Color Effect of Landscape Architecture Design under Computer Aided Collaborative Design System

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Abstract. Color is an indispensable and important factor in landscape design. Based on the computer aided collaborative design system, this paper establishes a landscape design model. This paper focuses on the important role of color collocation in landscape design, which can improve the artistic and aesthetic quality of landscape design. Starting from the color extraction of landscape architecture, this paper discusses the emotional guidance of color in the design of street interface space through the study of "environmental emotional structure". SD method was used for color space perception evaluation to capture the scale of color emotional effect. Factor analysis of each variable is carried out to obtain the psychological structure of urban residents, the emotional phenomenon of color in scenic spots under the influence of color psychological effect and color grouping. The emotional phenomenon of color in street space influences the main line of the emotional structure of gardens, guides the design of the spatial color context and the establishment of the relationship between space and emotion, and provides directions for shaping the color themes of different landscape gardens.

1   INTRODUCTION

Garden landscape is the steel city "oasis", is to improve the quality of national life, is to edify the sentiment, express the emotion of natural residence. It can effectively adapt to the characteristics and characteristics of the development of the city and meet the demands of the people for life. Generally speaking, landscape has a relatively rich types and expressions, such as architectural landscape, scenic landscape and so on. But no matter what kind of landscape, in the process of

design and landscape, we need to take into account the use of color landscape. Color can beautify the environment, decorate the life, highlight the aesthetic characteristics and artistic charm of the landscape, so the color as the starting point of landscape design, has its fresh inevitability and necessity [1]. However, how to apply color landscape to design gardens and how to enhance the aesthetic value of landscape by highlighting the charm of color landscape have always been the key issues discussed in landscape design in China. As an important product of human spiritual civilization, color aesthetics will directly affect people's subjective feelings. Modern garden planning and design mainly pay attention to space extension and color aesthetics, which is not only reflected in the vegetation color of the garden, but also reflected in the color of the garden paving. The application of color aesthetics in plane composition also affects the planning and design of gardens. The combination of the two provides more references for landscape design [2].

With the continuous progress and development of computer science, more and more fields have begun to promote the overall industry digitalization and informatization into its main development process, and the field of landscape design is also no exception. Specific manifestations are as follows: More and more landscape design practice began to use computers and other digital media, the design and planning of specific projects, the market began to appear a variety of software applications for landscape design [3]. It can be said that digital technology has promoted the further development of landscape design to a large extent, and provided more convenient and high-quality conditions for the relevant design staff to better carry out landscape design work. It is a promising technical means.

The so-called digital technology specifically refers to the application of binary algorithm to edit and process relevant information, and the application of it to the computer, Internet and multimedia and other advanced technology, to ensure the realization of information digitization. As the technology continues to evolve, more and more fields are starting to use it as a basic indicator to measure industry development and incorporate digitalization into their overall development plans. Specifically in the field of landscape design, digital technology has broken through the original design mode and opened up a new road of landscape design. The application of digital technology makes the landscape design scheme and effect be effectively presented, and ensures the diversification of the presentation effect.

2 RELATED WORKS

Many scholars have studied the color effect of landscape design. Narasimha et al. [4] analyzed the role of plant communities in urban ecological landscape gardens and the ornamental content of plants in gardens, and discussed the principles and methods of plant allocation in urban ecological landscape gardens. Lenzholzer et al. [5] proposed that designers should make scientific and reasonable collocation of plant colors according to plant growth characteristics and seasonal changes, and highlight and improve the ecological benefits and ornamental effects of gardens on this basis. Cheng et al. [6] combined with the concept and connotation of color landscape, explored the value of color landscape in landscape design and proposed the corresponding application path. Caivano et al. [7] proposed that landscape design should start from the perspective of people's psychological characteristics and visual sensory experience, properly integrate some regional historical and cultural characteristics, adhere to the design principle of harmony and unity, and do a good job of reasonable collocation of different colors.

In recent years, the computer aided collaborative system has been more and more applied to the color research of landscape architecture design. Raaphorst et al. [8] expounded the application of AutoCAD software in computer-aided landscape design, and analyzed the advantages of using multi-segment lines in landscape architecture drawing, as well as the editing skills and essentials. Huang et al. [9] took the key points of plant landscape construction of urban constructed wetland as the research object and summarized the key points of plant landscape construction of urban constructed wetland in the emergence stage while analyzing the content of plant landscape

construction of urban constructed wetland. Manav et al. [10] introduced the application of digital technology in landscape design and believed that the introduction of digital technology in landscape design can greatly improve the design efficiency and quality and effectively reduce the cost.

To sum up, through the analysis of the application of digital technology in landscape design practice, it can be found that this technology not only effectively improves the quality and efficiency of design work, but also plays an important role in broadening design ideas and optimizing design concepts. Combined with the specific development situation, it can be predicted that in the following process of landscape design, the application and promotion of digital technology will march to another new height, which is manifested by the emergence of a large number of computer-aided design software, the establishment and perfection of landscape design database, the VR effect of virtual model and so on. In a word, the continuous evolution and development of digital technology will further promote the progress of landscape design work, and may even realize that everyone participates in landscape design practice, and fully expresses their understanding and understanding of relevant design concepts, design techniques and design concepts through the medium of digital technology.

3   ANALYSIS OF COLOR EFFECT IN LANDSCAPE ARCHITECTURE DESIGN

3.1   The Design of Landscape Architecture Models

The drawing process of landscape renderings mainly has the following several links: First, use AutoCAD and other software to carry out vertical layout or draw schematic diagram; Secondly, 3DS Max and other modeling software were used for modeling. Finally, the model is continuously improved and rendered until the design scheme is passed. Considering that there are many elements of unplanned shape design applied in the process of landscape design, and there are special requirements for modeling, it is necessary to pay attention to whether the modeling software has the design direction facing the landscape in the choice of modeling software. The design steps of landscape architecture model are shown in Figure 1.
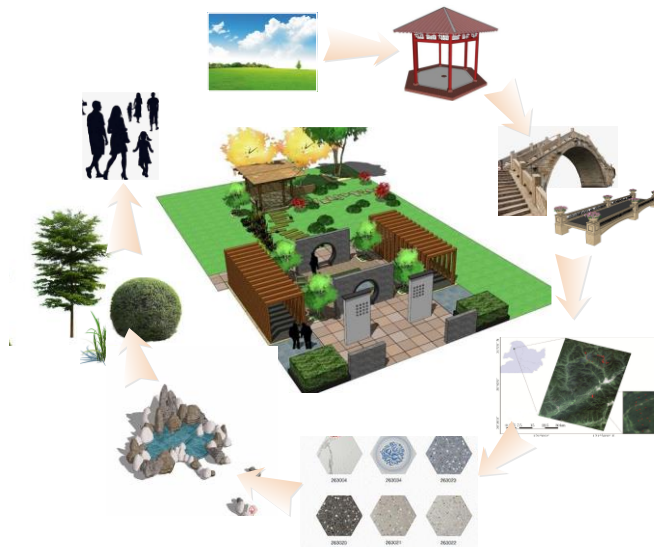

Figure 1: Basic steps of landscape architecture model design.

(1) Select an appropriate scene from the scene library as the background. Users can choose according to the landscape design needs, such as valleys, rivers, oceans, plains, hills and desert scenes;

(2) Secondly, import the solid model using the import tool of Lumion3D, and adjust the model to the appropriate position;

(3) For material editing, Lumion3D contains a rich material library, which can easily compare and replace materials;

(4) Use the terrain model established by SketchUP to import the entity, thus forming the terrain scene;

(5) Making and importing plants; You can add people and weather conditions in a similar way to importing plants.

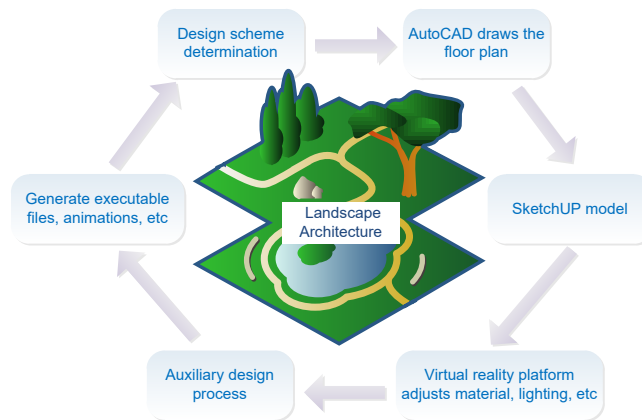## 3.2 Color Rendering of Landscape Design Models

Figure 2: VR assist the implementation of garden planning and design procedures.

Color landscape can effectively highlight the overall environmental theme of the garden, and help landscape designers to show the ancient beauty, simple beauty, plain beauty or noble beauty, luxurious beauty and rich beauty through the application of color landscape. Enrich the artistic beauty of garden landscape, deepen the aesthetic experience of garden, and help designers to better emphasize the vision and deepen the sense of space and hierarchy of garden. For example, in the hierarchy of landscape building, designers can use complementary colors and saturated colors of two colors to decorate the vision, so that the vision has a "close" feeling. In the garden landscape with narrow space, cool colors are used. The depth and profound sense of landscape can be enhanced to create a solemn, quiet and cold environment. However, in order to express a specific theme or create a specific atmosphere, it is necessary for landscape designers to flexibly apply color categories to enhance the artistic appeal of landscape. For example, the light and elegant style of ancient literati is highlighted through the black and grayish-black colors of architecture. Similar colors (yellow and orange, green and yellow, etc.) are used to reflect the sense of space and hierarchy of landscape, so as to form a quiet and soft visual experience.

After the completion of the three-dimensional effect of landscape design, the effect presented is the plain model, that is, the three-dimensional model of a single-color structure without rendering. Therefore, after getting the 3D renderings, designers need to render them with the help of digital technology in order to fully present the design concept and scheme they want to express.

Rendering operations mainly include: the selection of the application scene of the garden design, the material setting of the specific garden model, the rendering of the environmental conditions, such as: lighting conditions, lighting effects, etc., generally can be used such as 3Ds Max, Keyshot and other three-dimensional model rendering software can effectively achieve the rendering of the established model. After rendering and processing of the model, the design scheme can be expressed more intuitively and accurately. In the process of handover with customers, the established purpose can also be achieved quickly. The specific procedures of landscape planning and design assisted by virtual reality technology are shown in Figure 2.

3.3   Color Analysis Method

Taking the above landscape architecture design model as the research object, this paper adopts the Semantic Differential Method (SD), a psychological research paradigm of subject-object relationship, to conduct qualitative spatial perception evaluation on the control axis and representative areas of landscape color spatial structure. Combined with SPSS statistical factor analysis, cluster analysis and principal component analysis, this paper studies the psychological structure of tourists, classifies the landscape, and establishes the main line of the emotional structure of each landscape.

Each street in the city should have its own unique atmosphere of color space, which brings different perception and experience to the pedestrians. By recording these perceptions, the paper studies the color emotional structure of residents, and tries to find the object indicators that affect the psychological structure, such as the realistic form of streets and the influence of street components on psychology, so as to provide reference for planning and design, and achieve the purpose of improving the quality of space and changing the psychological perception.

Assessment Items	Evaluation Scale (Color Expression)
Hue	Warm - cool
Brightness	Dim - bright
Saturation	Bright - pure
Continuity	Continuous -- discontinuous
Spaciousness	Open - enclosed in space
Layering	Hierarchical - Hierarchical and fuzzy
Richness	Colorful - having a single color

Table 1: The evaluation factors involved in SD method.

The research team took the 11 street interfaces as the survey samples, collected the perception intentions of urban residents in the form of questionnaires, and conducted the SD method of "color space perception evaluation" (Table 1). Under the guidance of the coordinate system of color image [6], 20 pairs of positive and negative adjectives were selected to evaluate the perception of color space to form a "Semantic Difference Scale". The evaluation items were mainly aimed at the physical attributes and psychological effects of color is a quantitative statistical analysis. According to the feeling level of ordinary people who cannot be confused, the evaluation level is divided into 7 levels and given numerical values (-3, -2, -1, 0, 1, 2, 3). The psychological feelings of street color images are measured by language scale.

4   ANALYSIS OF RESULTS

4.1   Acquisition of Basic Data and Evaluation Curves

Emotional structure indicates the tension between objective structure and subjective feeling, highlighting the role of personal emotion and experience in shaping ideology. It is an organic thing that develops, changes and evolves in the course of history, and is always in the process of shaping and remaking. A new generation will react in its own way to the unique world they have inherited, absorbing many traceable continuities for reproduction, shaping their creative responses into a new emotional structure. In addition, the concept of color image scale provides a measurable scale basis for the psychological perception evaluation of color. On this basis, an evaluation system is established to analyze the color emotion structure of evaluators.

The recovered evaluation value is statistically analyzed, and the score table and evaluation curve are shown in Figure 3. Among them, the maximum value of the absolute score of each street interface represents the color image characteristics of this interface. The overall curve fluctuates around axis 0 and the smaller the fluctuation range is, the street has no characteristics. The larger the fluctuation away from the axis is, the brighter the color personality of the street is. The average score curve of streets presented in Figure 4 fluctuates around axis 0, indicating that the landscape is faced with the problems of not prominent regional personality of color space and weak design of color context.
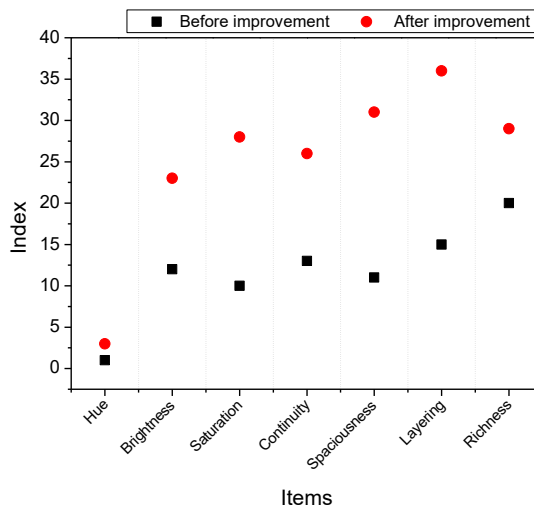

Figure 3: The result of the survey evaluates the score before and after improvement.

4.2   Analysis of Color Relation in Garden

Color landscape mainly refers to the landscape environment with visual color as the main feature. In landscape design, color landscape is mainly based on the application of color, taking color expression as the fundamental purpose and main basis of landscape design, emphasizing the function and role of color in landscape performance, and taking aesthetic experience and artistic feeling of human vision as the starting point. Therefore, in the field of art, color landscape focuses on color aesthetics, highlighting the function and role of color in the whole and part of the landscape. In characteristics and characteristics, color landscape can be divided into color system and no color system.
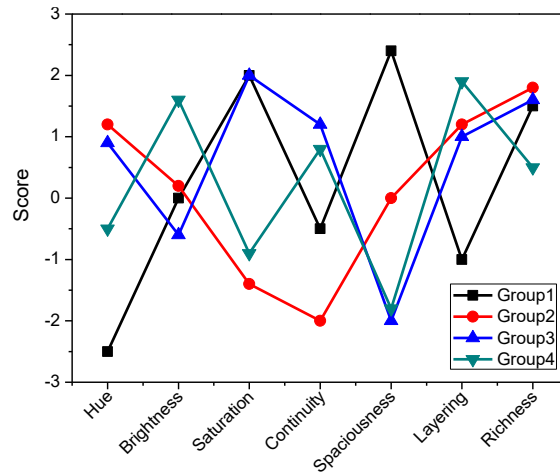
Figure 4: The result of the survey evaluates the score.

Among them, color system, including purple, green, yellow, orange, red and so on, has attracted higher attention and wide application scope in landscape design. And has lightness, purity, hue and other characteristics. Purity, on the other hand, refers specifically to the degree of purity, and also to the proportion of a particular color in a particular object. If some color purity is high, the purity of other colors will be relatively low. Finally, the lightness name the brightness of the color. The brighter the color is, the more light it reflects, and the less it reflects. In terms of color categories, the main colors used in landscape design are water bodies, buildings, rocks, plants and other colors. In tone, there are black and white, gold and silver, similar colors, contrast colors, cool colors and warm colors. Therefore, in the application of color landscape, designers should not only understand the brightness, purity, hue and category of color, but also need to consider the subjective feeling of the observer, light refraction and the existence form of the real landscape. Only in this way, can they better play the function and role of color landscape in landscape design.

Color landscape can be divided into color system and no color system. Among them, color system, including purple, green, yellow, orange, red and so on, has attracted higher attention and wide application scope in landscape design. And has lightness, purity, hue and other characteristics. Among them, hue is the basic feature of color landscape, which refers to the color difference of a certain color can be accurately distinguished. Mainly refracting the spectrum of the human eye on the other hand, refers specifically to the degree of purity, and also to the proportion of a particular color in a particular object. If some color purity is high, the purity of other colors will be relatively low. The brighter the color is, the more light it reflects, and the less it reflects. In terms of color categories, the main colors used in landscape design are water bodies, buildings, rocks, plants and other colors. In tone, there are black and white, gold and silver, similar colors, contrast colors, cool colors and warm colors. The color extraction is carried out on the garden model, and the result is shown in Figure 5.

As can be seen from the above figure, the extracted colors from the NCS color system show that the extracted colors concentrated in the dark areas are the main colors, and the bright colors are the auxiliary colors. Figure 6 is an analysis of the blackness of the garden: 63 low blackness colors (0-30), 24 medium blackness colors (30-70) and 16 high blackness colors (70-100). They accounted for 61%, 23% and 16% of the number of extracted colors respectively.

As a result, the number of high-blackness colors in the landscape model is small, and the colors create a sharp contrast. The deep combination of color and architectural design can highlight the artistic conception of design.
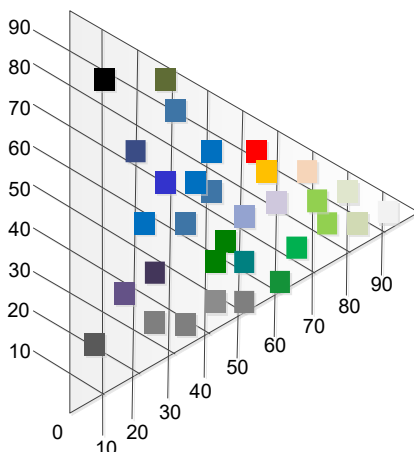
Figure 5: The main color orientation of landscape architecture.
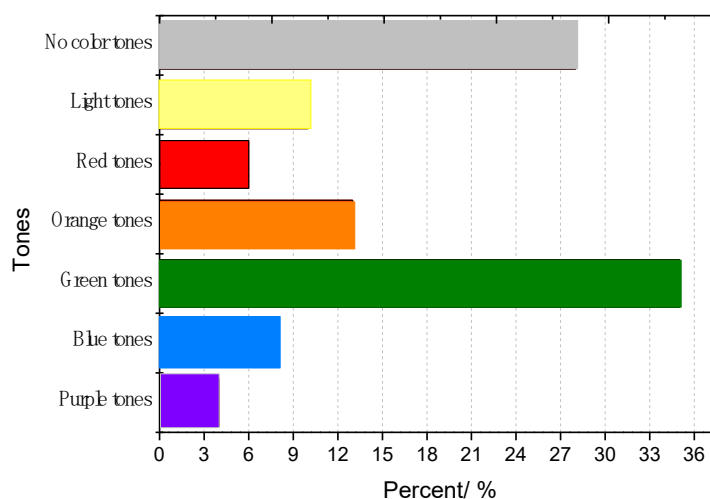

Figure 6: The main color distribution of the garden.

Then in the process of designing architectural landscape, designers need to use the color conversion method to integrate various styles of garden architecture together, which fully reflects the artistic conception of garden architecture. In this way, it can bring people a more methodical experience, and also strengthen the artistic sense of garden space. Therefore, for the collocation and choice of color, it is necessary to fully reflect the coordination of garden architecture, fit with the surrounding environment of the garden, follow the tone coordination, reflect the uniqueness of the garden landscape.

4.3   Analysis of Color Emotional Structure of Tourists in Scenic Spots

In order to more accurately analyze the emotional structure of urban residents, factor analysis method was adopted. According to the color perception impression scores of each street interface in Table 1, 20 pairs of adjectives were taken as variables to find out the main factors with high sensitivity of color perception and obtain the psychological dimension of urban residents. In the

specific factor analysis, the eigenvalue method is adopted, combined with the cumulative contribution rate, and the comprehensive consideration is carried out. The factors with characteristic value greater than 1 were retained, and the number of factors was determined to be 3. The cumulative contribution rate reached 92.697%, and the common degree of the 20 variables was basically above 90%, indicating that the factor extraction effect was good. The psychological quantity obtained from 20 pairs of adjectives was taken as the similarity degree, and the longest distance method in the cluster analysis method was used for analysis. Streets were grouped, and 4 different conscious streets were obtained (Figure 7).
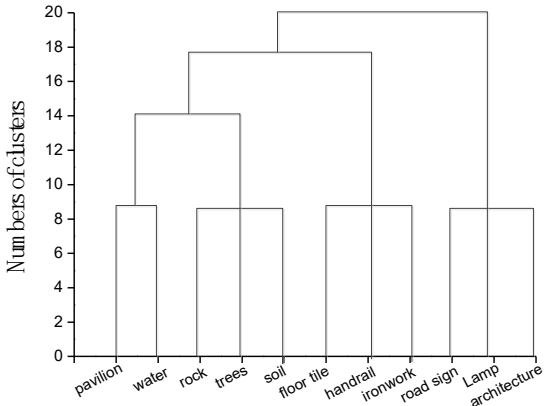

Figure 7: Cluster analysis diagram of landscape.

Factor load size decreased from top to bottom in each group. Among them, the adjectives of the first type of factors respectively reflect the lightness, richness, chroma, sense of theme and degree of change of landscape color, and comprehensively express the eye-attraction of the psychological structure of the color of the main landscape in the garden, so the first factor is named as the personality factor. Similarly, the composition of the second factor shows the continuity, sense of space, sense of scale, sense of hierarchy, degree of correlation, order and transition of garden design, and comprehensively describes the structural system of the psychological structure of street color, so the second factor is named as the structural factor. The composition of the third factor shows the sense of weight, distance, hue attribute, rhythm, vitality, uniformity, attraction and the sense of times of the garden, and reflects the artistic conception of the psychological structure of color as a whole, so the third factor is named implication factor. To sum up, the psychological structure of tourists is composed of three psychological evaluation axes, namely personality, structure and implication, to evaluate and analyze the impression of a city.

5   CONCLUSION

Based on the computer aided design technology, this paper establishes the landscape model, carries on the color extraction, and analyzes its color collocation and color emotional experience. The use of color conversion method, the integration of various styles of garden architecture, can bring people a more methodical experience, but also strengthen the artistic sense of garden space. Therefore, for the collocation and choice of color, it is necessary to fully reflect the coordination of garden architecture, fit with the surrounding environment of the garden, follow the tone coordination, reflect the uniqueness of the garden landscape. In addition, computer-aided design can adjust the color, enrich the composition, form a unique seasonal effect and aesthetic experience. Therefore, in the process of practical application, the landscape designer should color, rock, road color, the color of the plant and square Angle, through the collocation of color and

composition, improve the look of a landscape, deepen the visitors on the landscape of the emotional experience, the spirit of the meet the viewer demands, promote the healthy development of the urban landscape, landscape garden.

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