Research on Environmental Colour of Shenyang South Canal Waterfront Park Based on SD Method

Mei Lyu[1*], JiaNing Niu[2], ZhongQiu Sun[3] , Dong Sun[4]

lymmei@sjzu.edu.cn[1*], huadubadeniao@163.com[2], 1039600878@qq.com[3], sundong@sjzu.edu.cn[4]

Shenyang Jianzhu University, Shenyang China

Abstract. The environmental quality of urban waterfront parks affects the well-being of residents, and color is an important part of urban park landscape design and the main medium for people to perceive the environment. In this paper, four urban waterfront parks, namely Nanhu Park, Youth Park, Wanliutang Park and Wanquan Park in Shenyang, were selected as the research objects, and the SD semantic difference method was used to quantify the user's expectation, and compared with the current situation of park landscape color, so as to further put forward reasonable optimization suggestions and strategies for the landscape renewal and color planning and design of urban waterfront parks.

Keywords: waterfront parks; Color; color perception; optimize

1.   Introduction

Urban waterfront parks are those beautiful landscapes created by the planning and design of large water body areas distributed within urban limits. Urban waterfront parks [1] are unique, more than other types of urban parks to show the characteristics of the city style, is ecological environmental protection, residents of leisure and recreation, urban economic development and garden art display and other characteristics of the integration of urban public open space [2]. At the beginning of the 20th century, Le Corbusier used colour as an element of spatial limitation, practising the idea of colour harmony between architecture and the environment.[3]. In the 60s of the 20th century, the French colorist Jean-Philippe Lenclos proposed "color geography" based on a large number of practical investigations, revealing that urban colors are affected by the natural environment and the human environment, and have a strong regional nature [4]. The theme of "landscape colour" mainly includes urban environmental colour, urban image, streetscape colour, and research on people's perception and experience [5], which focuses on the significance of quantitative research on colour, and at the same time explores people's perceptions of colour and the key factors affecting colour in a human-centred way. The first published research literature on landscape colour elaborates that different colour landscape bands give people different psychological feelings [6], and that the rational application of plant colour landscapes is an important way to beautify the urban. Wu Wei and Liu Honghong (2006) pointed out that colour is one of the important factors for people to feel the urban style through their vision [7], and the colour landscape needs to be planned. Landscape colour research relies on the actual colour carrier, the definition of different fields of colour is different, refer to Yin Siqun for the "urban colour landscape" definition [8], that is, the use of space within the crowd visual perception of the landscape elements, including natural and artificial environmental

colour, the former mainly includes the sky, water, plants and other colours, while the latter can be divided into buildings, landscape facilities and vignettes and other external colours. The latter can be divided into buildings, landscape facilities and vignettes and other external colours. Good landscape colours can be a strong attraction for visitors, resulting in a highly satisfying sensory experience.

The landscape colour perception studied in this paper is mainly based on the visual dimension, exploring the current situation of landscape colour in the South Canal Waterfront Park and visitors' psychological perception of colour. Summarize and analyze the urban waterfront parks landscape colour status quo problems, put forward colour corresponding countermeasures and recommendations for the future of Shenyang city waterfront parks planning and design of natural and artificial colour configuration to provide reference basis.

2.　Method

2.1 Survey region

This paper takes into account the size of the park and ensuring a more representative study population. Four representative waterfront parks were also selected for the study based on factors such as completed and relevant facilities, high integrity of landscape colour construction, high park footfall and popularity, and crowd composition and activity types.
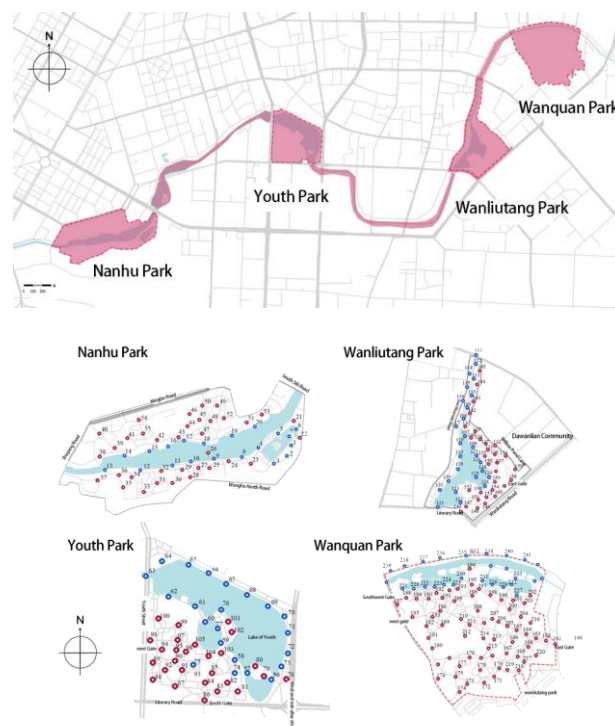

Fig. 1. Grid division of research area and sample points.

2.2 Data acquisition and data preprocessing

In the actual research process, in order to ensure the homogeneity of the selected points, the park was divided into a 50M×50M grid, and one sampling point was selected within each grid [9]. The four waterfront parks had 256 original sampling sites, which were screened and ultimately retained for sampling at 243 sites. South Lake Park (56), Youth Park (50), Wanliu Pond (56), and Wanquan Park (84) were the final samples for this study（e.g. Fig.1）. Fixed viewing angle and pitch angle were set at each sample point, and the front view 0°, right view 90°, back view 180°, left view 270° of each sample point were taken in turn, 4 pictures of one point with image size of 800×500 pixels, and panoramic photographs and video recordings were taken for documentation.

The saturation and brightness of landscape images are affected by the weather, in order to ensure the colour accuracy of the collected images, the field research requires three people to travel together, one person comparing the architectural colour card, one person taking photographs and records, and the other person identifying the colour card values [10], avoiding the influence of sunlight, photographing the architectural colour card at the same time as the on-site samples for numerical corrections, and comparing the colour card values for sample corrections using the Photoshop software, to Weaken the bias produced by the influence of ambient light.

2.3 Data processing

To better obtain the public's perceptual evaluation and intention preference of the landscape colours in the South Canal Waterfront Park [11], the study used the SD method in combination with the questionnaire survey method for the perceptual evaluation [12]. 100 questionnaires on expectations were randomly distributed to the public in each park during the sampling cycle, 400 questionnaires were distributed and 340 valid questionnaires were recovered. In addition to this, the study invited 35 postgraduate students with a landscape background to evaluate the SD perception of the sample sites, and the questions concerned contained a total of 10 groups of semantically opposite words as evaluation factors for artificial colours such as basic colour attributes [13], spatial perception of colours, and psychological perception of colours, and only four groups of semantically opposite word pairs were selected as evaluation factors for plant colours due to the limitations of natural colours [14]. The use of slides and a rough preview of all sample photographs allowed the assessor to establish assessment criteria before evaluating judgements. Each slide was shown for 25 seconds. Evaluators learnt the colour information for all samples and rated them independently on a Likert scale: -2 (low-quality samples) and -2 (high-quality samples). A total of 35 questionnaires were received with a 100% return rate. After screening, 35 valid questionnaires were finally obtained.

3.   Results

3.1 Perceptual analysis of SD perceptions of colour status and expectations of waterfront parks along the South Canal in Shenyang

Expectation and perception data of architectural colours, landscape facilities and vignettes colours, paving colours and plant colours in the waterfront parks along the South Canal in Shenyang City were analysed and SD scores were plotted (eg.Fig.2). Through the questionnaire

survey on the "South Canal waterfront parks", it can be concluded that the activity of the crowd on the urban waterfront parks landscape colour is not a high degree of understanding, people for the four parks landscape colour can be recognised and accepted, the South Lake Park, the overall colour landscape is better, the highest rate of praise. South Lake Park the lake and the sky view is wide, rich and lush greenery, architectural colours give the best vision. Youth Park in the landscape colour evaluation is relatively excellent, the paving colour is rich, and plants and square paving are harmonious and unity; in the park recreation path plant species and colourful make the road full of natural sense; Wanquan Park waterfront nodes less, hydrophilic is not good. The colour of green is the most popular.
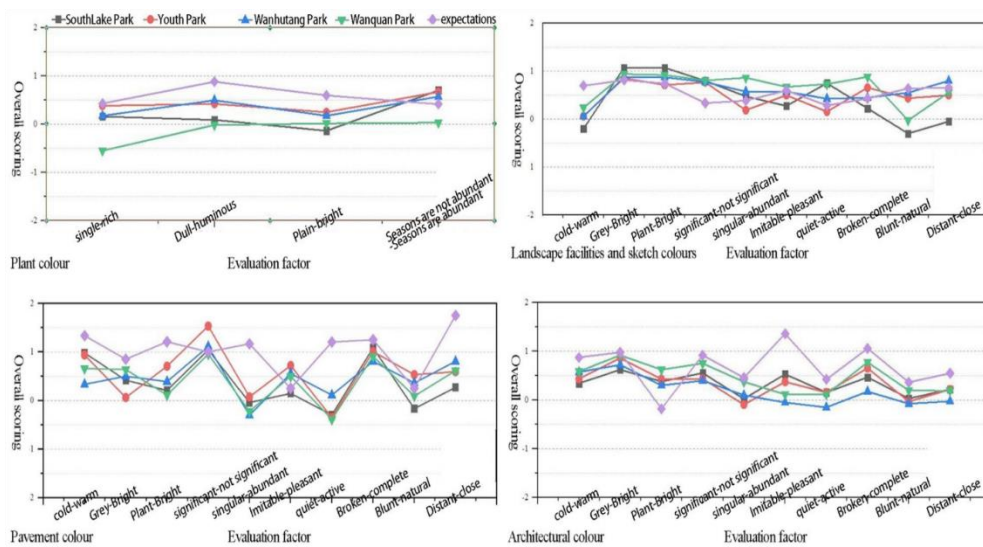

Fig. 2 SD Score Table for Environmental Colour.

Visitors have a high level of overall expectation of the colour of the two landscape elements, architecture and paving. Paving in parks has a low point of view and the secondary colours are generally present in the landscape environment in the form of secondary colours, so they do not receive enough attention. Visitors have high expectations in terms of paving. In terms of architectural colour, the building itself is an overall spatial form, and its external image serves as an important carrier of landscape colour, making a close correlation between architecture and colour.

In terms of landscape facilities and vignettes, the highest mean value is for guide signs, with high colour recognition, as the main function of a guide sign is to convey information, which requires a certain degree of recognition to guide visitors. The lowest is the rubbish bin, which, due to the small scale of the image, is generally used as a secondary colour to meet the basic usage needs of visitors.

Seating facilities and landscape vignettes need to be aesthetically pleasing and functional in parks and need to further enhance the quality and vibrancy of the landscape environment. In terms of natural colours, plants, as the most important constituent elements of the landscape, are

more obvious to the public in terms of their colour perception, especially in autumn when plant leaf colours are most likely to be of concern to the public.

In the results of the questionnaire, the larger gap between the mean values of plants is richness, mainly in the study sample, a single plant species, plant community colour phase is relatively more neighbouring colours or the same kind of colour contrast, brightness and saturation on the visual stimulation of the weaker, tourists are more inclined to the rich colour variation, bright colours of the landscape.

4.   Discussion

4.1 Policy & Governance

4.1.1 Implementing landscape colour planning and management

Urban landscape colour is an important part of the overall visual environment of the city, which affects the presentation of urban style. However, China's current urban colour planning is still immature and the management system is not sound [15]. Establish a coordination mechanism for urban colour management work, through scientific, standardized and effective colour planning and management, reasonably determine the scope of colour control of urban waterfront parks landscape, and strengthen the control of lots with high colour impact [16]. And in the landscape design should be in strict accordance with the relevant norms for colour design, for some important landscape nodes in the park colour design, should be controlled by experts, in the design of the programme stage to put forward control requirements.

4.1.2 Strengthening the awareness of tourists and residents on colour conservation

There is a strong correlation between the residents' pleasure and the colour space colour scheme, and reasonable colour planning is necessary for human health [17]. In order to further strengthen the awareness of colour conservation among the residents and visitors in the park, publicity was carried out through the media radio and public announcements, so that the visitors and residents would be aware of the importance of the park's colours and the significance of colours to the environment, and would actively participate in the park's colour conservation work.

4.2 Design optimization

4.2.1 Artificial colours continue the cultural lineage and show local colours.

Jean-Philippelenclos, in the 1960s, proposed that urban colours are influenced by human and natural environments and are territorial in nature. Therefore, in the selection of artificial colours, colours with regional characteristics [18] are considered first. This, coupled with rapid globalisation, has led to cultural convergence in many cities, causing many to lose their local identity. So nowadays the traditional colours inherent in the urban are fully explored. When renovating parks, increase the layers of colours and add traditional colours so that they can form a certain contrast.

4.2.2 Increase the richness of plants and enhance the colour level of the plant landscape.

1) Optimise the original plant landscape to make it more in line with the construction requirements of modern urban waterfront parks. For example, in the existing plant landscape, some of the tree species and flower colour forms are single, which can be enriched by updating, replacing and replanting to make it more colourful [19].

2) Planting according to the law of change of plant colour, the ornamental period of different plant colours is different, choose appropriate colour combinations to match, so that the plants have a sense of hierarchy and increase the richness of plants;

3) Select plants for colour matching based on factors such as seasonal changes and regional characteristics.

5.   Conclusions

In urban waterfront parks environments, colour brings out the most intuitive feelings. Accordingly, colour has a psychological impact on people's evaluation of the visual quality of parks. A comparison of user expectations with the current status of colours in the waterfront parks selected for this study concluded that satisfaction with waterfront park landscape features and amenities was higher than satisfaction with building colours and paving colours. The biggest difference between the current state of paving colours and the desired impression, the high frequency of paving colourless colours, and the biggest gap between colours and users' expectations are due to the weak visual stimulus presented and the poor visual experience. The biggest difference between the current state of paving colours and the desired impression, the high frequency of paving colourless colours, and the biggest gap between colours and users' expectations are due to the weak visual stimulus presented and the poor visual experience.

Fig. 3 South Canal Waterfront park color sample point information.

In addition, the use of landscape colour quantification techniques played an important role in updating the park's colours during the research and study of the samples. Combined with a large amount of research, a geographic information colour database [20] was established, which includes colour RGB values, coordinates latitude and longitude, photographs of sample points, spatial information and characteristics of the current status of the sample points (e.g. Fig.3). In order to further sort out and grasp the future development trend of landscape colours, the heterogeneous colours in the database are assessed for suitability, filtered and screened, and comprehensively upgraded and optimized, so as to establish a gene pool of landscape colours in the riverfront park with sustainable development and regional characteristics[21].

References

[1] Yang Rongjin.: Research on the construction of urban ecological recreational green space[J]. Journal of China Academy of Environmental Management Cadre. 24(04):24-26+36 (2014)

[2] Liu Liming.: Research on urban waterfront parks landscape [D]. Southeast University. (2004)

[3] Verena Schindler . Le Corbusier's Colour in Architecture : The Colour Keyboards of 1931 and 1959[J]. World Architecture. (12):111-114 (2006)

[4] Lenclos J P, Lenclos D, FBarr mao, et al: .Colors of the World:A Geography of Color[M]. US (2004)

[5] Fan Rong, Wu Hanyu, Zhao Kingland Zheng.: Status and prospect of urban landscape colour research based on bibliometrics[J]. Modern Urban Research. (07):107-113 (2018)

[6] Liu Can, Zhang Qixiang.: Colour reconciliation theory and plant landscape design[J]. Landscape Architecture. (02):29-30 (2005)

[7] Wu Wei, Liu Honghong.: Colour landscape planning in urban environment[J]. Journal of Chongqing Architecture University. (03):33-35 (2006)

[8] Zhong Yanting.: Research on colour gene mapping of Luling traditional village landscape based on colour geography [D]. Jiangxi Agricultural University. (2022)

[9] Zheng Yu, Zhang Weiqi, Wu Qiannan, Chen Ziru, Wang Yuchen, Ding Guochang, Chen Shipin, Fu Weicong, Zhu Zhipeng, Huang Shuping, Wu Jingjing, Dong Jianwen.: Quantitative study of autumn landscape forest colour in Shaanxi Jinshi Grand Canyon National Forest Park[J]. Journal of Northwest Forestry College. 31(03):275-280 (2016)

[10] Liu Yijuan.: Research on the colour system of Suzhou classical garden [D]. Beijing Forestry University. (2014)

[11] Li Xiaojuan.: Research on urban colour planning and control in China based on cognitive imagery [D]. Tianjin University. (2013)

[12] Li Shiyang, Xu Dawei.: Plant landscape evaluation of Shenyang South Lake Park based on SD method[J]. Modern Horticulture. (16):28-30 (2018)

[13] Wang Mengyun.: Research on colour optimization of Harbin Central Street block based on semantic analysis method[D]. Shenyang University of Architecture. (2021)

[14] Lou Yu.: Research on the colour characteristics of plant landscape in community parks based on participants' satisfaction [D]. Guizhou University. China (2021)

[15] Wang, Jiangbo , L. Zhang , and A. Gou .: Study on the preference of city colour image selection based on the logistic model: a case study of Shanghai[J]. Colour Research & Application. (3): 45 (2020)

[16] Liu Peilin.: Construction and application of landscape gene mapping for traditional Chinese settlements[D]. Peking University. (2011)

[17] Wan, Jiangjun, et al.: Research on Color Space Perceptions and Restorative Effects of Blue Space Based on Color Psychology: Examination of the Yijie District of Dujiangyan City as an Example[J]. International Journal of Environmental Research and Public Health. 17(9):3137 (2020)

[18] Jean-Philippe.: Colors of the world-A geography of colour, W. W. Norton and Company. 10-17 (2004)

[19] Zhu Xiaoyue, Zhang Huarong, Lan Siren, Huang Qitang.: Research on the optimization of colour landscape of traditional villages based on quantitative analysis and public perception--Taking Hairypu Village in Southern Fujian as an Example[J]. Journal of Central China Normal University (Natural Science Edition). 54(01):50-59 (2020)

[20] Yin Sijin.: Planning and design of urban colour landscape[J]. World Architecture. (09):68-72 (2003)

[21] Sun Wei, Xub X D.: Research on Chinese Urban colour sorting method based on quantitative analysis[C] 2nd Annual International Conference on Social Science and Contemporary Humanity Development. (2016)