The Use of Computer-Aided Design to Enhance the Aesthetic and Practical Environment of Art Design

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Abstract. When exploring effective strategies to improve spatial quality, environmental art design undoubtedly plays a crucial role. Given the increasing pursuit of diversity and individualization in contemporary society, traditional design models are inadequate and unable to respond to these dynamic changes in demand fully. Therefore, this article explores in depth the innovative application of computer-aided design technology (CAD) in the field of environmental art design, injecting new vitality into the design process by constructing detailed 3D models. Furthermore, we have integrated virtual reality (VR) technology, which not only greatly enriches the display dimensions of 3D models, making the visual effects of design schemes more realistic, but also greatly expands the space for design modification and optimization. The experimental data fully demonstrates that this comprehensive method significantly improves the accuracy of 3D modelling, effectively reduces error rates, and ensures the high quality of design results. The optimized system not only achieved a leap in accuracy in model construction but also significantly shortened response time and improved the efficiency of the overall design process. Compared with the current mainstream design methods, the method proposed in this article demonstrates significant advantages in presenting the realism and naturalness of different landscape forms. Endow design works with a more vivid and captivating aesthetic experience.

Keywords: Computer-Aided Design; Environmental Art Design; Aesthetic and Practical
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1 INTRODUCTION

Environmental space, as the cornerstone supporting the prosperity and development of human society and cities, is closely linked to the improvement of its quality and the wave of urbanization and technological progress. With the leap of technology, we are no longer limited to achieving basic spatial functions but have moved towards the ultimate pursuit of spatial aesthetics, creating unparalleled comfort experiences and delving deeper into the cultural connotations of space [1]. This transformation has profoundly influenced the development trajectory of the field of environmental art and design, prompting a rapid expansion of design demands towards diversification, personalization, and environmental protection. Specifically, modern people's expectations for environmental art design have far exceeded the scope of practicality. They long to feel the influence of art, the harmony of nature, and the manifestation of personalized style in their living and working spaces. The design works are endowed with more emotional colours and cultural meanings, becoming a bridge connecting people and nature, the past and the future [2]. Good design can bring pleasant visual experience and psychological feelings, and promote people's physical and mental health [3]. Environmental art design is also an important carrier of cultural inheritance and innovation. By integrating traditional and modern elements, designers can create design works that are both national characteristics [4]. These works can not only satisfy people's aesthetic needs but also stimulate people's cultural identity and creativity. In its development, the improvement of design aesthetics and practicability helps to enhance the environmental adaptability and sustainability of design works [5]. In this context, smart home environments have rapidly emerged with their intelligent and personalized characteristics, and traditional air conditioning systems with a single temperature control goal are no longer able to meet people's diverse and refined needs. In order to achieve this goal, the concept of environmental space art design is deeply integrated into it [6]. Through artistic spatial layout, colour matching, material selection and other means, it closely collaborates with smart home systems to create a beautiful and comfortable living space. This step effectively reduces data noise, improves data consistency and reliability, and lays a solid foundation for subsequent analysis and prediction. In addition, to address the potential decrease in model prediction accuracy caused by initial threshold and weight randomness, a solution using a genetic algorithm to optimize model parameters has been proposed. In order to accurately predict the thermal comfort level of indoor environments and ensure that data quality becomes a solid foundation for prediction accuracy, researchers have ingeniously introduced the K-means clustering algorithm and carried out meticulous preprocessing work on complex experimental data [7]. This innovative measure not only optimizes the data structure but also significantly improves the efficiency and reliability of subsequent analysis. Subsequently, based on profound insights into high-quality data preprocessed by K-means, some scholars ingeniously constructed prediction models based on BP neural networks. Under the excellent ability of the BP neural network in nonlinear relationship modelling, this model successfully captured the complex interaction between many factors that affect indoor thermal comfort and thus realized the highly accurate prediction of indoor environmental thermal comfort. In the smart home environment, the air conditioning control strategy with thermal comfort as the core control objective not only precisely regulates key environmental indicators such as indoor temperature and humidity, but also takes into account energy conservation and consumption reduction, reflecting the perfect balance between environmental friendliness and residential comfort. This model fully utilizes the nonlinear mapping ability and learning and memory characteristics of neural networks, combined with the optimized parameter settings of genetic algorithms, to achieve real-time and dynamic monitoring and control of indoor thermal comfort. The genetic algorithm, with its powerful global search ability and adaptability, has successfully solved the local minimization trap, further improving the accuracy and stability of prediction models [8].

Under the sweep of the digital wave, the traditional boundaries of urban blueprint drawing, landscape design, and even flat building layouts are undergoing unprecedented transformation. They not only established a clear design vision as the core driving force but also relied on powerful simulation technology and detailed data evaluation systems to meticulously craft every detail from the deep logic of design patterns. On the vast stage of environmental space art design, the interweaving of technology and art shines brightly, heralding infinite possibilities and potential. In this transformation, scholars use actual design cases as experimental fields to explore the mysteries of multi-objective optimization, cleverly transforming complex design challenges into exquisite layouts of parametric design. This deep integration not only greatly accelerates the design process and improves work efficiency, but more importantly, it promotes fundamental changes in design methods and thinking patterns. Designers are starting to examine problems from a more systematic and scientific perspective, guiding design decisions through data analysis, empowering artistic expression with technology, and creating spatial works that meet functional requirements and are rich in aesthetic interest. In this process, computer-aided planning technology is no longer just a tool but has become the core engine of design innovation, deeply integrated with the fine operation of parameter control and the flexible application of optimization strategies, jointly promoting the leap of design practice [9]. This provides a comprehensive and detailed analysis of parameterized landscape architecture design in environmental space art design. In order to reveal the subtle balance between the operational techniques of parametric planning and artistic creation in the practice of panoramic structural layout. It not only greatly improves design efficiency and shortens design cycles, but also makes quantitative analysis in the design process more reasonable and accurate. Practice has proven that parametric design has a strong driving force and broad application prospects in environmental space art design [10]. Parametric design has demonstrated multiple characteristics in environmental space art design, including efficiency, universality, multi-objective, sustainability, and optimization. It can not only help designers more accurately control the design process and results, but also achieve artistic and personalized expression of environmental space while meeting diverse design needs. More importantly, the strict logical algorithm process behind parameterized design has brought new development momentum and infinite possibilities to environmental space art design.

The continuous progress of society and the continuous improvement of people's aesthetic taste are quietly leading the field of environmental art and design into a new era of aesthetic diversification and personalization. It not only profoundly influenced the trend of thought in the design industry, but also prompted modern environmental art design to explore a harmonious coexistence between traditional essence and modern style. In this process, the awakening of cultural confidence has become an undeniable force [11]. Through the use of new materials, new technologies and new processes, designers create designs that are both traditional and modern. In the aesthetic standards, environmental protection and sustainability is one of the important aesthetic standards. In the vast field of environmental art and design, designers are gradually moving towards a higher level of pursuit. By deeply integrating considerations of environmental performance and sustainability into the exploration of aesthetics, we strive to achieve the ideal vision of harmonious coexistence between humans and nature. To achieve this goal, designers place practicality at the core of their design, carefully crafting a spatial experience that balances functionality and comfort. Through precise spatial planning and humanistic design details, they ensure that every design can accurately meet people's daily needs. They deeply understand that the true value of design lies not only in its visual appeal but also in its substantial improvement of quality of life and responsible attitude towards the future of the earth. Simultaneously endowing the space with a warm and comfortable atmosphere, allowing people to experience physical and mental pleasure and relaxation within it. Therefore, aesthetics and practicality will have a great impact on the final effect of environmental art design, and there are often many problems in the promotion of the two in actual design. First of all, aesthetics and practicality interact with each other to a certain extent. Some designers, limited by design experience, cannot strike a good balance between aesthetics and practicality and tend to pursue the effect of one side too much while ignoring the problem of the other. Secondly, traditional environmental art design takes the designer as the core, and the designer's experience and aesthetic level are the cornerstone of the design results. Some designers lack innovative thinking and unique insights in the design process, resulting in the lack of new ideas and highlights in the design works. Finally, different designers have great differences in their awareness of environmental protection and sustainability, and some design results in actual design are difficult to meet the aesthetic standards of environmental protection and sustainability. Its application in environmental art design can realize automatic processing and accurate calculation through software tools, reducing the tedious drawing and calculation process in traditional manual design, and thus greatly improving the design efficiency. Designers can be more focused on creative play and design thinking, rather than spending a lot of time on details. It can also quickly generate a variety of design schemes, enhance the artistry and expressiveness of design effects, and help designers compare and choose schemes in a short time, so as to find the best design schemes and improve the quality of design works.

2 RELATED WORK

With the vigorous development of the social economy, people's quality of life has risen to new heights, and their longing for material enjoyment and a high-quality living environment has become increasingly strong. In this context, Savickaite and other pioneers [12] bravely explored and put forward a revolutionary strategy for the construction of a virtual environment, opening up a Xintiandi for landscape design. They conducted in-depth research on the parameterized path of new image generation in landscape design, particularly focusing on the ingenious application of virtual reality technology in coastal landscape shaping, demonstrating the infinite possibilities of technology-empowered design. The core of this innovative method lies in the deep integration of virtual reality and intelligent algorithms. By introducing the innovative technology of three-bit binary encoding, precise expression and manipulation of digital elements have been achieved. This technological breakthrough not only simplifies the complex design process but also achieves an unprecedented level of realism in the construction of virtual environments. Through the exquisite presentation of simulation display technology, viewers feel as if they are immersed in real coastal scenery. This significant change prompts us to deeply reflect on and practice the design concept of harmonious coexistence between humans and nature, deeply rooted in every inch of the soil of environmental space art design, striving to achieve harmonious coexistence and seamless connection between urban landscape and surrounding natural ecology. Wang [13] conducted an in-depth analysis of the potential application of virtual reality technology in coastal landscape design. The research results indicate that using virtual reality technology, digital elevation models (DEMs) can be displayed at a display level of up to 50%, and the level of detail in image display also reaches an astonishing 90%. This is an editing and simulation of a real coastal garden environment. This achievement fully verifies the effectiveness of the algorithm proposed in this article. In addition, through close integration with 3DMAX software, these virtual environment models can be easily imported into the 3DMAX operating interface.

In the current stage of development of Building Information Modeling (BIM), despite its enormous potential, many engineers are still limited by traditional workflows. This manual method of creating semantically rich BIM models is not only time-consuming and laborious, but may also lead to model defects, so engineers often hold a reserved attitude towards applying semantically rich models. Wu et al. [14] validated the feasibility and effectiveness of this method through two examples of framework structures. In addition, this method also reserves additional parameter space for the expansion of building information. On the vast stage of environmental space art design, a new method that integrates traditional and modern technologies is demonstrating its immeasurable potential for application. The core of this conversion process lies in the clever utilization of CAD layer information, which is like a navigation map, guiding the system to automatically generate the geometric forms of building skeletons such as beams, slabs, columns, etc., laying a solid foundation for BIM models. This method not only reduces the manual workload of designers but also greatly improves the efficiency and accuracy of model construction. The structured processing of semantic information is particularly important in the process of model construction. Through carefully designed algorithms, this information is meticulously classified, organized, and accurately embedded into the corresponding element models. This process begins with the careful drawing of CAD 2D drawings as blueprints for design concepts, which are then cleverly transformed into BIM models to reproduce every detail of the design in three-dimensional space. However, in the face of the complex challenges in the process of transforming from two-dimensional to three-dimensional, scholars' wisdom and innovation have once again emerged. They proposed a revolutionary semi-automatic method aimed at directly extracting deep semantic information from 2D CAD drawings and building both rich and accurate BIM models based on it. This process ensures that the BIM model is not only a visual presentation but also an intelligent agent rich in data that can comprehensively reflect design intent and construction details.

Ancient artists used different materials and techniques to create many exquisite works of art in the natural environment, presenting a unique artistic charm to the environment. With the changes in society and people's concepts, environmental protection awareness is gradually increasing.

Environmental art, as an art form that expresses environmental protection and green concepts, is receiving attention and respect. Environmental art has begun to appear in public places, becoming a part of urban culture and development. In the 21st century, with the development of science and technology and social progress, environmental art is increasingly combined with science and technology, forming a new form of art. Virtual environment art, projection art, digital art, etc. have become new forms of environmental art. These art forms enhance the interactivity and experiential nature of art by utilizing computers and technological devices to create virtual environments or projection effects. In the pioneering practice of Yang et al. [15], virtual reality (VR) technology was cleverly applied in the field of interior environment design, creating an unprecedented immersive experience space for customers. Experiencing the exquisite spatial layout, harmonious colours, and texture of materials and textures firsthand greatly enhances the intuitiveness and interactivity of the design. This virtual experience not only accelerates the iteration and optimization of design solutions, ensuring high accuracy of design results but also significantly enhances customer engagement and satisfaction. This innovative measure completely overturns the limitations of relying on 2D drawings in traditional design processes. Through VR devices, customers can directly "step into" the design process. Yang and Yang [16] use projection technology to create an environment. For example, through projection technology, various beautiful patterns, animations, or videos can be projected onto the ceiling, walls, and even dining tables of a restaurant. The projection content not only responds to the theme and atmosphere of the restaurant but can also be customized according to the preferences and needs of customers. In addition, some designers have installed multiple interactive landscape installations in the museum, combined with the fibre structure of insect forewings in nature. We have built an exhibition hall that can capture subtle physical changes in human activities, as well as surrounding weather and temperature information, to provide data support for studying weather and human activities.

With the development of people's green design and sustainable development concepts, environmental art and design in the future are often a more diversified, innovative, green, and comprehensive manifestation of interdisciplinary cooperation. Zhang [17] analyzed the environmental art design of coastal cities. Reduce negative impacts on the environment while creating a beautiful and comfortable environment.

3 ENVIRONMENTAL ART DESIGN MODEL BASED ON COMPUTER-AIDED DESIGN

3.1 Optimization of Environmental Art Design Model Combining Genetic Algorithm and Parameter Design

The field of environmental art and design has long faced multidimensional and complex spatial challenges. Traditional design patterns often overly rely on designers' subjective intuition, quick-thinking ideas, and long-term accumulated experience. In the broad application field of environmental art design, parametric design not only significantly improves the accuracy of 3D model construction but also ensures seamless integration of design from concept to implementation. Parametric design, as a revolutionary design tool, lies at its core in adjusting specific or multiple-dimensional parameters in graphic elements. This technology not only broadens the operational dimensions of environmental art design but also endows the design process with unprecedented flexibility and depth. Although this approach has its own charm, it inevitably limits the diverse exploration and innovation boundaries of design to a certain extent. Nowadays, with the rise of parametric design technology, this situation is quietly changing. The automatic triggering of the computing engine enables real-time adjustment and optimization of graphic output, achieving a harmonious coexistence of random creativity and precise control in the design process. With its powerful image processing capabilities, innovative image differential prediction algorithms, seamless scaling, fine deformation, and efficient restoration of images have been achieved. In this process, traditional image differencing methods have been given new vitality by ingeniously setting the average and difference values between two colour pixels (as shown in formula (1)). Parametric design can capture image details more accurately, ensuring that the design effect maintains its original charm while achieving unprecedented visual impact and creative expression.

$$d = \frac{i+j}{2}, h = i - j \tag{1}$$

Where the grey values of adjacent colour pixels are respectively expressed as and their value range is [0,255]. d Expressed as the mean, h Expressed as the difference. Through the integer wavelet reversal transformation, we can get:

$$\begin{cases} i = d + \frac{h+1}{2}, j = d - \frac{h}{2} \middle| h \geq 0 \\ i = d + \frac{h}{2}, j = d - \frac{h-1}{2} \middle| h < 0 \end{cases} \tag{2}$$

By embedding a pixel difference, the differential extended prediction formula is obtained:

$$h_w = 2h + w \tag{3}$$

There is a strong correlation between colour pixels in environmental art design, which is the basis of colour prediction and linear compression. There is a negative correlation between distance and correlation between pixels, so the accuracy of prediction by adjacent pixels is higher than that by pixels that are farther away. Therefore, you can select any specified pixel in the material colour and determine its adjacent pixel. The predicted pixel values and errors can be obtained. Then, according to the above formula, any two-pixel colour components in the design can be predicted, and the corresponding errors and differences are shown in (4):

$$\begin{cases} d = \frac{a_1 + a_2}{2} \\ h = a_1 - a_2 \end{cases} \tag{4}$$

After integer wavelet reversal transformation, we can get:

$$\begin{cases} a_1 = d + \frac{h+1}{2}, a_2 = d - \frac{h}{2} & \left| d \geq 0, h \geq 0 \right. \\ a_1 = d + \frac{h}{2}, a_2 = d - \frac{h-1}{2} & \left| d \geq 0, h < 0 \right. \\ a_1 = d + \frac{h}{2}, a_2 = d - \frac{h+1}{2} & \left| d < 0, h \geq 0 \right. \\ a_1 = d + \frac{h-1}{2}, a_2 = d - \frac{h}{2} & \left| d < 0, h < 0 \right. \end{cases} \tag{5}$$

Then embed the prediction pixel:

$$h_w = (a_1 + a_2)\sqrt{2h + w} \tag{6}$$

Taking into account the above errors, the colour components of any pixels to be predicted are obtained, and the parametric model of the difference of colour images for environmental art design is finally obtained, as shown in (7):

$$\begin{cases} \left| a_{nw} \right| = \left| a_n \right| - 1 & \left| a_n > T_n \right. \\ a_{nw} = a_n + 1 & \left| \bar{a} < 128, a_n < T_n \right. \\ a_{nw} = a_n - 1 & \left| \bar{a} \geq 128, a_n < T_n \right. \end{cases} \tag{7}$$

In order to improve the aesthetics and practicability of environmental art design, this paper introduces a genetic algorithm (GA) to optimize the design. GA algorithm is used to select high-quality populations according to the adaptation degree of populations and hybridize them to obtain new individuals, select variant populations in the new populations for population iteration, and so cycle to achieve the goal or the maximum number of iterations. The individual fitness evaluation after the initial population was encoded is shown in (8):

$$F = k[\sum_{i=1}^{n} abs(y_i - d_i)] \tag{8}$$

$$\begin{cases} f_i = k / F_i \\ p_i = \dfrac{f_i}{\sum_{i=1}^{n} f_i} \end{cases} \tag{9}$$

In the formula, individual fitness is expressed as F_i and f_i The relationship between them is reciprocal. p_i The probability represented is the individual selection probability.

The crossover of new populations is shown in (10):

$$\begin{cases} a_{ij} = a_{ij}(1-b) + a_{nj}b \\ a_{nj} = a_{nj}(1-b) + a_{ij}b \end{cases} \tag{10}$$

In the formula a_{ij}, a_{nj} For individuals with good genes, b the Yes parameter.

The final variation is shown in (11):

$$\begin{cases} a_{ij} = \begin{cases} a_{ij} + (a_{ij} - a_{\max}) \times f(g) & r > 0.5 \\ a_{ij} + (a_{\min} - a_{ij}) \times f(g) & r \le 0.5 \end{cases} \\ f(g) = r(1 - g / G_{\max})^2 \end{cases} \tag{11}$$

The comparison results of the two design optimization algorithms are shown in Figure 1. In the comparison experiment, the three design optimization algorithms need to optimize the data according to the optimization index, and the results are compared from two aspects of optimization degree and time. The results show that the optimization degree of the three design optimization algorithms is above 0.7. The optimization degree of the GA algorithm is slightly higher, but there is little difference between the three optimization degrees. From the optimization time, the optimization time of GA is slightly lower than that of the annealing algorithm, and the gap between them is not obvious. In terms of optimization degree and time, the GA algorithm has better performance than the other two algorithms, can control optimization time while maintaining a high optimization degree, and has higher cost performance.

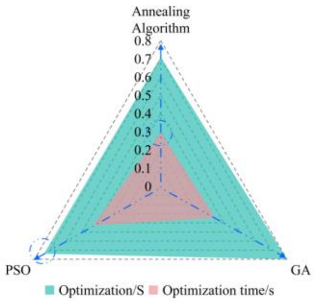

Figure 1: Comparison results of optimization performance of three design optimization algorithms.

3.2 Construction of a Three-Dimensional Model of Environmental Art Design Based on Virtual Reality Technology

Through virtual reality technology, the results of environmental art design can be effectively and realistically presented, enabling designers to discover and solve potential problems in advance, presenting the overall design effect from multiple perspectives, thereby avoiding major modifications or rework in the later stage. Considering that in the actual design, the spatial environment and design modelling conditions of environmental art design are highly variable, in order to obtain better the relevant data needed for design, this paper combines point cloud technology to obtain data and conduct preliminary processing. In order to improve data quality, this paper realizes real-time prediction of the value of points with uncertainty in the design by weighting known points near them, as shown in formula (12):

$$F_c = \sum_{n=1}^{c} l_n \times w_n \tag{12}$$

$$R(x,y) = \sqrt{j_q} \cdot \alpha\beta(x,y) \cdot \alpha\lambda(k / \sqrt{x^i + y^j}) \tag{13}$$

Among them, $q = 1,2,...,i$, different environmental data are expressed as The data format conversion speed judgment parameter, format judgment parameter, and conversion factor respectively α,λ,β.

After preliminary data processing, it is also necessary to build corresponding databases according to actual needs. On the one hand, hierarchical management and operation of database data can be realized, and on the other hand, corresponding data can be provided according to unnecessary environmental art design scenarios. Improve the coordination between scenarios and enhance the performance of system modules.

$$ds(E,s) = \phi \in D|s - i| \tag{14}$$

Where the total traffic volume of the image points is expressed as, where a point cloud value is denoted as ϕ, the image point value is expressed as s,i.

$$D = AX + BY + CZ \tag{15}$$

Where any point contained in the plane can be represented as AX,BY,CZ. Figure 2 shows the schematic diagram of the construction process of a three-dimensional environmental art design model based on virtual reality technology.

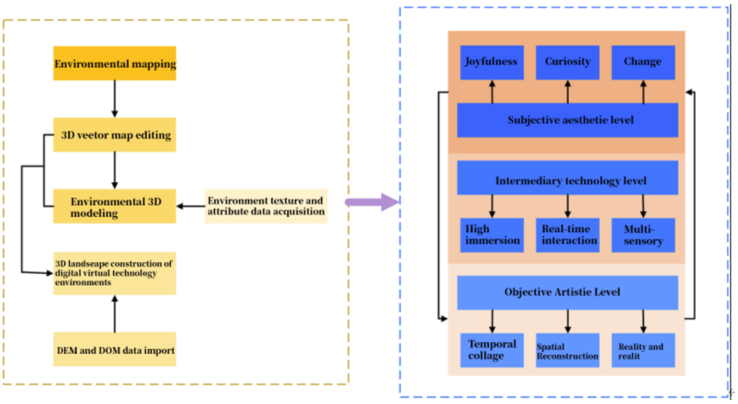

Figure 2: Schematic diagram of the construction process of a three-dimensional environmental art design model based on virtual reality technology.

On the foundation of database construction and preliminary 3D environment model building, a crucial step is to implement fine rendering of the model and seamless embedding of the 3D landscape to ensure its realism and immersion. As shown in Figure 3, this method not only promotes the dynamic evolution of the design process but also encourages the free flow of design thinking, making the final presented environmental landscape model both in line with the logic of the physical world and full of the charm of artistic creation. Aiming to break the linear framework of traditional design and endow 3D environmental landscape model design with higher flexibility and depth. On the one hand, it is rooted in the objective laws and foundations of the physical world; On the other hand, it deeply imprints the aesthetic pursuit and emotional projection of the designer's inner world. As shown in Figure 3.

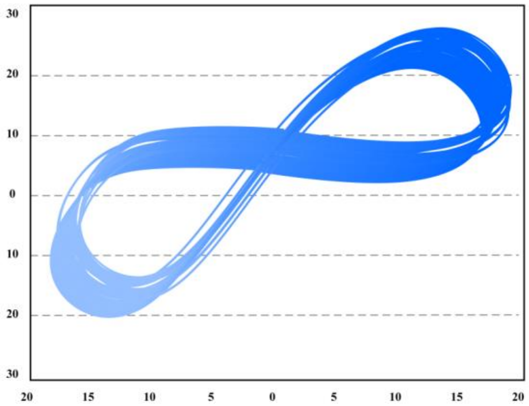

Figure 3: Schematic diagram of environmental form chaos model based on virtual reality view.

When designers construct virtual environment forms, their core perspective focuses on the data captured through deep environmental experiences, which are like the cornerstone of design language, guiding every step of form shaping. In order to further validate the practicality of the proposed method, we conducted a critical experiment and compared the constructed model with the traditional 3D environment art design system in the key performance indicator of scene module response time. Therefore, establishing initial conditions that are highly recognizable, integrating sensory randomness, and maintaining objective orderliness have become the cornerstone of this method. This process begins with a chaotic and disordered state, and then gradually evolves into an outline of order and structure under the subtle influence of initial conditions. As shown in Figure 4, this experiment not only reveals that system response time is an important measure of system performance and user experience but also directly relates to the improvement of design efficiency and overall system performance, providing technical support for both design aesthetics and practical functionality. The results showed that the response time of both systems fluctuated in different scenarios, but the fluctuation amplitude of the traditional system was more significant. In the experiment, we carefully selected five representative environmental art design scenes as test samples. It is particularly worth mentioning that in terms of average response time, the system proposed in this paper has achieved a significant reduction compared to traditional systems, with an efficiency improvement of over 50%. This data intuitively proves that the system in this article has better performance stability and faster response speed when dealing with complex design tasks.

4 EVALUATION RESULTS OF AESTHETICS AND PRACTICABILITY OF ENVIRONMENTAL ART DESIGN BASED ON COMPUTER-AIDED DESIGN

Considering that the design content is mainly outdoor, the first comparison method adopts the three-dimensional modelling method of digital photography. The second method uses the GIS 3D modelling method, and the third method is the method in this paper. Figure 5 shows the overall effect of the three methods of environmental art design.

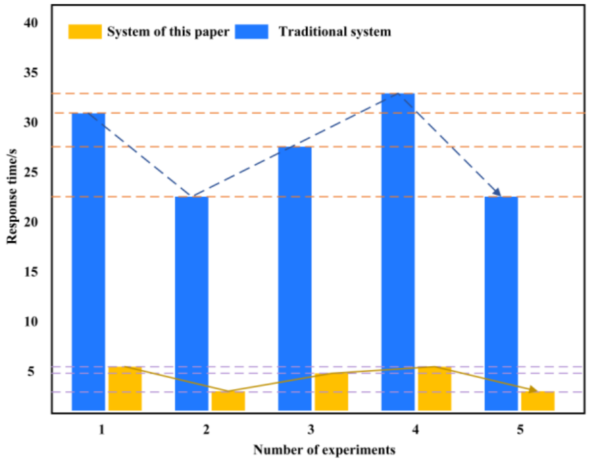

Figure 4: Response time of the two systems in different scenarios.

From the overall effect, the overall accuracy of method 1 is relatively low, and there is more noisy data; The accuracy of method 2 has been improved to some extent, but it lacks the naturalness in the aspect of authenticity. The overall authenticity of this method is good, the accuracy is relatively high, and the comprehensive performance is the best.

Figure 5: Overall effect of three methods of environmental art design.

Figure 6 shows the comparison results of the error rates of the three design methods. It can be seen from the results that different landscape forms have a certain impact on the error rates of the design methods, and the error rates of natural plants are usually higher. Among the three design methods, the error rate of method 1 in the process of different landscape form modeling is more than 4%, and the error rate of method 2 has a certain range of reduction, but the reduction rate of natural landscape form modeling is relatively low. In this paper, the error rates of all landscape form modelling methods are significantly reduced, and the reduction rate of natural landscape form is larger, which is 73% lower than that of method 1 and 62% lower than that of method 2. In view of this, the 3D model of environmental art design proposed in this paper has a small error rate and high precision, which can provide more accurate, effective, and systematic data for the 3D model of virtual technology environmental art design and is conducive to the system helping designers to improve the aesthetics and practicability of environmental art design.

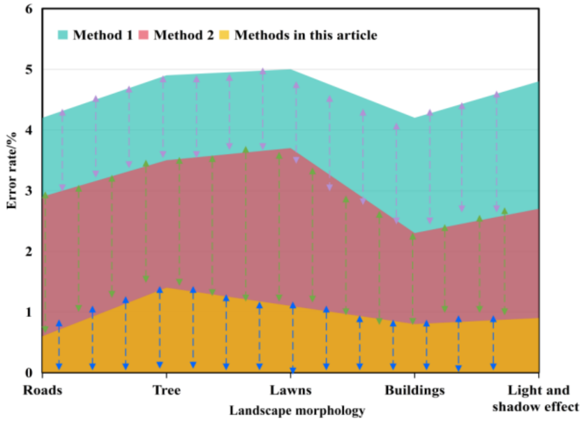

Figure 6: Comparison results of error rates of three design methods.

In order to further test the aesthetic and practical enhancement effects of different design methods, this paper further compares the authenticity, enhancement efficiency and cost reduction of different design methods, and the results are shown in Figure 7. As can be seen from the results of the figure, in terms of authenticity, the authenticity of methods 1 and 2 can reach more than 80%, but both are lower than 90%. The authenticity of different landscape forms designed by the method in this paper reaches more than 94%. In terms of efficiency, The efficiency of method 1 and method 2 has been improved slightly, and the efficiency of the methods in this paper is increased by more than 10% on the basis of the efficiency improvement of the previous two methods. In terms of cost reduction rate, the method in this paper has the highest reduction rate, and the cost reduction rate of some landscape forms is even nearly twice the previous two reduction rates. This shows that the method in this paper can effectively help designers optimize the landscape form, enhance authenticity and naturalness, and select better relevant data for designers.

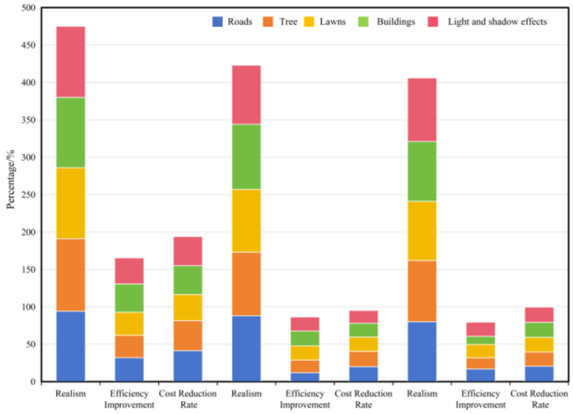

Figure 7: Comparison results of aesthetic and practical performance improvement of three design methods.

5 CONCLUSIONS

Environmental art and design play a crucial role in the pursuit of high-quality living and working environments. However, traditional design patterns that overly focus on the designer's intuitive experience and creativity are often limited by their inherent limitations, making it difficult to fully respond to the increasingly diverse and personalized needs of modern society. This innovative method not only significantly improves the accuracy and quality of 3D model construction, but also achieves deep polishing and excellence in design schemes through data-driven optimization strategies. The ironclad evidence of experimental data shows that the design path proposed in this article has achieved a qualitative leap in model construction accuracy, effectively shortened the design cycle, and reduced the cost of correction. In order to overcome this bottleneck, this article cleverly integrates computer-aided design (CAD) technology, the essence of parametric design, and cutting-edge virtual reality (VR) technology to jointly construct a new ecosystem of 3D models for environmental art design. Compared with traditional systems, the system designed in this article demonstrates astonishing efficiency advantages and response speed. Its rapid response capability not only provides designers with a smooth and unobstructed operating experience but also greatly enhances the flexibility and efficiency of design iterations, laying a solid foundation for the rapid implementation of design ideas. At the same time, its authenticity is significantly higher than that of the other two design methods, which improves the aesthetics and naturalness of the design. In addition, on the basis of effectively improving design efficiency, it reduces design costs and improves practicability.

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