment so that users enjoy the ultimate visual sensory experience brought by the combination of reality, as shown in Figure 3.

The 3D modeling and color quantitative data reflect quantitative information about the product modeling features and color features, respectively [18]. To better realize the appearance of data fusion, it is necessary to analyze the differential characteristics between the two types of data first. In terms of three-dimensional modeling quantitative data, the principal component data obtained by the three-dimensional modeling quantitative mathematical model are numerical, generally expressed as continuous real numbers, and it should be noted that there may be large differences in the data outline between different principal components. In terms of color quantization data, the color data obtained by the color quantization mathematical model are also numerical, but generally expressed as discrete integers, and their data outlines are less different. Since real numbers can better measure variables with continuous variation characteristics compared to integers, they are more suitable for quantitative description of product 3D modeling and color characteristics.

The fundamental characteristic and aim need for the imagery design of product 3D forms are image-oriented 3D shape creation. The creation technique of product 3D imagery forms presented in this part is primarily based on the development of CVAE to concurrently meet the objective of producing new 3D shapes based on spherical harmonic coefficient reduction and generalization of the target imagery. Unlike traditional shallow neural networks, the multilayer neural network structure in CVAE gives it the advantage of expressing complex functional relationships more effectively, thus learning data features with stronger representational performance in high-dimensional data and exhibiting better data reduction and generalization generation capabilities, which are accomplished by the recognition network and the generation network of CVAE, respectively [19, 20]. Among them, the output of the recognition network realizes the downscaling of the spherical harmonic coefficients and assists in completing the modeling imagery localization, and the output of the generation network realizes the generation of new modeling data by combining external conditions. The target image-labeled data are used as the external condition, and the data are input to CVAE together with the 3D modeling principal component data to complete the generation of new 3D modeling following the established target image-labeled data. After completing the automatic calculation of the multi-objective optimal design module for product appearance, the generated Pareto appearance solution set is a collection of individual appearance solutions that contain the calculated scores of multi-objective imagery adjectives. To simulate the design process completely by computer, a multi-attribute decision method is required to complete the optimal decision of the appearance solution. The techniques used in the previous design modules have accumulated the advantages of product appearance design innovation and multi-imagery matching accuracy, and to consolidate the advantages and obtain accurate decision results, the optimal solution decision design module needs a multi-attribute decision method that can objectively use the multi-objective imagery adjective calculation score data to complete the automatic calculation, but also has strong operability and multi-technology integration, as shown in Figure 4.

In the design process, the color quantified data of the preliminary color schemes completed by the designers are substituted into the color imagery prediction model to calculate the color multi-objective imagery values of each preliminary scheme, and the optimization direction of the preliminary scheme is clarified by comparison with the color design objectives. In the process of clarifying the optimization direction, different color scheme design ideas are formed according to whether there is a consistent correlation between the key color variables and the multi-target imagery [21, 22]. If there is a consistent correlation, the correlation is used to adjust the key color variables to generate an optimized color scheme. On the contrary, the color multi-imagery preference model is used to complete the evaluation and preference of multiple preliminary product color schemes. After the optimization is completed, we determine whether the optimized color scheme meets the color design objectives. Let all the test subjects evaluate the target imagery of the optimal color scheme and observe whether the evaluation result is consistent with the design goal, and iterate again if it is not until the final color scheme with the evaluation result consistent with the design goal is generated.

Ergonomics is also a product development method, and the core of which is to guide consumers with certain perceptual information, to obtain a further perceptual evaluation of various aspects of the product, and to use quantitative engineering methods to transform consumers' perceptual information about the product into design elements that can be used in the design phase. In this process, perceptual engineering theories and methods can help consumers broaden their own emotional experience, fully express their feelings, and then guide consumers to express their subjective needs. For the designer, the designer can accurately obtain the consumer's feelings and potential needs based on the consumer's subjective evaluation of the product's appearance, color, material, and other aspects, to maximize the consumer's subjective needs and enhance their subjective satisfaction. Perceptual engineering is a quantitative method to explore the interrelationship between consumers and various design elements, transforming consumers' perceptual information about products into design concepts or specific design parameters, thus truly

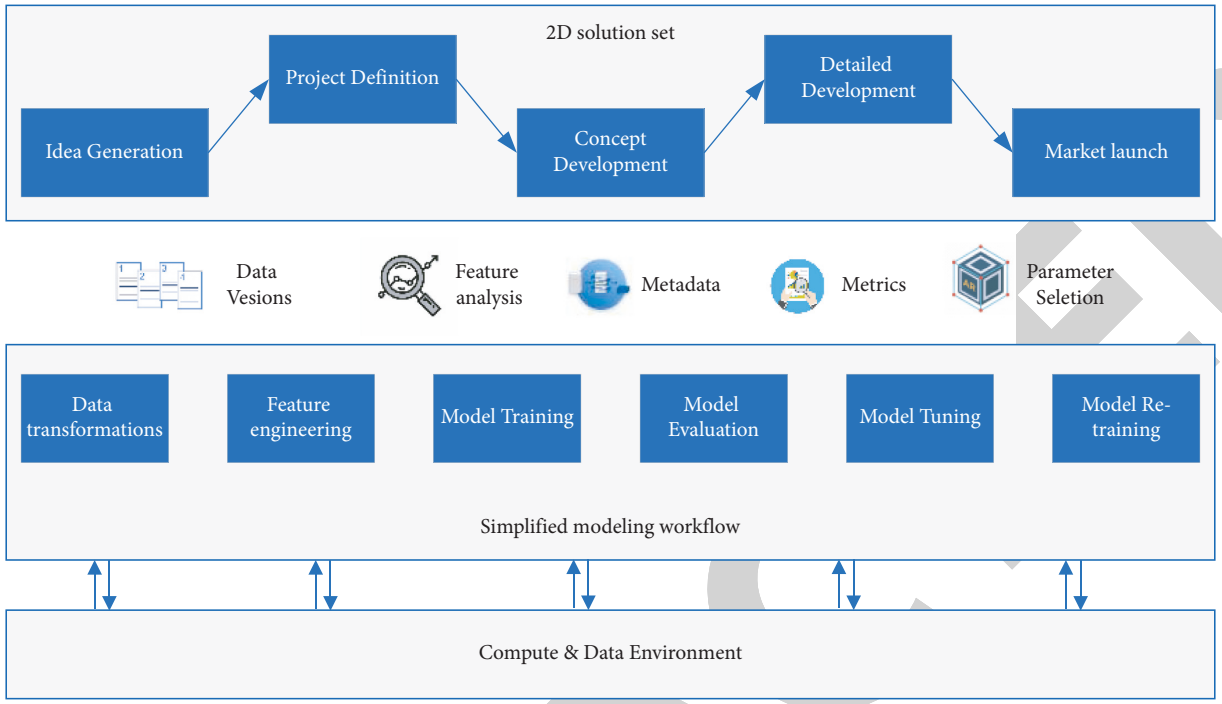

Figure 3: Image-oriented product 2D modeling generation and evaluation process.

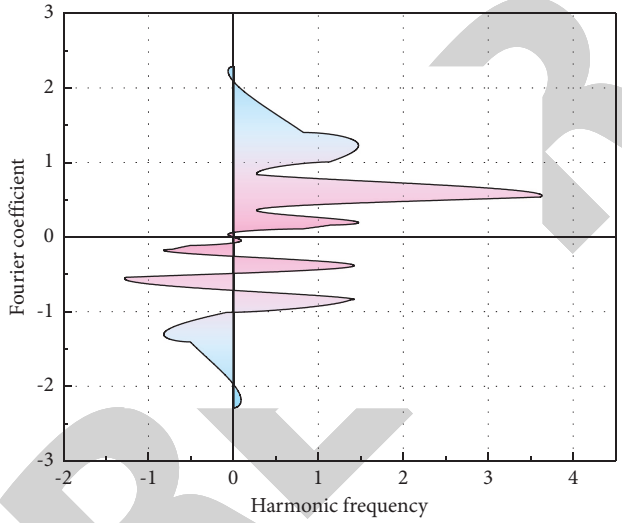

Figure 4: Elliptic coefficient of the profile.

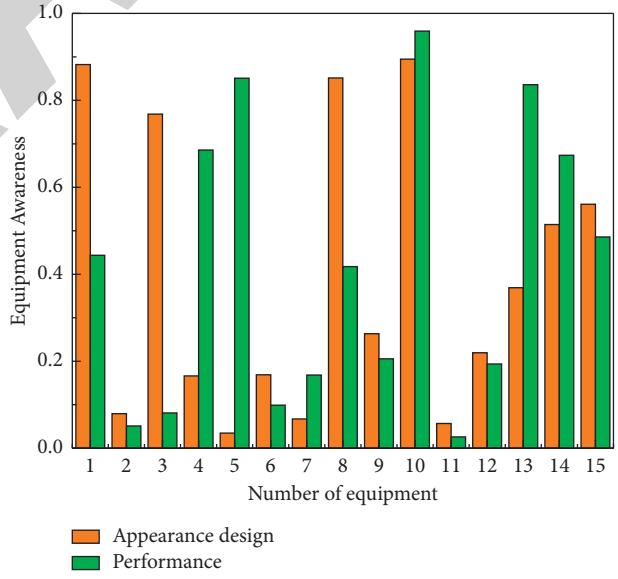

Figure 5: Cognitive intensity.

combining perceptual information with product or service elements for product design and product development from consumers' perceptual needs.

4. Analysis of Results

4.1. Performance Results of Virtual Reality Technology for Product Design. The user's experience should be at the forefront of product design. The user's sensory experience is primarily for the trial of the product in the display design and the usage of interaction design in the process of showing the scene, according to the research direction of the virtual display design experience. Interaction experience, sensory experience, and emotional experience are the three major experiences of users, and these three stages can be regarded as a process of experience from primary to advanced, and they are closely related, complementary, and mutually constrained. To stimulate users' desire to buy, we must design the means of the display to trigger users' identity and emotion, touch their psychological reaction, and make them purchase the displayed products. All the display design activities should be carried out around the premise of "user experience," which is the fundamental of the whole display design, as shown in Figure 5.

In the process of virtual display design, user experience design should be carried out in the heart, physiology, and use habits, and other aspects of comprehensive consideration, including visual, auditory, sensory touch, and another complete experience process. In the process of design, users should be able to resonate with the above aspects of use. The above research data show that the experience and evaluation of smart wearable products will be affected by a variety of factors, such as the user's gender, age, education level, and growing up the atmosphere and their preferences. When studying the user's experience, we should focus on. There is also the user's experience environment, such as the lighting effect of the space, the color composition of the space, and the stretching range of the space, which will have a decisive impact on the final experience. The third thing to pay attention to is the user's interaction experience; then, the primary need to first study the principles of ergonomics, interactive gestures, and the application of interactive means will affect people's psychological feelings and experience satisfaction. VR technology occupies a dominant position in the design of product appearance with color visual effects as the core, throughout the design process. This is the ideal form of application for the small-batch, customized production method promoted by smart manufacturing in which the product research, the conception of the color visual effect, the construction of the 3D form echoing the color effect, the exploration of the color and shape adaptation effect, and the final output of the design solution model are all completed using Tilt Brush, as shown in Figure 6.

The starting point of this design concept is that in the process of the previous commercial product display design, the traditional two-dimensional flat form of the display can no longer meet the actual needs of consumers. Its product display content information is relatively small, and Dan cannot be comprehensive, all-around to let consumers understand the full performance of the product. The new display methods are emerging, but most of them are not out of the traditional two-dimensional display method. In recent years, with the continuous progress of science and technology, virtual reality technology has gradually stepped into everyone's vision. Along with the continuous development of computer technology, the traditional pictures and videos can be stitched together with each other to form a real virtual scene, in the visual. It seems that you can grasp the subjective appearance of the product in a three-dimensional way, which is nowadays a kind of virtual reality technology is called panoramic image technology performance, and is the visual communication direction of a kind of new technology. The first thing that needs to be strengthened in the process of using advanced display methods to display products is to display the product's technical means, the intelligent product digital virtual, in the virtual scene to simulate the product's practical functions, and the use of software to note so that the consumer can be the first time and intuitive understanding of the product indicators.

4.2. Results of the Application of Visual Optimization of Product Appearance Design. Figure 7 shows the effect of

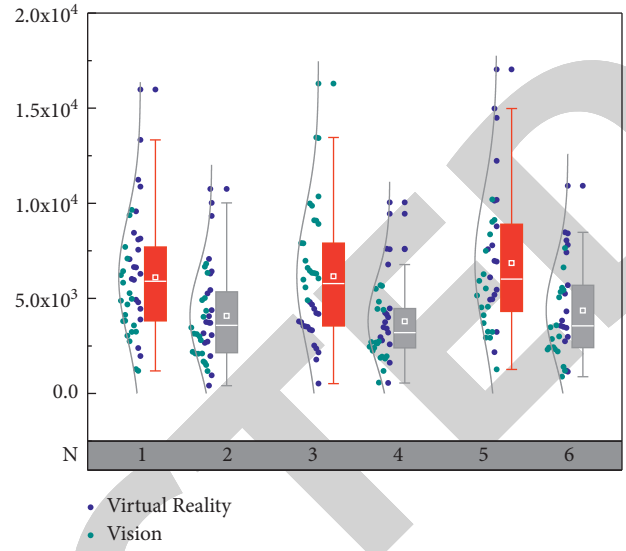

Figure 6: Target orientation.

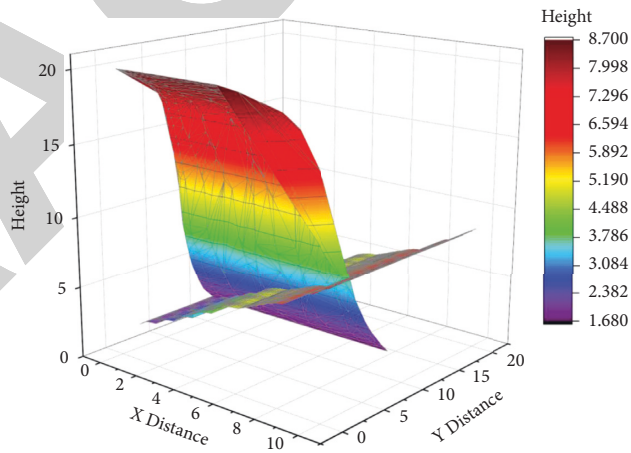

Figure 7: Fitting effect of different principal component scores for a random sample.

fitting the side modeling contours with different principal component scores for a randomly selected sample. Principal component 1 has been able to describe the overall characteristics of the original sample contour better, and only in local details, there are differences with the original contour. As the number of principal components increases, the fitted curves further approach the original contour in different localities, indicating that the other principal components also have significant effects on the contour localities. Combined with the variance contribution of each principal component shown in Figure 7, the cumulative variance contribution reaches 99.99% when the number of principal components is increased to 9, at which time the fitted profile overlaps with the original profile; that is, the elliptic Fourier coefficient matrix of the 20 overall samples can be expressed by downscaling to the data matrix of 9 principal components.

Both AIC and BIC demonstrated that the key component-based styling imagery prediction model

improved the accuracy of the styling imagery prediction model by preferentially selecting key components as fitting variables, and predicted all styling key imagery better than the commonly used linear evaluation models using other fitting variables. The elliptic Fourier coefficient data of the three creative car styling solutions were added to the overall sample data matrix of the benchmark car and the principal component scores were calculated, and the target imagery scores of the three solutions were calculated using the key component-based styling imagery prediction model. Further preprocessing of the sample 3D modeling was completed by computer-aided 3D design software to initially obtain the sample mesh data containing vertices and faces. The number of vertices and faces for each sample was set to nearly 20,000 vertices and 40,000 faces to standardize the 3D modeling mesh data for different samples. As a result, the MSDs are not the same for each sample when the minimum ADC is taken, so it is necessary to test to select the MSD with the optimal spherical parameterization result. After testing, the MSDs for each sample are finally determined and used to complete the spherical parameterization of the samples. After that, the coordinates of the spherical vertices mapped to the sample unit sphere were obtained.

After completing the spherical parameterization, the spherical Fourier transform is applied to the spherical vertex coordinates of each sample to obtain its spherical harmonic coefficients. In this process, by testing the visual effect of 3D modeling reconstruction for each sample at different harmonic frequencies, the ideal harmonic frequency l is determined to be 30. Figure 8 gives the 3D modeling reconstruction effect of this sample at different harmonic frequencies. With the increase of harmonic frequency, the surface features obtained by reconstruction become increasingly abundant and fine. When l30, the visual effect of the reconstructed model is sufficient to reflect the main 3D modeling features of the original model and the shape noise can be well controlled. Therefore, the spherical harmonic coefficients of the overall sample are calculated at this harmonic frequency.

The structural contours have most of the characteristics of the original contours and have very little noise. The normalized elliptic Fourier coefficient data for each sample are combined into a matrix, and principal component analysis is performed on this matrix to obtain a low-dimensional principal component data matrix, to ensure high accuracy reconstruction of the sample profiles, and to reduce computational complexity. The color application must pay attention to its special specificity, which has a different concept from the brand image-standard colors. For example, in some colors reflecting safety signs, red is used to indicate fire, rescue, and stop; yellow is used to indicate danger and warning and attention; and green is used to indicate environmental protection and safety. These standardized colors have become the worldwide common color identifying signals in public spaces and transportation. The unified textual information is conveyed in the visual communication and

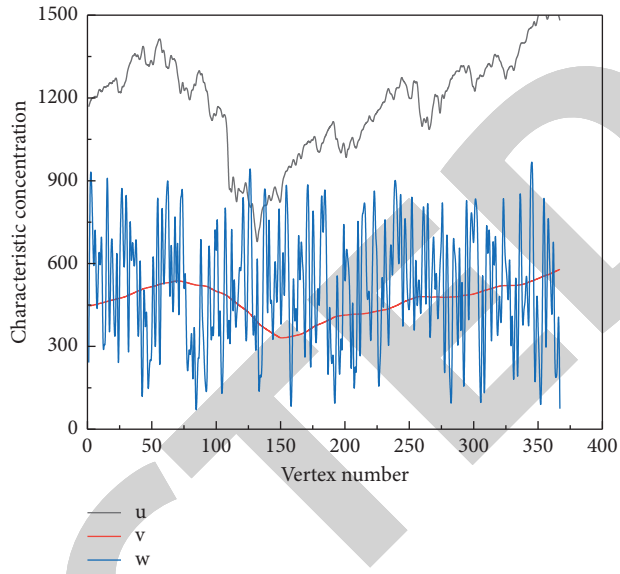

Figure 8: Application results.

communication of the brand by the unique textual representation, which reflects the independence and individual features of the brand image. The text primarily represents two aspects: standard font design and defined application font, as one of the most fundamental visual identity design systems. Standard word design mainly refers to the full name and abbreviation of the name of the standardized design of special text, also known as brand image-standard word, divided into full standard word and abbreviation standard word, where the abbreviation standard word sometimes also do linguistic signs to use; designated application fonts refer to the selection of one or more sets of fonts from the existing font library as the standardized and unified application fonts of the brand visual identity system can also be designed and developed separately according to the needs. A complete set of specified application fonts can also be designed and developed according to the needs. Brand fonts are widely used, covering almost all application design items in the visual identity design system, and are even more frequently used than logos and other graphic elements. It is mainly applied to natural information such as trade names, facility names, associated department names, addresses, and a wide range of textual information such as advertising campaigns and official documents. As the most common visual element that audiences or users meet, fonts play an important role in the establishment of brand image, carrying more functions of brand value communication, just like language, in the process of using many media, naturally and powerfully influencing people's thinking, and deepening the audience's impression of the brand, embellishing, and silent.

5. Conclusion

Virtual reality technology display method can make the smart wearable products, which do not need to consider

the display space and display time. Impact, we can provide users with a product display at anytime and anywhere can be simulated simulation scene, can be from all angles of the product construction and performance for a full range of understanding, and consumers can be based on their own needs for product features and configuration to choose, help enterprises to the market for different levels of division, and product coverage form development of more diversified, facing high, medium, and low end are consumer market. Through the example of the interactive function display effect of intelligent products, it is concluded that the virtual display form design from three-dimensional to two-dimensional production out of the design process, with the two-dimensional traditional display without interactivity, whether the product function module or product shape design can be done according to the consumer's own needs to choose, choose to complete the production by the manufacturer, that is, to save design costs, but also save display costs, to achieve the marketing of new products. The historical origins of visual identity design are examined, and the dissemination and development rules of visual identity design beauty at each stage are understood through the study of the development history, and the factors influencing the evolution of visual identity design are summarized and outlined from the development rules. The esthetic creation and esthetic communication are discussed and studied in depth based on practice, and the practical materialized development form of esthetics in the concrete operation of realistic visual identity design is discussed, which is the sum of the practical process and result as well as the esthetic goal to be achieved.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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