




The Application of Augmented Reality Technology in Brand Space Experience Design and CAD Collaborative Design

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Abstract. With the development and changes in economic forms, the demand for design experience in brand commerce is increasing, and traditional graphic decoration design can no longer meet the spatial needs of brands. The fashion and richness of the brand make the value of design presentation more and more complex. The spatial experience style is the product of the Internet information age. Based on the individual characteristics of the audience, providing them with a brand space experience can not only shorten the distance between the product and consumers but also promote effective communication between the two. Based on the above background, this article uses augmented reality technology to update the spatial experience of brand design presentation and further explores the effect of brand spatialization design application with the help of CAD computer-aided technology. Firstly, the main elements of brand space experience design will be analyzed, with the research direction of immersive display of augmented reality technology. Explore interactive strategies for brand spatialization design, use augmented reality AR technology to generate real-time virtual scenes, and seamlessly integrate brand concepts into the real environment through virtual and real integration. Secondly, consumer sentiment analysis on brand visual design will be conducted in a three-dimensional space, and the impact of augmented reality technology on user consumption behavior will be explored. Finally, combined with the CAD collaborative design, an auxiliary system is constructed to meet the needs of an augmented reality environment, efficiently completing the data analysis and design generation work involved in the process of realizing brand spatial experience.

Keywords: Augmented Reality Technology; Brand Space Design; Virtual Experience; CAD Technology; Collaborative Design

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1 INTRODUCTION

With the rapid development trend of cutting-edge tools such as big data, information technology, and artificial intelligence, they have been widely applied in various fields. The design and promotion of

brand visual images in the Internet era has changed in concept, media, and form. Barreda et al. [1] selected two major categories of brands, e-commerce brands, and cultural and museum brands, for comparative analysis of AR technology case studies. E-commerce brands mainly rely on the Internet platform for sales, which is the perfect brand field in Internet media. It has the advantage of learning from others. Propose some forward-looking opinions that can be used as a reference for the cultural and historic brand, which has strong inherent color and distinctive characteristics. Help enterprises in other fields represented by cultural and museum products to better adapt to the development requirements of the Internet era and carry out transformation design to a certain extent. Ben et al. [2] explored the significance of the research, the factors that influence it, and the optimization strategies for interaction density in brand space augmented reality collaborative design. Brand Space Augmented Reality Joint Design brings consumers an immersive brand experience by integrating physical space and virtual elements. In this process, the level of interaction density directly affects the degree of interaction between consumers and the brand, as well as the effectiveness of brand information transmission. Studying interaction density helps brands better understand consumer needs, optimize joint design solutions, and enhance brand influence and market competitiveness.

The use of augmented reality technology in the design and presentation of some brand industries has brought users an immersive experience and authentic interaction. In coastal cities, marine culture, as a unique tourism resource, also needs to keep up with the times in its tourism product brand design, fully utilizing modern technological means to enhance the experience and brand identity of tourists. Among them, CAD augmented reality technology, as an efficient and innovative design tool, is gradually becoming an important support for the brand design of marine cultural tourism products in coastal cities. Chen and Zhou [3] use specific devices to overlay designed virtual elements onto real scenes, achieving interaction between virtual and reality. In the design of tourism product brands, CAD augmented reality technology can provide designers with more intuitive and vivid design preview effects, helping them better grasp brand characteristics and market demands. This mode of interaction between people and virtual reality makes products clearer, more vivid, and more flexible in the eyes of consumers. At the same time, it can also display more internal details and increase consumer purchasing desire. It can be seen that the combination of e-commerce and augmented reality technology has become a key direction for the transformation of this industry and an important reference for brand design innovation. Different brands have different market positioning and consumer groups, so their needs and application scenarios for AR and VR technology will also vary. Hilken et al. [4] analyzed the need for brands to evaluate the applicability and cost-effectiveness of AR and VR technologies. Although both technologies can bring significant improvement effects to brands, there are also significant differences in their implementation methods and costs. VR technology typically requires expensive equipment and professional content production, while AR technology is relatively more flexible and cost-effective. Therefore, when choosing technology, brands need to comprehensively consider factors such as business scale, budget, and feasibility of technology implementation to ensure that the introduction of technology does not cause excessive pressure on brand operations.

In the design process, brand art should not only focus on people's requirements for modern aesthetics but also pay attention to the final presentation effect of brand design. More and more cross-cultural exchanges are making brand experiences more diverse. The fit between visual elements and brand concepts is an important indicator for evaluating the effectiveness of packaging design. In tea packaging design, it is important to ensure that the visual elements used accurately convey the brand's philosophy and values. If the brand emphasizes the concept of nature and health, then the natural elements and green tones of tea should be highlighted in the packaging design to reflect the core concept of the brand. Hu et al. [5] effectively conveyed brand concepts and values through symbolic visual expression. In tea packaging design, the use of visual language is particularly crucial. It not only attracts the attention of consumers but also enhances their awareness and memory of the brand through symbolic design elements. For a long time, brand experience design has mainly focused on text, images, sound, and video. Brand visual image design has become particularly critical in the Internet media. In order to make enterprises stand out, Mo et al. [6] studied the transformation strategy of corporate brand visual image design and promotion under the Internet

media. After using CAD collaborative design technology, networks, and various electronic devices to intervene in brand design and promotion, it is necessary to break the pattern and innovate. Grasp the new trends of micro-interaction, hand-drawn dimensions, and minimalist style in brand image design. The key to successful brand visual image design lies in breaking traditional thinking patterns and design concepts. Use the current Internet hotspot plan to integrate the advantageous resources, communication methods and characteristics of various media, and respond to the national policy action plan. Fully utilize the characteristics of the big data era to change the visual image design style and aesthetic concepts of traditional brands. The use of Internet media and new methods will affect the public's demand for brands, and the future development of enterprises will be unlimited. However, as consumers' personalized needs become increasingly apparent, their consumption concepts have shifted from a material level to a multi-layered fusion of material and spiritual elements. The spatial experience design of a brand has become particularly important as a place that can meet people's dual material and spiritual conditions. More and more enterprises have established brand awareness. In order to spread their own image and culture, and increase the stickiness of consumer groups, they not only build spatial experience design platforms on mobile terminals but also expand this immersive interactive behaviour to offline physical environments. Augmented reality (AR) technology, as an innovative digital means, plays an increasingly important role in collaborative strategies in the digital space of fashion brands, and its applications are constantly evolving and deepening. In the application stage of augmented reality technology, Park and Chun [7] utilized it for 3D product display and virtual fitting. Through AR technology, consumers can see the 3D model of the product on their mobile phones or specialized AR devices and even try to "wear" it on themselves, thereby gaining a more intuitive understanding of the appearance and effect of the product. This application not only enhances the shopping experience for consumers but also brings more marketing opportunities for brands.

Faced with the backdrop of consumer upgrading, the purchasing methods of the masses are becoming increasingly diverse, and the consumption process has shifted from simply obtaining goods to purchasing services and experiences. In the digital age, marketing methods are changing rapidly, and various innovative technologies are emerging endlessly. Among them, augmented reality (AR) technology is gradually becoming a new favourite of brand marketing due to its unique interactivity and immersive experience. Plotkin et al. [8] used augmented reality marketing to enhance brand image, shape unique brand personality, and attract and retain more consumers. For service brands, this means that brand concepts, service characteristics, and unique values can be presented to consumers more vividly and intuitively. Through AR technology, service brands can create unique brand images and stories, allowing consumers to feel the warmth and cultural connotations of the brand while enjoying services. For example, in the tourism industry, through AR tours, consumers can gain a deeper understanding of the history and culture of tourist attractions while also feeling the professionalism and dedication of tourism service brands. From this, it can be seen that brand space experience design, as a cross-border integration model in innovative development, can effectively compensate for the shortcomings of online brand design and offline entity integration and promote brand renewal and development. Prasad et al. [9] constructed a conceptual model of the relationship between augmented reality, experiential marketing, and brand assets to understand their inherent connections and mutual influence better. Augmented reality technology combines virtual elements with the real world to provide consumers with an immersive experience. The introduction of this technology enables experiential marketing to be no longer limited to traditional offline or online models but to create more diverse and multi-dimensional interactive experiences. Consumers can interact more deeply with the brand through AR technology, understand the characteristics and advantages of the product, and thereby enhance their awareness and favorability towards the brand.

Augmented reality technology and CAD collaborative design, such as the ability to apply computer-generated virtual scenes or systems to real scenes and meet the demand for enhancing the real world, have become the main medium for people to obtain information and experience interactive experiences. Augmented reality AR technology has numerous application scenarios which can meet people's multi-dimensional visual enjoyment in the real world. With the advancement of technology and the pursuit of immersive experiences by consumers, augmented reality (AR)

technology is gradually penetrating various fields. Especially in brand space design and marketing, it plays an increasingly important role. In the juxtaposition space, augmented reality collaboration not only brings a brand new way of presentation but also profoundly affects the needs and characteristics of the brand space. Radu et al. [10] conducted an in-depth investigation and analysis of the brand space needs and characteristics of augmented reality collaboration in juxtaposed spaces. Juxtaposition space refers to an area where multiple spaces with different functions or attributes are interconnected and mutually influential. In such a space, augmented reality technology can create a more diverse and multi-dimensional display and experience environment for brands through the superposition and interaction of virtual elements. By enhancing real-world collaboration, brands can achieve deep interaction with consumers in juxtaposed spaces, enhancing brand image and awareness. These visual elements optimized by augmented reality technology innovation have advantages that are more in line with human visual perception in real scenes. Therefore, augmented reality AR technology can become a core tool for scene construction after the integration of physical space and brand products. Based on this, this article also utilizes augmented reality technology and CAD collaborative strategies to optimize the design effect of brand space experience and analyzes their practical applications.

2 THE CURRENT DEVELOPMENT STATUS OF AUGMENTED REALITY TECHNOLOGY AND CAD TECHNOLOGY

Building brand loyalty is crucial in the luxury retail industry. Brand loyalty not only means repeated purchases by consumers but also represents their deep recognition and word-of-mouth dissemination of the brand. In today's digital age, CAD collaboration strategy, application marketing, and brand experience have become the three key elements for building brand loyalty. Shahid et al. [11] analyzed through CAD technology that retailers can achieve efficient collaboration with suppliers and other parties. Ensure that every step of the product, from design to production, is precise and error-free. This collaborative design not only improves work efficiency but also ensures the high quality and uniqueness of the product. For luxury consumers, the quality and uniqueness of products are important factors in their brand selection, and CAD collaborative strategies are the key to ensuring these factors are realized.

In the context of the digital Internet era, science and technology have developed rapidly, and the continuous iteration and subversion of brand visual image communication media have spawned a large number of Internet media channels, making the form and carrier of its promotion more diversified. After participating in brand design and promotion with computer technology, networks, and various electronic devices, the design and promotion form of the brand visual image needs to be innovative and more suitable for the characteristics of online media. Silva et al. [12] summarized the relationship between brand visual image design and promotion and Internet media through theoretical analysis and case study. Explore the new needs and key points of the brand's visual image at the design level. Explore how to combine more innovative ways of expression, multi-channel cognition, and interactive communication experiences with brand image. And put forward specific methods and strategies for the transformation of brand visual image design and promotion under the Internet media. Help brands better integrate into the Internet reciprocal family and promote brand image design to enter the professional design promotion stage in the era of rapid development of the Internet. Brand visual image design and promotion require more attention to meet the needs of the times. The widespread use of Internet media, the impact of digital social life, and the emergence of new technologies and new technical means have subtly affected everyone's way of thinking and aesthetic experience. With the development of the digital age, the design of the brand's visual image is constantly expanding in-depth, and many new digital application areas need to be designed. The inherent brand image design thinking and normative model under the rigid model in the past can no longer be applied in the new field of the Internet, let alone fully meet the actual needs of design [13].

In the research of brand design and promotion methods and strategies under Internet media, we have taken classic successful brand cases from different fields and different backgrounds. Wang et al. [14] compared the Wenbo brand and the Internet brand in different fields by analyzing successful

cases in different fields at home and abroad. The visual communication characteristics, development prospects, and impacts of the brand's visual image on the Internet platform compare traditional brands with brands that have successfully carried out Internet communication. It can be clearly seen that the role of Internet media publicity has made a qualitative breakthrough in the brand. With the change in media, brand image has also undergone strategic changes. More and more enterprises attach importance to brand communication strategies in Internet media, which lays a theoretical foundation for later methodology. In brand space assembly, AR technology can display the position, direction, and attributes of assembly components in real-time, helping assembly personnel quickly and accurately complete assembly tasks. Brand space assembly not only requires assembly personnel to have rich experience and skills but also requires them to understand and identify the designer's assembly intentions accurately. Visual communication technology conveys brand concepts and product information to consumers through visual elements such as images, colours, and words. In brand product design, these visual elements not only shape the appearance image of the product but also convey the brand's values and cultural connotations. Through clever combination and collocation, visual communication technology can create a unique brand atmosphere so that consumers can feel the difference and uniqueness of the brand for the first time [15]. Augmented reality (AR) technology is gradually penetrating into every aspect of our lives, among which the fashion brand field is an important stage for them to showcase their strength. From the perspective of user experience design, augmented reality technology has brought unprecedented changes and opportunities to fashion brands. Xue et al. [16] enabled consumers to see virtual clothing, shoes, or accessories on their mobile phones or specialized AR devices through AR technology. And try to put it on yourself. This virtual try-on not only saves consumers time and energy but also improves shopping satisfaction and conversion rates. In addition to the shopping experience, augmented reality technology can also bring richer interactive experiences to fashion brands. Through AR games, interactive exhibitions, and other means, brands can establish closer connections with consumers and enhance brand awareness and loyalty.

With the increasingly fierce market competition, the speed and quality of brand product development have become key factors for enterprises to gain competitive advantages. Yang et al. [17] mainly studied the new design performance of brand visual images under the Internet media, the new development trend of communication and promotion, and new methods and strategies. Help enterprises build the driving force and influence of brand image communication under the Internet media and promote the long-term continuous development of enterprises. The analysis obtained the new demand characteristics and new development trends of the brand image under the Internet environment. Digital media, such as Internet thinking and digital interactive devices, can be used to enhance users' perception of the brand's visual image. Spread the influence of the brand and promote its development and transformation from both purpose and function. It explores how to use these novel media methods as carriers for brand visual image design and promotion. Zha et al. [18] analyzed the brand-building framework of augmented reality. It has conducted an in-depth exploration of the cognitive level in this field. It provides an in-depth understanding of consumer behaviour characteristics and preferences in the AR environment to guide brands on how to meet their needs better. Brand experience design explores how to design effective brand experiences in the AR environment to enhance consumer perception and evaluation of the brand.

3 APPLICATION OF AUGMENTED REALITY TECHNOLOGY IN BRAND SPACE EXPERIENCE DESIGN AND RESEARCH ON COLLABORATIVE STRATEGIES WITH CAD TECHNOLOGY

3.1 Research on the Application of Augmented Reality Technology in Brand Space Experience Design

Since the rapid development of the information age, the physical industry has been impacted by online network sales. The sales revenue of brand entities is getting worse and worse, even experiencing negative growth at one point, which has had a significant impact on the economic development of enterprises. Therefore, innovating brand design, achieving cross-border integration,

improving brand spatial experience display, and creating brand spatial experience scenes from the perspective of diversified integration have become the main ways to solve the above problems. We use statistical methods from the database to analyze the changes in the number of studies on brand space experience design in various countries:

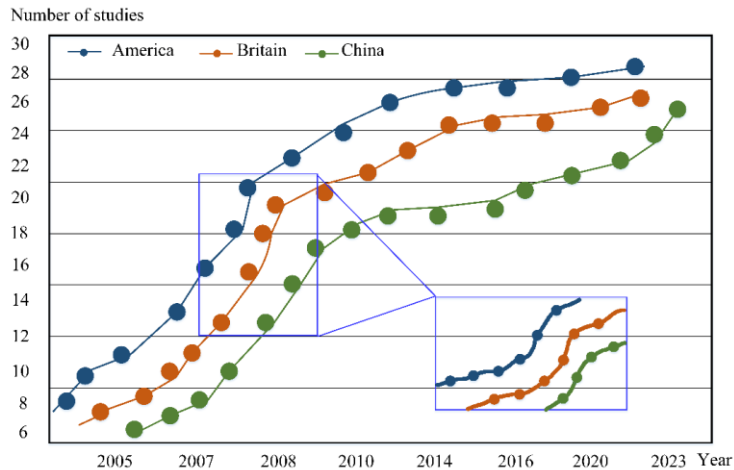


Figure 1: Changes in the number of studies on brand space experience design in various countries.

As shown in Figure 1, the United States has conducted research on brand space experience design relatively early. Since 2008, most countries have invested significant efforts and costs in the research of brand space experience design, and the number of studies on this project has also shown a cliff-like increase. The design of physical brand space, as the most direct contact scenario between consumers and brand owners, has become a key link in improving the speed of brand development. In this study, augmented reality (AR) technology was used. Due to the large proportion of visual perception in the public experience, AR, as the main means of enhancing visual elements in real scenes, is particularly suitable for the brand space design needs in the current digital era. Augmented reality technology can integrate physical space with product information, forming a three-dimensional space for virtual and real interaction. Compared to the shortcomings of traditional virtual reality environments that are disconnected from reality, AR technology can bring a new extension space for brand image design, and allow users to combine virtual scenes with reality, obtaining a more realistic experience. In addition, the interactive environment constructed by augmented reality technology can visually adjust real-time data, allowing brand space designers to comprehensively understand the changes in interaction information between products and users.

In the construction of brand space experience, it is also necessary to consider the subjective feelings of users. Utilize rich spatial elements such as materials, lighting, and guidance methods to create high-quality interaction with multiple senses. In the visual experience design of brand space, in addition to using scenario-based design thinking, it is also necessary to create a shopping atmosphere that meets consumer aesthetic needs, thereby stimulating consumer identification with the brand. Plan the brand space using elements such as brand logo, pattern, colour, shape, etc. to make its interior more personalized. Enhance the sense of brand space scene, enhance the difference with other brands, and gain a competitive advantage. We use augmented reality AR technology to allow consumers to try on various virtual products in the store, create product interaction areas that are perceived in the first person, and simulate the process of product use. This method not only enhances sensory perception but also provides visual feedback on timely wearing effects in virtual scenes. Therefore, under the influence of self-reference, brand experience has a more significant impact on consumer purchasing power. We compare the changes in brand space experience design

before and after optimization using augmented reality technology in terms of influencing consumer purchasing desire:

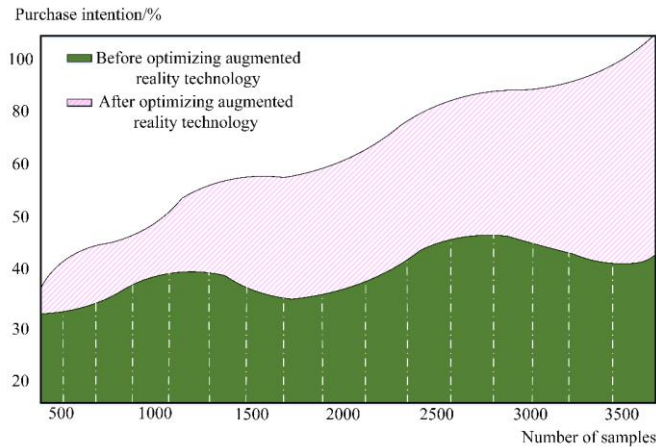


Figure 2: The impact of brand space experience design on consumers before and after augmented reality technology optimization.

As shown in Figure 2, as the number of data samples continues to increase, more consumers exhibit a strong desire to purchase in the brand space experience environment optimized by augmented reality technology. It can be seen that this AR brand space experience process allows consumers to view the changes in their self-image in the virtual environment without restrictions. Encourage consumers to re-examine the details of brand products and actively participate in brand product purchases. Next, we will explore the application effect of augmented reality technology in brand space experience design from the changes in user emotional experience. The framework diagram of the emotional survey model for brand space experience is as follows.

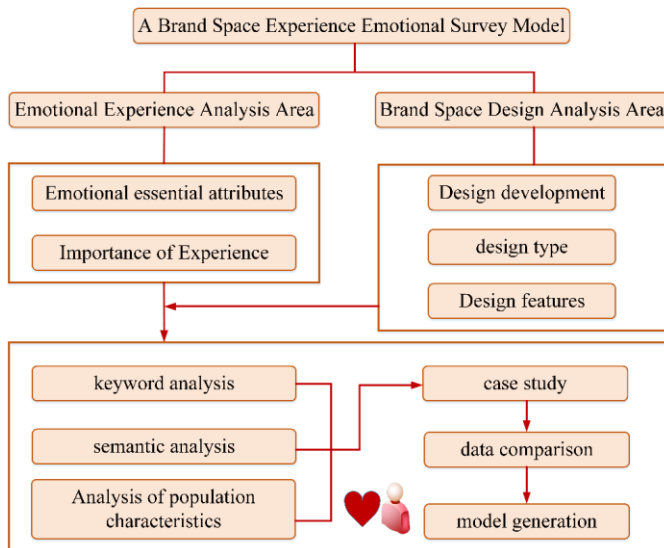


Figure 3: Framework diagram of emotional research model for a brand space experience.

As shown in Figure 3, the emotional analysis model for brand space experience design includes two parts: emotional experience analysis and brand space design analysis. Emotional experience analysis includes the essential emotional attributes of consumers and the importance of experiences. The analysis of brand space experience design includes the development, types, characteristics, etc. of brand space design. By comprehensively evaluating the results of semantic analysis, keyword analysis, and crowd characteristic analysis, a user-emotional change system for brand space experience design is constructed. The emotional activity of users in the system is represented through three-dimensional information. This system can also analyze the psychological changes and emotional characteristics of consumers in order to obtain the correlation with the brand space experience and dynamically adjust the brand space image design scheme. Research has found that the layout, material, structure, and colour in brand space experience design have the greatest impact on consumer perception. In the future, we will combine CAD collaboration strategies to enhance further the impact of augmented reality technology in brand space experience design.

3.2 Research on the Construction of a Brand Space Display Auxiliary Design System Combining CAD Technology and Augmented Reality

The noun concept of brand space experience design is used to describe offline physical stores with certain creativity and unique style. They take brand culture as the starting point and combine various technologies to communicate with users in the brand experience process. These stores that pursue a sense of brand space experience are different from ordinary brand specialty stores in terms of design schemes, product placement, and other aspects. Brand space design usually consists of a brand display area, interactive communication area, and media intermediary area. In order to meet the augmented reality needs of brand space display, we use CAD collaborative strategies to optimize and enhance it in our research. CAD technology itself has strong data calculation and image processing analysis capabilities, which can help designers analyze and design products from a multidimensional spatial perspective, making design schemes more reasonable and shortening the design cycle. The traditional CAD design process takes place in a completely virtual environment, and the immersive experience of this virtual environment deprives designers and consumers of the characteristic of realistic orientation. The collaboration between augmented reality technology and CAD can combine reality and virtual experience, embed virtual objects into real space, and achieve interaction between users and products. We will showcase the workflow of augmented reality scenarios optimized using CAD collaborative strategies as follows:

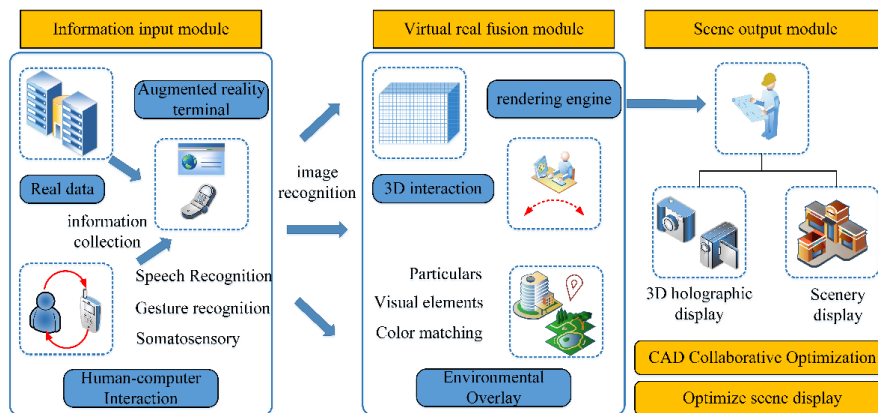


Figure 4: CAD Collaborative Design Optimization for Augmented Reality Scene Workflow.

As shown in Figure 4, the workflow of the joint integration of augmented reality and CAD technology includes the input of data information, the fusion of virtual reality, and the final product display stage.

Firstly, collect multimedia data such as text, images, audio, and video from real-world data in the input system. Input the obtained information into the augmented reality system terminal and incorporate various functions such as human-computer interaction, pattern recognition, and gesture experience. Secondly, in the integration module of virtual and real space, emphasis is placed on the visual design experience of 3D multi-dimensional interaction. Optimize the 3D virtual space using rendering invisibility and other auxiliary processes, and overlay the position coordinates of the virtual scene with the actual real scene. Finally, in the finished product display output, consumers are required to wear holographic display aids to achieve interaction with the product in specific spatial lighting. In our research, we use CAD technology to measure the two-dimensional plane benchmarks oriented in the design to ensure the restoration of the most realistic real-world scene in the AR environment. Firstly, use CAD technology to quickly extract the visual feature point elements needed in the brand space. Using feature point detection algorithms to incorporate the calculation results into the training model. In the training model, the position information of feature points has a certain vector relationship with surrounding pixels, and the formula is defined as follows:

$$m_{pq} = \sum_{x,y \in r} x^p y^q I(x,y) \quad (1)$$

Among them, $I(x,y)$ the grey expression represents the feature pixel image, and the image centroid formula is:

$$D = \left(\frac{m_{10}}{m_{00}}, \frac{n_{01}}{n_{00}} \right) \quad (2)$$

$$\theta = \arctan \left(\frac{m_{10}}{m_{00}} / \frac{n_{01}}{n_{00}} \right) \quad (3)$$

$$\theta = \arctan m_{01} / m_{10} * (n_{01} / n_{10}) \quad (4)$$

The vector information obtained from this is the distribution direction of the feature pixel in the overall angle. The main purpose of CAD technology in collaborative adjustment is to calculate feature descriptions. In addition to selecting feature points, it also includes group pixel data bounded by the centre point range, comparing the grayscale values of each group in the design image:

$$\tau(p,x,y) = \begin{cases} 1: p(x) < p(y) \\ 0: p(x) \geq p(y) \end{cases} \quad (5)$$

$$p_i, q_i (i = 1, 2, \dots, n) \quad (6)$$

In the formula, $p(x)$ represent the grayscale coefficient of each pixel centre, and then obtain the binary calculation formula for the next step:

$$fn(p) = \sum_{1 \leq i \leq n} 2^{i-1r} (p, x_i, y_i) \quad (7)$$

Next, we will add the 3D geometric formula detection method to the CAD collaboration strategy to analyze the spatial variation parameters of the design. The formula for ordinary 2D plane design after changes is as follows:

$$x \sin \theta \cos \omega + y \sin \theta \sin \omega + z \cos \theta = r \quad (8)$$

$$0 \in (x, \pi), \omega \in (-\pi, \pi) \quad (9)$$

$$r \in (0, \text{Max}(p_{-1}, p_{-2} \dots p_{-n})) \quad (10)$$

In the formula, r the distance from the centre of the plane to the centre point of the space. In order to improve the success rate of integrating virtual scenes and real environments in brand space design, we have also added a mechanism of virtual real registration in the AR environment. The trajectory calculation method is used to monitor the real-time movement data of the device's position, and the formula is as follows:

$$E_k = E_0 + \sum_{n=1}^K d_n \sin \theta_n \quad (11)$$

$$N_k = N_0 + \sum_{n=1}^K d_n \cos \theta_n \quad (12)$$

In spatial design, irregular geometric shapes such as arcs and curves are often encountered, and most scenarios require CAD systems to output data on arcs. Due to the large number of feature points involved, we define the formula for calculating the function of arcs:

$$(x - x_0)^2 + (y - y_0)^2 = r^2 \quad (13)$$

Given a radius coefficient suitable for most scenarios, define the entire circle function:

$$F(x, y) = (x - x_0)^2 + (y - y_0)^2 - r^2 \quad (14)$$

Finally, a smooth curve generation control mechanism is added to construct an irregular curve in space with any three points as coordinates for output. Draw these pixels that meet the connection point conditions, and the general generation formula is:

$$p_i^k = \begin{cases} p, k = 0 \\ (1-t)p^{(k-1)} + p_{(i+1)}^{(k-1)}, k = 1, \dots, n, i = 0, \dots, n, n - k \end{cases} \quad (15)$$

The calculation results of the above formula can meet the data requirements for irregular curve and shape drawing in CAD-assisted augmented reality space generation. The application of collaborative strategies in augmented reality systems using CAD technology can help brand space experience design become more realistic and have potential value in various functions such as brand image display, product interaction design, and leisure shopping assistance.

4 APPLICATION OF AUGMENTED REALITY TECHNOLOGY IN BRAND SPACE EXPERIENCE DESIGN AND ANALYSIS OF CAD COLLABORATIVE DESIGN RESEARCH RESULTS

4.1 Analysis of Research Results on the Application of Augmented Reality Technology in Brand Space Experience Design

In the context of the transformation of consumption patterns, most consumers pursue more diversified and personalized consumption experiences. The shopping process has also shifted from simply obtaining goods to obtaining shopping experiences and services, focusing on sensory changes in brand purchases. Traditional brand space design is no longer able to meet the spiritual needs of consumers. This article takes eyewear brands as an example to explore the process of realizing and optimizing the spatial experience of eyewear brands in the research. The eyewear brand itself can extract facial features from buyers, obtain user-related information, and import it into the brand's self-developed adaptation system. The augmented reality system we have designed can adjust the structure of the glasses based on the provided data parameters, making it perfectly match the consumer's face and improving the comfort of brand wearing. Due to differences in the degree of the left and right eyes of some users, as well as differences in the choice of lens weight, it can also affect the wearing experience. So we are building an enhanced try-on display area that combines virtual reality, bringing consumers a brand new shopping experience. This design concept combines the dual ideas of sensory perception of actual objects and non-sensory perception of imagined objects. From a technical perspective, it not only increases the deep interaction between customers and products but also enhances the sensory dimension of users when wearing trial glasses. In order to verify the effectiveness of the research application, we asked different participants to wear glasses provided in the display area of the brand space experience design and brand glasses provided by manual sales, and explored the degree of matching between the actual glasses and their facial features, as shown in Figure 5.

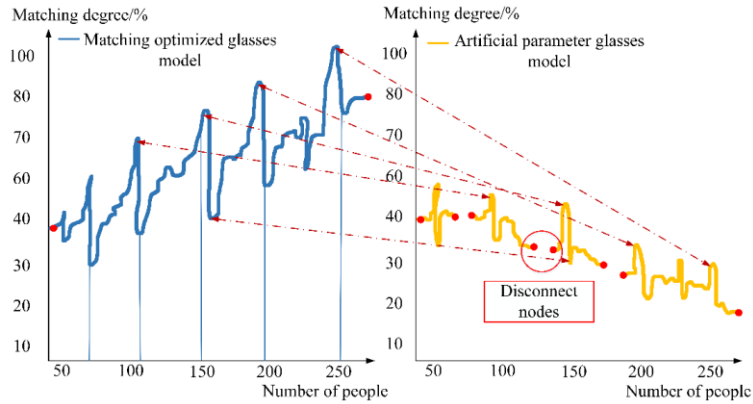


Figure 5: Changes in the degree of matching of facial features under different wearing environments.

From Figure 5, it can be seen that the glasses-wearing model provided by the brand space experience design area optimized using augmented reality technology can match the user's face to a great extent, while the glasses model provided by ordinary manual parameter adjustment is prone to matching errors and even matching disconnection, which is not suitable for a certain group of people to use. In addition, the visual elements in brand space experience design are also an extension of the brand's visual image in multidimensional space, which can transform two-dimensional planes into three-dimensional environments and help effectively display the brand image. The lighting settings and design material selection in the spatial experience will have an impact on the consumption behaviour of users of different brands. We use data graphs to compare the impact of the two on consumer shopping tendencies:

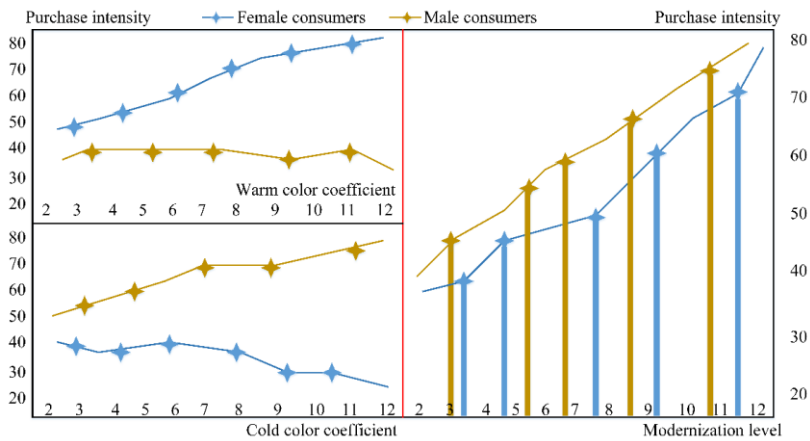


Figure 6: The impact of the two on consumer shopping tendencies.

From Figure 6, it can be seen that in brand space experience design, when the lighting setting tends towards warm colours, female shoppers have a greater purchasing tendency, while when the lighting setting tends towards cool colours, male consumers have a greater purchasing power. In brand space experience design, the more materials conform to the modern and technological index, the greater the purchasing desire of consumers of both genders.

4.2 Analysis of Research Results on the Construction of a Brand Space Display Auxiliary Design System Combining CAD Technology and Augmented Reality

The brand display area is an important component of the brand space design function, used to convey brand design concepts to consumers and display products. This pursuit based on brand space experience places more emphasis on humanized emotional expression and spatial structural matching. In addition to satisfying the consumer experience of the audience in the brand space, it can also provide consumers with the joy of interaction and communication. It is precisely because more and more brands are pursuing space experience design that sales stores are no longer just commodity venues, but gradually forming community-based consumer activity spaces. Before using the CAD collaborative design to optimize the augmented reality system, this article first downloaded the AR 3D spatial mapping module and entered the 3D modelling area from the virtual space options. Secondly, annotate the graphic output, combination view settings, visual element attributes, and other contents included in the modelling to ensure that the design efficiency can be improved in generating the brand space experience design model. Finally, we place cameras and other recording devices in the generation site, combining virtual benchmarks with real space. We randomly capture virtual benchmark data and analyze whether the virtual item points in the augmented reality scene optimized using CAD technology match the actual brand space content:

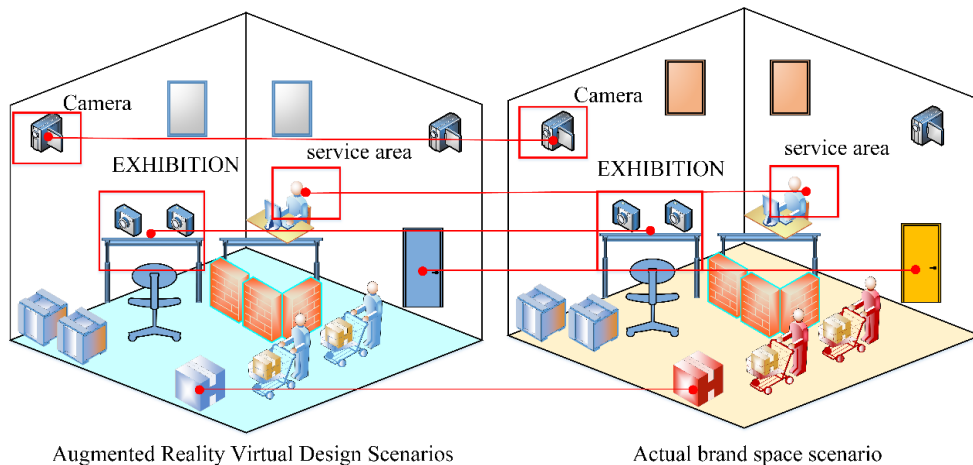


Figure 7: Comparison between augmented reality scenes and actual scenes optimized by CAD technology.

As shown in Figure 7, the augmented reality scene improved by using CAD collaborative design can highly overlap the virtual placement details in the design model with the actual item positions in the generated space. This not only improves the system's practical application ability after generating design results but also reduces the error defects between conceptual design and actual scene construction. It can be seen that the 3D modelling of AR technology is an effective tool to improve design efficiency and reduce design cost generation. The constructed model is also in line with the real environment, and during the brand space experience assembly process, it can connect the virtual model with real objects to complete the interactive experience across spaces. In addition, the excellent rendering ability provided by CAD technology also makes the brand space experience design style more in line with the modern aesthetic of the audience. In addition to incorporating bold color combinations, it also incorporates perceptual information from various media data fusions. Enable users to not only enjoy an immersive experience in the environment when trying out branded items but also obtain more product information, making it convenient to choose items that meet their own needs.

5 CONCLUSIONS

With the rapid development of the Internet and the economic society, the concept of modernization has made consumers' demand for brand design experience more and more high. Brand space experience, as the main bridge connecting users and products for communication, has received increasing attention and attention from brand owners. They found that transforming traditional brand displays into spatial experience designs not only enhances users' shopping tendencies but also enhances the brand's audience in the industry. This article explores the process and practical application effects of brand space experience design using augmented reality technology and CAD collaborative design from a large number of theoretical research cases. Firstly, analyze the customer's experiential needs for brand space design from their shopping needs. Referencing the advantages of augmented reality technology in two-dimensional model design, complete the construction of a three-dimensional design scene for brand space experience. Secondly, divide the brand space experience design into multiple functional areas, and focus on using AR technology to achieve the first-person experience process for customers. And use consumer behaviour to assess the effectiveness of augmented reality technology in design. Finally, utilizing CAD collaborative strategies to optimize and enhance the authenticity of real-life space scenes, the brand space experience is integrated with virtual and real elements to meet the personalized needs of users to the greatest extent possible. Analyze the impact of assembly factors in brand space design on consumer shopping tendencies, and summarize the advantages of spatial design models generated by CAD technology in visual element selection. The research results indicate that augmented reality technology and CAD collaborative strategies can help brand spaces complete experience design transformation, forming a new shopping experience that integrates virtual and real scenes.

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