A study of colour in street architecture based on perceptual evaluation

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Abstract: China is a cultural power with a long history and vast territory, and has a rich and splendid architectural culture on the vast Chinese land, in which architectural color outlines a strong and colorful stroke. In a broad sense, architectural color refers to the color reflected in the sunlight by the materials and paints used on the building facade, but in a narrow sense, it also reflects the unique culture of a city, a region and a street to a large extent. This paper focuses on the study of street architectural colors, which are like the business cards of a city.

1. Background

For today's China, the color of the city has gradually become an inescapable issue. In an era of rapid development, cities of all sizes are looking for ways to improve their attractiveness and competitiveness, and residents are beginning to demand more from their living environments.

When it comes to the charm of cities, color is about the most direct and unforgettable beauty.

Cities are not only beautiful homes for people to live and live in, but also unique carriers of human civilization. Since color is one of the most active elements in cities, the appearance and color of a city can directly reflect its geographic, cultural and national characteristics. A scientist once claimed that human beings can perceive 80% of the color of an object within the first 20 seconds of seeing it. When we witness the reddish haze in the sky, although we don't know how to express it, our hearts have been deeply touched by it. The folk of human appearance "a white cover up a hundred ugly", also has its own simple reason. Color is also an important part of urban competitiveness. The famous architect Saarinen once said: "Let me look at your city, I can say what the city residents in the cultural pursuit."

The color of urban architecture, which is a representative visual element of urban landscape, influences the atmosphere of the city, as well as the emotions, will and behavior of the users. In the context of urban architectural color planning, rational planning and promotion are essential. The development of urban color planning is not to artificially regulate and control the color of the city, but to provide vibrant streets and comfortable and pleasant environments for all citizens living in the city, and to shape the city's image in order to stimulate the city's unique personality and meaning.

2. Research Purpose

Taking Huizhou Avenue in Hefei City, Anhui Province, as the target area, this project cuts across the interdisciplinary fields of colour psychology, architecture, and science and technology statistics,

and adopts quantitative methods such as questionnaire surveys, SD assessments, and brainwave analyses, combined with factorial clustering, Simpson's Diversity Index, and other research methods, to analyse the colours of street buildings in Hefei City.

This research method will be used to study the impact of colour on urban street design and on the mental health of residents. From this, a colour information database will be established to screen out colour genes rooted in Hefei's history and culture. In addition, the primary and secondary colours of the whole section of Huizhou Avenue will be positioned, and colour protection principles and application strategies will be proposed to provide a scientific basis for the renovation of the old city and the development of new urban areas.

In order to highlight the regional characteristics and cultural connotations of Hefei architectural colours, it is suggested to use the combination of colour charts and colour features with chromatographic method to achieve standardization and unification of Hefei architectural urban colour planning and design, and to provide a basis for the construction and management of Hefei architectural urban colour.

3. Research Methods and Literature Data Collection

3.1 Research method

At the beginning of the study, 1695 pieces of literature were selected and the time interval was limited to the period between 2012 and 2022, and nearly 400 high-frequency words were screened out through the high repetition rate of word frequency, and then keyword clustering and label analysis was carried out by using the VOSviewer software, as shown in the figure below.
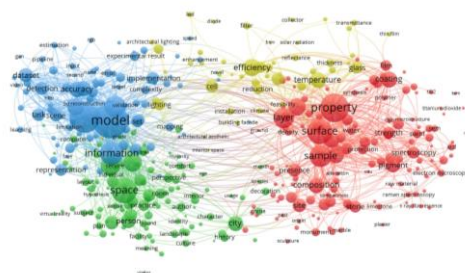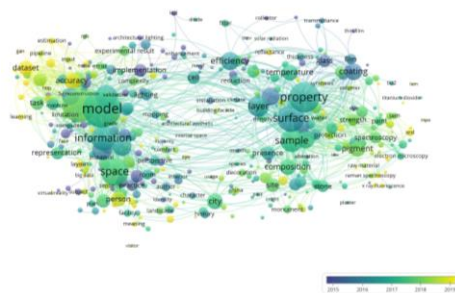

Figure 1: Clustering view

Figure 2: Label View

The clustering view (Fig 1) reflects the distribution of research hotspots. According to the analysis results of VOSviewer, property, model, space and person are the focuses and hotspots of current research. In the clustering view, the keywords are divided and summarized into different "collections", which represent different directions and regions of architectural colour research. For example, the "red collection" shows that in the study of architectural colours, researchers have paid more attention to the coating, composition and pigment of the façade; the "blue collection" tends to show the

accuracy, complexity and representativeness of the façade colour models and datasets. The "blue collection" tends to show the accuracy, complexity and representativeness of the colour models and datasets of architectural façades, as evidenced by the other labels "accuracy", "representation", "dataset", etc.

The label view (Fig 2) is mainly generated based on the keyword scores in the literature, which in this study is set as the chronological situation of keyword appearance. According to the illustration, it can be seen that as the colour changes from blue to yellow, the chronology transitions from 2012 to 2022, and the cutting edge of colour research has also gradually shifted from the materials of architectural colour to quantitative studies of the relationship between colour and people, among other things.

3.2 Literature data collection

The data in this paper mainly comes from the China National Knowledge Infrastructure(CNKI) and Web of science(WOS), with master's and doctoral theses and journal articles as the main carrier, searching for "urban colour", "street colour", "architectural colour" and "perceptual evaluation". A total of 3790 articles were found by searching keywords including "urban colour", "street colour", "architectural colour" and "perceptual evaluation". From the retrieved articles, the current main research directions are in the areas of urban colour and urban planning, colour study of historical and cultural districts, and architectural colour study. Externally, there is little research work on the colour between building clusters and between streets, as follows (Table 1):

Table 1: Summary of Keyword Search

Search Keywords	City Colours						Street Colours							Building Colours							Sensual Colours						A study of street architecture colour based on perceptual evaluation
Research	City Colour	Urban Colour Planning	Urban Colour Design	Urban Planning	Regionality	......	City Streets	Streetscapes	Street space	Urban Streetscapes	Street Colour Planning	Building Facades	......	Architectural Colours	Architectural Design	Architectural Colour Design	Urban Architecture Color	Architectural Interior Colors	Architectural Decoration	......	Perceptual Evaluation	Perceptual Engineering	Perceptual evaluation system	Perceptual Evaluation	Post-use Evaluation	......	/
Number of articles	528	317	51	48	45	1335	20	14	12	10	7	6	147	534	139	99	99	50	46	2298	6	3	1	1	10		0

4. Review of domestic and overseas studies

4.1 Overview of overseas studies

Italy's Turin and France's Paris are the forerunners of urban colour planning, the main purpose of which is to protect the city's historic districts and highlight local characteristics. Subsequently, the Longyearbyen city of Norway and London's Thames riverfront have also put forward colour schemes, most of which are based on the colour scheme of the new city, with an emphasis on the use of colour modulation to create a high-quality urban colour landscape.

For Asia, Japan's urban colour scheme is the most representative, as it focuses on colour surveys and sample analyses with both objectivity and authenticity, and requires practical consideration not only of buildings, but also of the overall harmony and unity of all the streets, landscapes, and vignettes in the city [1].In 2004, the Japanese government firstly introduced *a Landscape Law,* which, at the legal level, imposed a strict colour control in local areas. By 2007, Japan once again formulated the *Tokyo Metropolitan Landscape Plan*, which provides a detailed description of the principles of urban colour use.

4.1.1 Research on urban colours

With the arrival of the cultural economy, people want a creative cultural city to improve the quality of life, and urban colour design is really one of the key strategies, which not only meets the emotional and cultural values, but also plays an important role in constructing the city's identity, responding to the local image and shaping the city's brand. Lee, Yun-Joo analyses the characteristics and colours of the city of MI1 City and finds that artificial colour schemes based on natural landscapes, regional resources and civic awareness can be an important way of reflecting the local image of the city, and shows that the aim of this research is to increase the satisfaction of the residents and to improve the development of the city by creating a unique cityscape and by realising the identity and competitiveness of the city. Also, he firmly believes that colour planning should become an independent application system and give it a unique identity, and that there will be more applicable and matching application areas in the future [2]. Coincidentally, Kim Yong-chul has completed Lee Yeon-choo's vision to a certain extent. He divided the areas that occupy an important part of the colour of the urban environment, such as flats, outdoor billboards, road facilities, public utilities, temporary roof buildings, etc., into examples based on the colour differences between traditional and natural spaces. Then, the components of urban colour and related conditions as well as the basic directions of the colour scheme are analysed and organised. Finally, an urban identity is established through colour and a harmonious direction for urban colour planning is proposed [3].

In addition, with the construction of smart cities in full swing, city colours have become more and more important in the construction of smart cities. Xufeng Yang used CityEngine and GIS data to quickly create a virtual city, and then used the MATLAB program platform to realize the parametric design of the city's main colour, including the control of the change of the spatial structure of the city's main colour, in addition, the Explorer software also supports the loading of multiple datasets, which can be downloaded from the Internet or uploaded locally, and it can dynamically load a large-scale 3D aboveground and underground city simulation models. The design of urban building colour or improvement schemes will then be carried out effectively.

4.1.2 Research on street colour

Currently, Chinese cities are facing the reality of the dilemma of the convergence of colour appearance and the demise of regional colours. There are more existing studies on macro-city colour planning, while there are fewer meso- levels and micro-levels of regional and street colour planning and design schemes, and the colour planning lacks operability and effectiveness. There are many studies on the planning, design and management of architectural colours, but very little research and design on the colours of street squares, environmental sketches, lighting and plants. In this context, Lingling Chen and Fanqiang Kong propose a detailed investigation and quantitative methodology for area and street colour planning at the meso-micro level, based on a street renewal design practice project on Jiangchuan Road in Minhang District, Shanghai. A multidimensional Menzel's colour database of the site was constructed through the comparative analysis of the colour card comparison method, photography and colour correction method, and spectrophotometer method [4]. Zixuan Liu and Lee,seokHyun, in the study of Nanjing historical and cultural neighborhoods, combined the colour policy required by the Nanjing Historical and Cultural City with the current situation of street colours, and carried out a field survey and colour analysis of Confucius Temple Street in Qinhuai District, Nanjing, and then, taking two major historical buildings and three streets in Fuzimiao Street in Qinhuai District as the objects, they analysed the relationship between the colour values determined by the government and the colour values of the field survey. The final results show that the colours of the surveyed areas are generally in line with the regulations of the local government, and the main colours of the street buildings adopt the same shades, which can maintain a good continuity of the

street colours. This study is expected to support the establishment and improvement of architectural colour policies, and at the same time, it can provide reference value for the development of research directions on the continuity and sustainability of colour in Chinese historical and cultural streets, as well as environmental colour standards [5].

At the meso level, landscape colour occupies a great part of street colour, and Mao Yingming and Jong Ki Kim explore the differences between Qingdao and Busan commercial streets from the perspective of landscape colour. Firstly, the relevance of the two cities in the landscape is discussed at the macro level, then the results are obtained at the micro level by collecting pictures, quantifying them, collating data and drawing charts, and then the results of the study are used to objectively analyse and compare the colour landscapes of the commercial street buildings in the two countries. Finally, it was concluded that both Qingdao and Busan commercial streets have red and yellow-based red tones supplemented by fresh and light blue tones in terms of colour distribution, but the colour of buildings in Busan commercial streets is lower than that of Qingdao, and the colour application is more inclined to yellow-green than that of Qingdao [6].

Similarly, Chen L, Ryu J and Lee J et al. conducted a comparative analysis of the colours used in the buildings of traditional Korean and Chinese commercial streets and obtained the following results: firstly, Korean commercial streets have a brighter ambience than Chinese commercial streets, but because of this, the huge difference in colours makes the buildings of the Korean commercial streets lack unity and continuity. This is caused by the diverse mix of new building facades and exterior materials, so in order to create visually more stable shopping streets, the author proposed some necessary measures such as: colouring the vastly different decorative materials with repainting or replacing the decorative materials, which will help to create a colour coverage that is compatible with the surrounding buildings [7].

4.1.3 Research on architectural colours

The architectural colour of the city is an important part of the city's specific history, culture and the spirit of the times, and plays a vital role in the development and change of the city. Taking Xingning traditional block in Nanning as an example, Zhang Lei selected some important nodes in the block and put them into the overall architectural landscape color, and found many bad aspects, such as lack of systematic planning, poor matching materials, messy architectural color and other challenges of contemporary social development to architectural environmental color. On this premise, he put forward the urban architectural environmental color planning and maintenance strategy [8]. Cui Jinjing, Juyeon and Kim et al. believe that the colour and the proportion of colour used in each area of the city are different, just as "there are no two leaves in the world that are the same", there are no two alleys in the world that are the same. Different alleys have different atmospheres and characters due to the personalities of the local inhabitants, climate, hydrology, vegetation and other colour-related accessories.

Therefore, how to make effective use of architectural colour to string together the background of the whole neighbourhood and to bring out the culture of a city is an issue that planners, architects and related practitioners must pay attention to [9].

4.2 Overview of Domestic Research

Compared with foreign countries, China's urban colour research started late. In March 2000, the Beijing Municipal Government promulgated the *Beijing Municipal Building Facade Keeping Tidy Management Regulations*, which put forward "grey tones as the basis of the composite colours, in order to create a stable, atmospheric and elegant urban environment". Like a spark, Beijing's initiative has triggered many cities to conduct relevant research and practice.

In February 2018, the Nanjing Municipal Planning Bureau issued the *Nanjing Colour Control Guidelines*, which put forward the urban architectural colour themes of "Sycamore Plain Colour" and "Jinxiu Make-up Flower", decorating the plain background of the sycamore with bright colours such as Jinxiu like flowers to make the city colour more layered and rich. In May 2022, Fuzhou Municipal Natural Resources and Planning Bureau put forward the *Fuzhou City Colour Planning Implementation Guidelines*, based on the historical and cultural characteristics of Fuzhou City and the characteristics of the natural environment, put forward the urban architectural colour theme of "refreshing landscapes and elegant banyan city", guiding the formation of natural landscapes and humanistic buildings to reflect each other, with warm and elegant architecture. The overall colour image of the city is warm, elegant, fresh and pleasant, reflecting the natural landscape and humanistic architecture.

4.2.1 Research on urban colours

Colour is the most sensitive visual element that can be perceived by the visual senses, and the feeling it evokes is often overwhelming. The colour of a city is the precipitation of history and culture, as well as the choice and preference of many residents [10]. In foreign countries, scientific and orderly urban colour planning and construction has made many cities unique and eye-catching. At the same time, it gives all these cities valuable intangible value. In China, on the other hand, due to the lack of understanding of urban colour planning and the theory of built environment, many buildings have caused serious visual pollution to the overall image of the city in the process of urbanisation. Therefore, Zhao Qing believes that the planning and research of urban colour is of great practical significance to the design of the whole urban landscape [11].

Therefore, how to meet the requirements of the times for the beauty of uniqueness and individuality while preserving the characteristics of the city has just become one of the hottest topics in this century. Based on the importance of urban colour, Lan Bai, Chengnan Li and Xin Zhang have carried out practical work in three fields, including the identification of urban colour, the extraction of urban primary colours, and the adjustment of urban colours, which effectively reflect the current situation of urban architectural colours and make long-term plans [12].

However, the current domestic research in related fields is obviously insufficient, which is not difficult to see by comparing with experts and scholars in the fields of color theory, urban color planning and practice at home and abroad. Luo Pingjia and Li Zizhe believe that nowadays, urban architecture and environmental color are only studied from the static point of view of people, rather than from the experience of people moving constantly in space, which has a blind spot. Perhaps this may provide a new development model for the study of color harmony in Chinese urban space, thus promoting the scientific development of urban color planning [13].

The progress of human beings is inseparable from the development of technology, and this is also true for academic research. In order to achieve quantitative control of colour design and precise control of urban colours by digital means, Honglang Jiang and Hongnan Gu use the quantitative control method of colour, combined with the interpolation and regression algorithms of the MATLAB software platform, to auto-fill the image map and obtain the ideal base map of the main city hues [14] [15]. While Xuelin Xu, Zhengwei Zhu and Yi Ma collected and analysed the current urban colour data using semantic parsing (SD) and other methods, delineated different levels of colour control zones based on the impact of colours on the urban landscape, identified coordination zones of different shades through expert assessment, and derived the recommended chromatograms and control guidelines for each colour zone. Then, SHL colour parameters were extracted and digitally converted from the Menzel colour system to the SHL colour system, and independent colour determination, approval and monitoring were carried out on the basis of the information system, which established a complete urban colour process control system and achieved the digitization and

precision of urban colour control [16].

On this basis, Shen Jie, Yang Bo and Geng Jun worked out practical work plans and technical routes for specific projects, and studied and analyzed the natural environment, urban history and culture, traditional and modern architecture and the individual color of regional development. This project is based on the analysis of the natural environment, the history and culture of the city, the traditional and modern architecture and the individual color of urban development, and puts forward some suggestions on the management and implementation of the urban color plan. At the same time, on the premise of meeting the unified style of urban color planning, the personal color preferences of different functional areas are considered [17].

4.2.2 Research on street colour

Most existing urban colour plans are at the macro level, which makes it difficult to consider the scale of the street. For most colour plans, it is difficult to obtain meaningful results after implementation, and research that controls the colour characteristics of street surfaces can effectively control the construction of colourful street environments. Yan Hu analysed the colour culture of Beijing's royal and residential buildings as an example, and found that the royal buildings have rich shades of yellow and red, while the residential buildings are mostly grey and green, and therefore proposed corresponding conservation strategies [18].

As the capital of China and a famous historical and cultural city, its traditional city colours are an important part of the city colours and a reflection of the city's personality. Wuhan, as a central city in the central region, also faces a huge colour problem. So Ge Bai, Yufeng Wen and Wei Gan extracted and analysed the colour characteristics of Lihuangpi pavement, and proposed a colour weighting method to get the pavement colour scheme through parameter control, which guided the colour control and renovation of Lihuangpi pavement [19].

Qingdao is a famous tourist city along the coast of China, because of the colonial background in the past, there are a large number of existing German and Japanese buildings, it is a city with great characteristics and littered with cultural heritage, even so, the buildings in its old town are still influenced and impacted by modern architectural concepts. Taking the colour design of street pavements in Qingdao's old town as the object of study, Zhouxiang Tan and Chenglai Li elaborated on this issue from different perspectives and levels based on an extensive field study and proposed a colour optimisation strategy [20] [21].

The optimisation strategy is only a practice at the awareness level, but many innovative practices are needed to solve the street colour problem. In this context, Shijun Dong and Wan Wang et al. achieved the macro-control of street renovation through the overall coordination of urban colours and regional urban colour characteristics, and the micro-control of street renovation through the colour schemes of existing buildings on both sides of the street, such as walls, roofs, decorations, signs, floors, plants, and other landscape elements [22] .

4.2.3 Research on building colours

As an important part of urban visual perception, faҫade colour design has an irreplaceable role in today's rapidly developing urban society. As a new element in the development of urban colour planning, the dynamic palette model plays a crucial role in the overall planning of urban space and the overall understanding of urban perception [23]. Therefore, based on the basic hue model of colour, Qiangbin Pan, Xinyi Li and Zheng He explored the internal colour model and the changing law of colour under relative motion, classified street architecture as dynamic perceptual features, and introduced the colour design of urban architecture under dynamic hue, so as to achieve the goal of pedestrians and tourists experiencing the street architecture and enhancing the overall emotion of the

city [24].

However, at present, most Chinese cities have a wide range of colours, lack of urban primary and secondary colour systems with local characteristics, and urban colour management is out of control [25]. On this basis, Yunjiao Luo, Qingsong Liu and Ai Yang used computer technology to model and design work of building complexes according to functional divisions, and proposed a colour planning scheme to ultimately control building colours [26]. Meanwhile, taking the historical lot of Fifth Avenue in Tianjin studied by Lina Zheng, Changan Zuo and Yuan Li as an example, an in-depth analysis of the current building colour characteristics was carried out by obtaining colour samples, statistical analysis and mathematical modelling. Finally, the colour function model of the main colour of the building was constructed and a mathematical language describing the logical relationship between the colour of the building and the surrounding buildings was obtained [27].

4.2.4 Research in the field of perceptual evaluation

In China, there are fewer studies on the perceptual evaluation of street building colours, which are mostly used to measure people's perceived image of the city and evaluation criteria. Wenlei Li selected four representative streets in the regionally representative commercial streets of the ancient city, used the Semantic Difference Scale to conduct a questionnaire survey of mainlanders and Taiwanese, and analysed the results using SPSS statistical tools, and based on the quantitative results, inferred the correlation between the design features of the commercial streets of the ancient city and the semantic image [28]. .

In addition, Wang Zhaoyu and Zhuang Weimin took Nanluoguxiang in Beijing and Nanshe Ancient Street in Dongguan as examples, and expounded the common characteristics and elements of the two historical blocks through field investigation. Taking online reviews as data sources, the SD method is used to determine the user satisfaction of two commercial streets. In addition, it also analyzes the different evaluation criteria of urban and rural users for similar spatial types and the same design elements under the background of urban-rural differentiation [29] [30].

In short, most of these studies on colour involve the study of urban colour and the colour of historical and cultural districts, while there are very few studies on the colour of buildings along main urban roads and between building clusters. Secondly, most of the studies are mainly qualitative and lack quantitative in-depth analyses. On the other hand, architectural colour is constantly evolving, and scholars have mainly focused on the importance of colour to cultural heritage, but effective research and correlation with human perception assessment are lacking.

5. Conclusion

At present, many cities in China have realized the importance of urban colour in emphasizing the city's personality and regional characteristics, and the development of urban colour planning is moving forward. At the current stage of urban development in China, how do we judge the colour status of the various urban scenes before us? How can architects change the colours of streets and buildings to achieve the desired colours of the city? Is there a unity of values between urban planners, architects and ordinary city dwellers?

There is still a large gap in the study of urban colour planning at the street level. At the micro level, the complexity of the colour issue dictates that the focus of the review can only be on the colour control of the street surface. Perhaps by exploring the method of colour control on the street surface of Huizhou Avenue, some of the shortcomings of the detailed urban colour control plan can be remedied in the future, thus further implementing urban colour planning.

Based on the contrast, coordination and psychological characteristics of colors, the project aims to restore the old colors of streets and improve their characteristics. The design integrates the cultural

and historical colors of Huizhou Avenue into the street buildings, outlines and decorates the appearance of the buildings, and enhances the quality and sense of space of the streets. Finally, it links the streets with the urban development and positioning of Hefei, guides the inheritance of traditional culture in Hefei, continues the traditional historical and cultural features of streets, and provides an established and referential color model for Hefei's color norms.

References

[1] Zhanzhu Wang, Yamo Wu. A study of colour creation in Japanese cities [J]. Urban Planning, 2013, 37(04):89-96.

[2] Lee, Yun-Joo. (2008). Urban Color Planning for Enhancement of City Image and Identity - Focused on the Color Plan based on Natural Scenery of MI1-yang City. Journal of the Korean Institute of Architects, 10(2), 133-140.

[3] Song, Gwang Cheol and Kim, Young Cheol. (2010). A study on the current status and improvement plan of urban colour in Korea. Korean Society for the Convergence of Science and Art, 6, 45-54.

[4] Lingling, C. and Fanqiang, K. (2021) Quantitative Method of Regional Color Planning – Field Investigation on Renewal Design of Jiangchuan Street. Springer, Cham, 2021. 608-617.

[5] Liu Zixuan and Lee, seok Hyun. (2021). A Study on the Color of Street Architecture in Historical City -Focused on the Commercial Street of Kongzi Temple, Qinhuai District, Nanjing City. Proceedings of the Korean Colour Society, 35(4), 102-112.

[6] Mao, Yingming and Jong Ki Kim. A Comparative Study on Architectural Colors of Commercial Streets between Qingdao and Busan. Korea Institute of Design Research Society, (2021): n. pag.

[7] Chen L, Ryu J, Lee J .A Study on Comparative Analysis of Color Application Characteristics of Building Elevation and Outdoor Advertisements on Traditional Commercial Streets in Korea and China[J].Journal of Korea Society of Color Studies, 2016, 30(1):25-35.

[8] Zhang L, Peng Z .Planning and maintenance of urban architectural environmental color—A case study of xingning traditional block in nanning city [J].International Journal of Electrical Engineering Education, 2021:002072092098467.

[9] Jin-Kyung Choi, Ju-Yeon Kim and Guisook Seo. (2018). Characteristics of architectural elevation colour series in cultural urban regeneration areas. Korean Journal of Living Environment, 25(5), 541-554.

[10] Guo, A. 2020. Discussion on Shanghai's urban color creation. Sci. Dev. 2, 72-78.

[11] Zhao Qing. City, give you some colours to see--analysis of urban colour planning and design [J]. Urban Construction Theory Research (Electronic Edition), 2017(27):88-89.

[12] Lan, B. Chengnan, L. Xin, Z. Practical Exploration of Urban Colour Planning--Taking Chengdu City as an Example [J]. Urban Architecture, 2021, 18(35):48-51.

[13] Pingjia, L. Zizhe, Li. Research on colour planning problems in urban space based on colour dynamic reconciliation [J]. Journal of Southeast University (Philosophy and Social Science Edition), 2012, 14(01):69-72+124.

[14] Hongnan, G. Honglang, J. Quantitative control method of urban colour primary tone with digital technology support--Ankang city colour planning and design as an example [J]. Planner, 2013, 29(10):42-46.

[15] Changyong, C. Engang, L. Urban colour planning practice from perceptual cognition to quantitative control[J]. Planner, 2019, 35(02):73-79.

[16] Xuelin, X. Zhengwei, Z. Yi, M. Research on the construction of urban colour control system in Xiamen[J]. Planner, 2020, 36(18):77-82.

[17] Jie, S. Bo, Y. Jun, G. Research on urban colour planning--Taking Anlu City in Hubei as an example[J]. Central China Architecture, 2018, 36(02):9-12.

[18] Yan, H. Research on the traditional architectural colour culture and protection strategy of Beijing's historic districts [J]. Central China Architecture, 2014, 32(02):183-186.

[19] Ge, B. Yufeng, W. Wei, G. Research on colour characteristics and control methods of street interface in historical and cultural districts--Taking Lihuangpi Road in Wuhan as an example[J]. Central China Architecture, 2020, 38(03):81-84.

[20] Zhouxiang, T, Chenglai, L. Research on colour optimization strategy of street interface in Qingdao old city under colonial background [J]. Architecture and Culture, 2019(08):144-146.

[21] Shi, J. R., Duan, Y. Y., Cui, Y. Y., Zhao, X. M., 2013. The research of regional Coastal City color: a case study of Qinhuangdao urban color planning. Ecol. Econ. 10, 188-191.

[22] Shijun, D, Wan, W. Yuelin, X. Jianping, S. Research on colour control in street reconstruction[J]. Journal of Hebei University of Architecture and Engineering, 2010, 28(04):32-34+43.

[23] Aiping, G. Spatial Logic of Architectural Colour--Werner Spillmann and the Colour Scheme of German Town Kirchsteigfeld [J]. Journal of Architecture, 2007(01):77-80.

[24] Qiangbin, P. Xinyi, L. Zheng, H. A preliminary study on colour design problems of urban street buildings under dynamic reconciliation [J]. Chinese and foreign architecture, 2015(11):71-73.

[25] Long, H. Yukun, Z. Weidong, W. Practical Exploration of Urban Colour Planning and Building Colour Remediation in Wuda District, Wuhai City [J]. Modern Urban Research, 2016(05):47-52.

[26] Yunjiao, L. Qingsong, L. Ai, Y. Discussion on architectural colour planning techniques in urban image construction--Taking Beijing Road in Kunming as an example[J]. Planner, 2011, 27(12):101-105.

[27] Lina, Z. and Chang'an, Z. Yuan, L. (2013) Discussion on the construction method of architectural colour feature model of urban historic districts—Tianjin Five Avenues Windscape District. Urban Development Research, 20(02):129-132.

[28] Wenlei, L. Semantic evaluation of spatial sensibility consciousness of commercial street in ancient city [J]. Southern Architecture, 2016(01):39-45.

[29] Zhaoyu, W. and Weimin, Z. (2019) A study on post-use assessment of perceptual evaluation SD method driven by point-by-point data—taking urban and rural historic districts as an example. New Architecture, (04):38-42.

[30] Zhaoyu, W. and Weimin, Z. Research on post-renewal assessment method of neighbourhoods based on image deep learning--taking Beijing Shichahai neighbourhood as an example[J]. New Architecture, 2022(03):5-8.