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Research on the city image and cognitive distance based on chromatogram at the scale of mega city in Wuhan

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ABSTRACT

The research studies the city image and cognitive distance at the scale of mega city scale in Wuhan. In the research, lots of people's attitudes data towards city images were collected by questionnaire in 15 areas and analyzed by mathematical software. Moreover, they are presented by chromatogram. The following conclusions are drawn. The research obtains a lot of data on people's attitude data through the investigation and finds that the city images of Wuhan have changed with the expansion of the city. Also, the research finds that chromatogram is feasible to analyze the city image. As for the attitude data of people, the research analyzed it with distance data. Hankou beach, Hubu Lane, Wuhan Yangtze River Bridge, Yellow Crane Tower and Wuhan University show significant correlation according to the results. The nearest metro stations around these five images are generally above 1 km. However, for the correlation analysis of Jianghan Road Walkway, Guiyuan Buddhist Temple, Optical Valley Business District, East Lake Scenic Area of Wuhan and Han Street, the results show that there is no correlation. The nearest metro stations around these five images are generally less than 1 km.

1. Introduction

1.1. Research background

The public intention of a city is the common memory of city environmental information of city residents, which is based on the common communication mode of city history, culture, and residents (Kevin Lynch 1960). In the daily activities of spatial behavior, people's perception, and cognition of the external environment, combined with their own culture, experience and emotion, transform this cognition into image. With the accumulation of time, several images gradually form an orderly structure, which forms the city image.

The research on the city image of Wuhan was first seen in the 1990s. According to the research at that time, Wuhan did not have a clear central image of the city, and its easy identification was in a medium level (Lin 1999). Although the geographical conditions were outstanding, the two rivers divided into three towns, the city spatial framework was clear, and the architectural complex at the intersection of the three towns also played an absolute control role, but in each area, there are still many fuzzy and blank city images.

With the development of the city, great changes have taken place in Wuhan. The central city area of citizens' consciousness is not limited to the intersection of three towns, but also expanded, the scope 1of sense of belonging has been expanded, and the city image has also been updated.

1.2. Research purpose

This research has taken Wuhan as the research object. Based on the city image investigation method proposed by Kevin Lynch, this research uses the method of questionnaire to investigate the city image of Wuhan among the citizens in 15 areas, and uses SPSS software to analyze 10 city images. The main purpose of the research can be summarized as follows:

I. Count the statistics of Wuhan citizens' attitudes towards Wuhan city image, including liking degree, familiarity degree and importance degree.

II. Try to use topological analysis method to present and analyze attitude data intuitively.

III. Discusses the relationship between cognitive distance and city image.

1.3. Research significance

Wuhan is in the middle of China and the middle and lower reaches of the Yangtze River. Wuhan, with an area of 8569.15 square kilometers and a resident population of 11.212 million. According to the

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definition of population of mega city (General Office of the State Council of the People's Republic of China, Notice of the State Council on adjusting the standard of city scale division, 2014), Wuhan, with a population of 11 million, is already a mega city. It has rivers, lakes and alleys interweaved, and the topography is rich. The Yangtze River and the Han River cross each other, dividing Wuhan into three towns. Also, it has a long history and culture, there are many historical buildings and cultural monuments in the city.

Referring to the previous journals and literatures, Wuhan is one of the few cities that began to study the city image earlier (Lin 1999). Compared with 30 years ago, great changes have taken place in Wuhan today. Not only has the city area been expanded, but also all kinds of city facilities are available. Has the development of the city also brought about changes in the city image? Therefore, it is imperative to study the city image of Wuhan.

The research of Lin Y. covers a high degree of construction area of Wuhan in 1990s, with an area of about 800 square kilometers, and there are around 6.69 million permanent residents in the city. And more than 30 city images are mentioned, most of which are single buildings. (Figure 1, the black line is the scope of the research and top 20 are listed). In the pre-investigation of this research of Wuhan city image, there are as many as 70 city images in people's cognitive scope (Figure 2, the black line is the scope of the research and top 20 are listed), not only historical and modern, but also artificial and natural, which can provide enough sample types and sample sizes for the research. Also, the research area reaches around 2600 square kilometers, three times higher than that in 1990s, and there are 11 million permanent residents in the city, nearly two times than that in 1990s. The diverse population composition also improves the accuracy of the experiment. The research on the city image of Wuhan is not only an update of the previous research, but also a reference for other cities of the same type.

Therefore, it is very important to study the city image of Wuhan in the new situation.

2. Previous research

2.1. Research theories

Kevin Lynch put forward the theory of city image in 1960s. He thinks that the city is not only a thing of its own existence, but also a city that residents feel. Through the cognition of the road, boundary, area, node, sign and other elements of the city, the residents form a cohesive feature, which reflects the direct or indirect experience cognitive space of the external environment in the brain, and is produced by connecting reality with certain imagination City impression, which is the subjective environment space in residents' mind (Kevin Lynch, The Image of the City, 1960). City image is the projection of city's space form and figure on people's psychology. Kevin Lynch believes that the description of city image by residents in the same city is similar, and any city seems to have a collective intention, which may be the overlapping of multiple and individual intentions. This research method is of great significance for analyzing city structure, leading city planning and studying environmental behavior.

2.2. Research of city image abroad

The theory and practice of city image research in foreign countries have appeared earlier. In recent years, Barbara Osóch (Osóch and Czaplińska 2019) studied the city image of Szczecin in Poland, by combining questionnaire investigation and cognitive map. The purpose of this research was to find out whether the spatial perception of young people in Szczecin is related to city image, and to make a hypothesis. Therefore, the subjects were matched according to their gender and nationality, and the adolescents aged between 12 and 17 were selected. The research required them to draw the city map and the central city map of Szczecin, and filled in the anonymous questionnaire. The statistical data shown that the road is the most common element to describe the city. The road, area and landmark are the most common element combination to describe the city. At last, they found that the younger the subjects, the less detailed the cognitive map, but it doesn't affect the spatial scope of cognitive map presentation.

Gabriele Filomena (Filomena, Verstegen, and Manley 2019), based on Lynch's theory of city image, adopted a new method of city image calculation, which combined spatial cognition and geographic information system to obtain a complete city image. Through network science and technology, Fhilomena studied the five elements of city image, detecting landmarks, integrating the components of reference points, forming a spatial data set, and comparing it with Lynch's map. The results shown that the combination of spatial cognition and GIS has a good correspondence with the results of traditional methods in road, area, and boundary, but there are great differences in landmarks and nodes.

2.3. Research of city image in China

In China, the research on city image is carried out later. The research on city image in Wuhan started from Lin (1999). Her research started from area, road and boundary, node, and sign. Then she constructed the city image of Wuhan. In this research, students from three middle schools in three towns of Wuhan were investigated by using the method of questionnaire and

1	Wuhan Market
2	Guishan TV Tower
3	Yellow Crane Tower
4	Wuhan Zoo
5	East Lake Scenic Area of Wuhan
6	Guqin Platform
7	Qingchuan Hotel
8	Jianghan Road
9	Wuhan University
10	Guiyuan Buddhist Temple
11	Wuhan Yangtze River Bridge
12	Wuchang Railway Station
13	Mo Mountain
14	The Yangtze Hotel
15	Wuhan Customs
16	Wuhan Gymnasium
17	Jianghan First Bridge
18	Liberation Avenue
19	Zhongshan Avenue
20	Dadong Gate

Figure 1. City image of Wuhan in 1990s.

cognitive map, and the most beautiful place in Wuhan (1995), the symbol and proud place in Wuhan, the recommended place to visit in Wuhan were summarized and discussed. It was also found that there is no unified answer to the city center from Wuhan citizens. It also reflects that Wuhan is not easy to identify.

In recent years, Mengmeng Guo and Liu (2019) have also studied the city image of Jincheng by combining questionnaire investigation with cognitive map. Jincheng is an important node city of Central Plains city group and the central city of Southeast Shanxi Province. This research classified the spatial framework, characteristic nodes, and signs of Jincheng city from five aspects of five elements of city image. It was found that Jincheng has a more obvious network format city framework, and the residents in the main city area have a high awareness, but the city boundary is not obvious, the functions of each area are fuzzy, and the landmark buildings are less. The business district is too centralized and there is insufficient development space. Yiyou Zhang (2019, 2020) and Linyan Shang

1	Hankou Marsland
2	Jianghan Road Walkway
3	Guiyuan Buddhist Temple
4	Wuhan Yangtze River Bridge
5	Hubu Lane
6	Yellow Crane Tower
7	Wuhan University
8	Optical ValleyBusiness District
9	East Lake Scenic Area of Wuhan
10	Han Street
11	Hubei Museum
12	Wuhan Happy Valley
13	Tan Hualin
14	The Second Yangtze River Bridge in Wuhan
15	Hankou Railway Station
16	Wuhan Railway Station
17	Wuchang Uprising Memorial Hall of Xinhai Revolution
18	Zhongshan Park
19	Guqin Terrace
20	Wuhan Tianhe International Airport

Figure 2. City image of Wuhan in 2020s.

(2020) also studied the city image of Chongqing from the perspective of five elements of city image. Different from the questionnaire investigation method, the research was based on the scene theory, using the unique expression of the film works on the city space, analyzing the city image through the film perspective, and finding that the city image not only represents the city image, but also reflects the society problems and social needs are also unique city images.

3. Research method

In previous research, it is found that city image theory and cognitive map are of great significance for analyzing city structure, leading city planning and studying environmental behavior. They are still common and main methods in city image research. And new research methods combined with software will present and analyze data more intuitively. The following are the research methods of this research:

3.1. City image theory

The five elements of city image include road, boundary, area, node, and sign (Kevin Lynch, The Image of the City, 1960). As the skeleton of the city, the road is the main element of the city image perception. The network system of the direction, identification and multiple roads of the road further strengthens the spatial structure of the city. Boundary is a linear element other than road. It can not only form a psychological landmark, but also form a psychological structure of different cultures. The boundary of a city includes natural boundaries, such as mountains, rivers, forests, etc. It also includes artificial boundaries, such as highways, railway lines, bridges, ports, etc. The area is a relatively large city area, in which there is a relatively strong field effect, such as living area and commercial area. Node is the connection point of city structure and elements, often the center or dominant position of city and area. As a point reference in a city, signs are often used to determine the identity of a city. They are unique and form a whole in regular interaction and interdependence with other elements.

3.2. Cognitive distance

The cognitive distance can be divided into three parts: straight distance, route distance and psychological distance. Straight distance refers to the shortest distance between two points, ignoring the space obstacles that are exciting. Route distance refers to the passable distance between two points in real space. There may be multiple routes, and both are objective. Psychological distance adds subjective feeling to the route distance. Even if the same length of the route, the cognition of length may change on the psychological level because of the rest facilities, plant landscape and other factors on the way.

The cognitive distance can be represented by cognitive map (1992). Cognitive map is produced in the mind, like the model of site map, which is a comprehensive representation of local environment, including not only the simple sequence of events, but also the information of direction, distance and even time relationship (Lin 1991. After collecting, storing, and coding the information of a specific space environment, people will reproduce the environment in their minds, which is commonly called environment in the mind. Cognitive map is not an objective depiction of space environment, but a subjective memory after people's perception and processing. Some of them are clear, some are fuzzy, some are concrete, some are abstract, but they all contain the main characteristics of the space environment, which is the most important part of the space environment.

4. Process of data collection
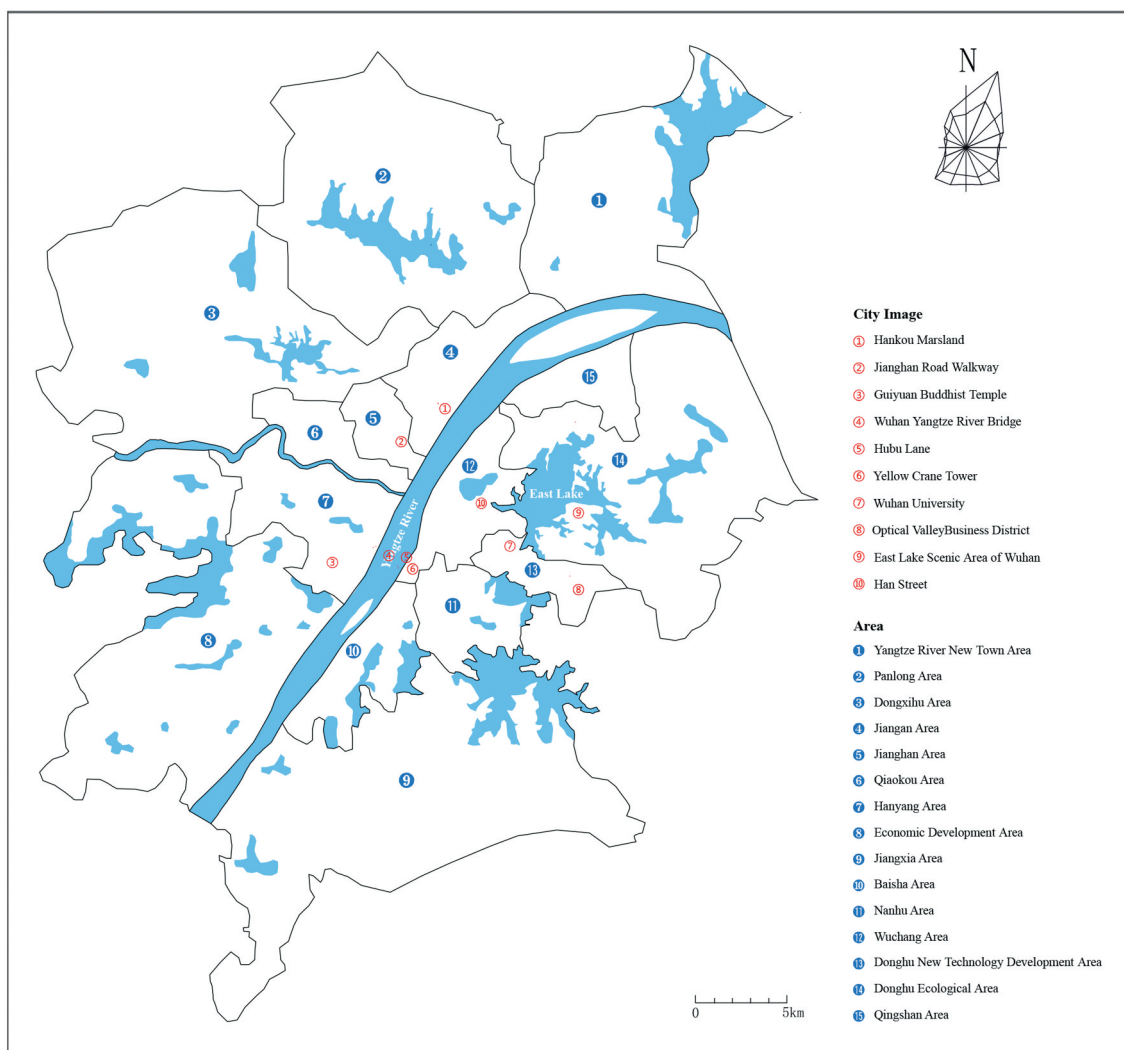
4.1. Research area

In this research, the city center of Wuhan is selected as the research area. Based on area construction degree in Wuhan and the subjective consciousness of citizens in different areas, and combined with the limited purchase boundary divided by Wuhan municipal government, the research area is divided into 15 parts and they are not districts (Figure 3), including: 1. Yangtze River New Town Area; 2. Panlong Area (east of outer ring expressway, south of Hou lake, west of Daihuang Expressway and north of Fu river); 3. Dongxihu Area (including Jinyin Lake, Jinyin Pond and Wujiashan area); 4. Jiangan Area; 5. Jianghan Area; 6. Qiaokou Area; 7. Hanyang Area; 8. Economic development Area (Wuhan Economic and Technological Development Zone, excluding Hannan); 9. Jiangxia Area (including Zhifang area, Miaoshan area, Daqiao area and Canglong area); 10. Baisha Area; 11. Nanhu Area; 12. Wuchang Area; 13. Donghu New Technology Development Area; 14. Donghu Ecological Area; 15. Qingshan Area.

4.2. Pre-investigation

According to the divided 15 areas, many researchers chose places with high flow of people in their respective areas to carry out the pre-investigation questionnaire under the condition of suitable climate and no special events. Each area randomly selected 30 Wuhan citizens as the pre-investigation objects, a total of 450 people, inquired face-to-face and filled in the most impressive and representative places in Wuhan. Finally, the results are as follows: Optical Valley Business District, Jianghan Road Walkway, Yellow Crane Tower, Wuhan Yangtze River Bridge, Hankou Marshland, Han Street, East Lake Scenic Area of Wuhan, Wuhan University, Hubu lane and Guiyuan Buddhist Temple are the most popular places in Wuhan (Table 1, Figure 3, Figure 4).

4.3. Formal investigation

The formal investigation adopts the open questionnaire as the main data source of the research. Wuhan is divided into 15 areas in the research. The investigation was conducted in sunny days without special circumstances. In order to ensure that each area has the same power of discourse, the investigation-place with similar population density were selected in each area. 55–60 people were randomly selected from each place, and a total of 845 questionnaires were obtained. After removing the invalid questionnaires, 750 valid questionnaires were obtained. The respondents were matched according to gender, identity, age, and other factors to improve the accuracy of the data (Figure 5).

City Image

① Hankou Marsland
② Jianghan Road Walkway
③ Guiyuan Buddhist Temple
④ Wuhan Yangtze River Bridge
⑤ Hubu Lane
⑥ Yellow Crane Tower
⑦ Wuhan University
⑧ Optical ValleyBusiness District
⑨ East Lake Scenic Area of Wuhan
⑩ Han Street

Area

❶ Yangtze River New Town Area
❷ Panlong Area
❸ Dongxihu Area
❹ Jiangan Area
❺ Jianghan Area
❻ Qiaokou Area
❼ Hanyang Area
❽ Economic Development Area
❾ Jiangxia Area
❿ Baisha Area
⓫ Nanhu Area
⓬ Wuchang Area
⓭ Donghu New Technology Development Area
⓮ Donghu Ecological Area
⓯ Qingshan Area

Figure 3. The distribution of 15 areas and 10 city images.

In the questionnaire, the research asked the subjects to rank the ten sites of the pre-investigation from the three dimensions of liking degree, familiarity degree and importance degree, and divide them into 1–10 grades according to the ranking (1 is the highest in the ranking).

Based on the pre-investigation, the formal investigation draws the research object and regional distribution map. In Figure 3, the blue dot is the place where the questionnaire is distributed, with a large flow of people, including people from all walks of life and ages. The questionnaires were handed out on a sunny rest day in October 2019 and they were filled face to face. And, the red dot is the ten most representative places in Wuhan selected from the pre-investigation results. Based on Baidu map, the center of gravity of each city image is determined. Finally, the distance between the center of gravity of the most representative place and the place where the questionnaires were sent out was counted, and the relevant tables were drawn (Table 2).
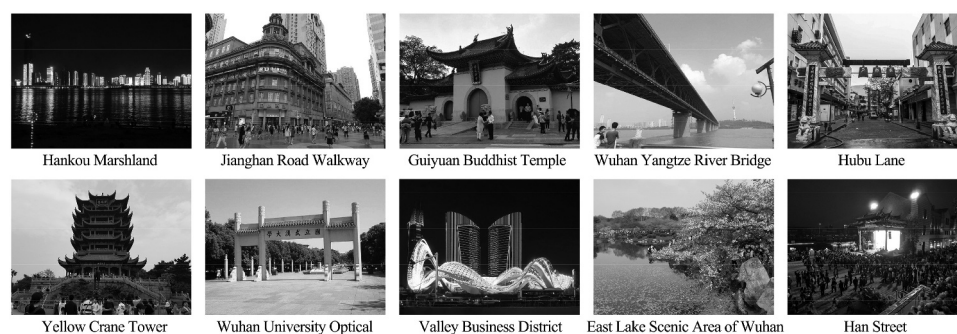
Figure 4. Top 10 city images in Wuhan.

Table 1. Statistics of Wuhan city image.

City Image	Frequency	Type	Time of existence[1]	Time of management[1]	Scale[2]	Nearest route distance from the nearest metro station[3]
Optical Valley Business District	57	Node	7 years	7 years	0.44 km^2	0 km
Yellow Crane Tower	55	Landmark	1798 years	40 years	0.36 km^2	1.7 km
Jianghan Road Walkway	51	Road	above 100 years	114 years	1.6 km	0 km
Wuhan Yangtze River Bridge	49	Boundary	65 years	65 years	1.2 km	2.5 km
Hankou Marshland	37	Boundary	above 160 years	19 years	1.6 km^2	1.2 km
Han Street	35	Road	9 years	9 years	1.8 km	0.2 km
East Lake Scenic Area of Wuhan	30	Area	118 years	118 years	88 km^2	0.1 km
Wuhan University	30	Node	127 years	127 years	2.5 km^2	1.8 km
Hubu Lane	29	Landmark	above 400 years	18 years	0.2 km	1.9 km
Guiyuan Buddhist Temple	24	Landmark	363 years	363 years	0.1 km^2	0.7 km

[1]. Data from Wuhan Local Chronicle
[2]. Data from Wuhan Natural Resources and Planning Bureau
[3]. Data from Baidu Map

4.4. Data statistics

The attitude data is divided into three dimensions: liking degree, familiarity degree and importance degree. Compared with the table of attitude data, the research used chromatogram to express attitude data, which connected the questionnaire sending place and city image center of gravity. According to the strength of attitude, ten color grades were divided, from 1 to 10 corresponding to different colors. Chromatogram is more intuitive in expression. The connection not only shows the distance between two points, but also reflects people's attitude. The specific results are as follows

4.4.1. Liking degree

According to the average value of liking degree, East Lake Scenic Area of Wuhan, Wuhan Yangtze River Bridge, Yellow Crane Tower, Wuhan University, Hankou Marshland, Jianghan Road Walkway, Han Street, Optical Valley Business District, Hubu Lane and Guiyuan Buddhist Temple are from top to bottom.

Although the Yangtze River New Town Area is far away from Guiyuan Buddhist Temple, it still has a high degree of liking, while the East Lake, which is closer, has a low degree of liking. However, it has a higher degree of liking for Han street, which is at a similar distance. Similar situation also occurs in Panlong Area. Jiangan Area has a low degree of liking for Hankou Marshland, which is closer. However, in Jianghan Area, there are different liking degrees for Guiyuan Buddhist Temple, Wuhan Yangtze River Bridge, Yellow Crane Tower, and Han Street, which are at a similar distance. Qiaokou Area has a high degree of liking for Optical Valley Business District which is far away. Hanyang Area and Economic development Area both have a high degree of liking for Guiyuan Buddhist Temple, which is closer. Although Baisha Area and Nanhu Area have low liking degree for Wuhan Yangtze River Bridge, their distances are not the same. Wuchang Area has a high degree of liking for Han street which is closer, however, Donghu New Technology Development Area and Qingshan Area prefer Guiyuan Buddhist Temple which is far away (Table 3, Figure 6).
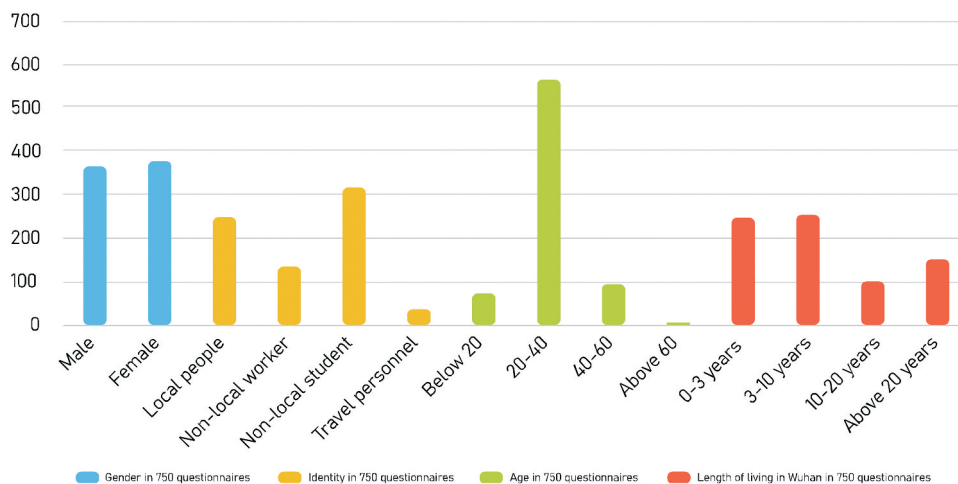
Figure 5. Basic information of the investigated people.

Table 2. Straight distance between the questionnaire sending places and city images center of gravity (km).

	Hankou Marshland	Jianghan Road Walkway	Guiyuan Buddhist Temple	Wuhan Yangtze River Bridge	Hubu Lane	Yellow Crane Tower	Wuhan University	Optical Valley Business District	East Lake Scenic Area of Wuhan	Han Street
Yangtze River New Town Area	13.83	16.88	24.33	22.29	22.22	22.60	19.89	22.27	18.37	18.24
Panlong Area	13.08	14.53	21.13	20.21	20.47	21.21	21.16	24.87	21.10	18.21
Dongxihu Area	10.46	9.63	13.57	13.82	14.35	15.28	17.80	22.11	19.18	14.37
Jiangan Area	5.75	7.93	15.27	13.67	13.78	14.37	13.62	17.28	13.62	10.84
Jianghan Area	4.59	3.59	9.51	8.70	8.85	9.90	11.71	16.00	13.08	8.28
Qiaokou Area	5.10	2.34	6.52	5.91	6.27	7.17	10.02	14.34	11.98	6.65
Hanyang Area	8.16	5.13	3.31	4.08	4.76	5.72	10.42	14.34	13.01	7.60
Economic development Area	12.90	10.08	2.65	5.00	5.40	5.65	11.38	14.33	14.51	10.08
Jiangxia Area	17.98	16.00	10.34	10.35	10.05	9.34	12.09	12.28	14.70	13.27
Baisha Area	16.38	13.79	6.69	8.14	8.23	8.00	12.90	14.74	15.95	12.66
Nanhu Area	9.43	8.24	7.11	4.56	3.84	2.97	3.53	6.28	6.58	4.39
Wuchang Area	2.91	2.86	8.38	5.86	5.69	6.04	5.59	9.84	6.99	2.29
Donghu New Technology Development Area	8.74	8.26	8.94	6.12	5.42	4.75	1.30	4.77	4.33	3.67
Donghu Ecological Area	8.58	10.31	14.65	11.71	11.17	10.85	5.46	6.29	2.66	6.75
Qingshan Area	9.98	12.87	19.36	16.66	16.32	16.33	11.68	13.33	9.65	11.66

4.4.2. Familiarity degree

According to the average value of familiarity degree, Wuhan Yangtze River Bridge, Yellow Crane Tower, East Lake Scenic Area of Wuhan, Wuhan University, Jianghan Road Walkway, Hankou Marshland, Optical Valley Business District, Hubu Lane, Han Street and Guiyuan Buddhist Temple are from top to bottom.

Yangtze River New Town Area is more familiar with Yellow Crane Tower, which is far away, than Han street, which is closer. Panlong Area is generally familiar with Hankou Marshland, even though it is relatively close. Jiangan Area, Jianghan Area, Qiaokou Area and Hanyang Area are more familiar with Guiyuan Buddhist Temple and Optical Valley Business District which are far away. Economic development Area is familiar with Guiyuan Buddhist Temple, Optical Valley Business District and Han street, but they are at different distances. Baisha Area, Nanhu Area and Wuchang Area are all less familiar with Wuhan Yangtze River Bridge, which is closer, while Qingshan Area is much familiar with Guiyuan Buddhist Temple, which is far away (Table 4, Figure 7).

4.4.3. Importance degree

According to the average value of importance degree, Wuhan Yangtze River Bridge, Yellow Crane Tower, Wuhan University, East Lake Scenic Area of Wuhan, Hankou Marshland, Jianghan Road Walkway, Optical Valley Business District, Hubu Lane, Han Street and Guiyuan Buddhist Temple are from top to bottom.

Table 3. Liking Degree (1 is the highest in the ranking).

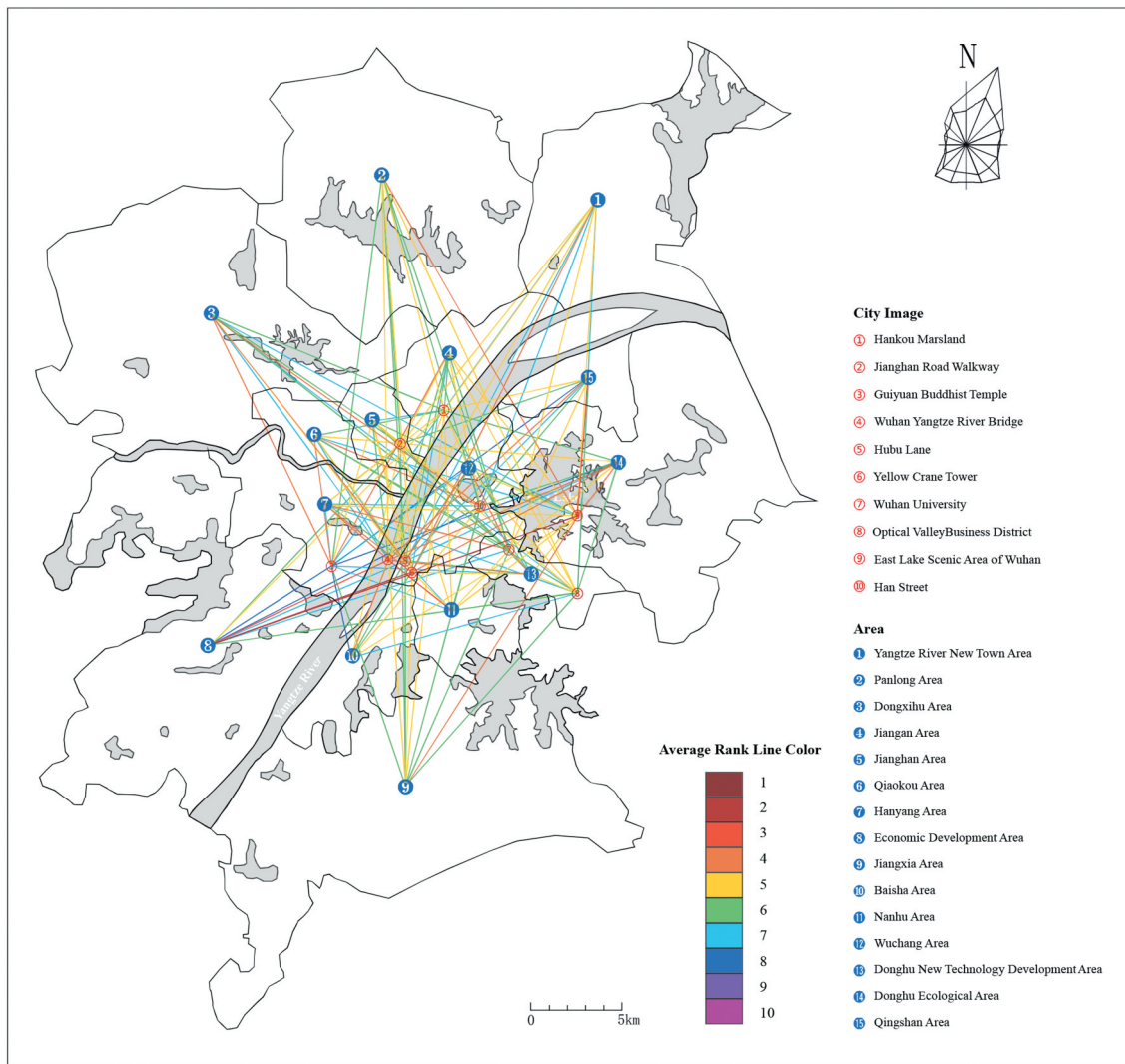|	Hankou Marshland	Jianghan Road Walkway	Guiyuan Buddhist Temple	Wuhan Yangtze River Bridge	Hubu Lane	Yellow Crane Tower	Wuhan University	Optical Valley Business District	East Lake Scenic Area of Wuhan	Han Street
Yangtze River New Town Area	4.56	5.22	6.52	4.5	6.7	4.36	4.54	7.24	4.62	6.74
Panlong Area	5.14	5.58	6.38	5.34	6.3	5.02	5.54	4.82	4.48	6.4
Dongxihu Area	5.72	6.16	3.5	6.78	3.86	5.42	5.9	6.9	6.52	4.24
Jiangan Area	5.88	4.94	4.32	5.6	5.68	6.78	6.08	5.1	5.42	5.2
Jianghan Area	6.86	5.46	4.86	6.32	5.38	5.24	5.74	4.68	5.6	4.86
Qiaokou Area	6.16	4.52	3.7	6.64	5.16	6.84	5.56	5.62	6.86	3.94
Hanyang Area	4.66	5.38	6.88	4.26	6.42	4.16	4.34	7.4	4.7	6.8
Economic development Area	5.38	6.34	8.16	3.14	6.5	2.4	7.06	6	2.28	7.74
Jiangxia Area	4.58	5.84	6.36	5.02	6.38	4.72	5.96	6.22	3.6	6.32
Baisha Area	4.6	4.86	8.4	4.12	6.32	5.56	4.78	6.5	4.54	5.32
Nanhu Area	5.2	5.28	7.1	3.18	6.66	5.44	4.74	6.34	5.04	6.02
Wuchang Area	4.8	5.54	7.42	3.92	6.48	5.64	4.24	5.46	4.5	7
Donghu New Technology Development Area	6.08	5.88	6.88	3.98	6.28	4.74	4.3	4.92	4.54	7.4
Donghu Ecological Area	5.52	5.46	8.14	4.04	7.28	3.5	4.58	6.4	4.38	5.7
Qingshan Area	4.5	5.78	7.56	4.46	6.8	6.4	4.6	5.84	3.4	5.66
Average	5.31	5.48	6.41	4.75	6.15	5.08	5.2	5.96	4.7	5.96

Figure 6. Chromatogram of liking degree.

Guiyuan Buddhist Temple, Hubu lane and Han Street are of high importance degree in Yangtze River New Town Area and Jiangan Area, but they are at different distances. As for Panlong Area, Guiyuan Buddhist Temple is more important than Wuhan Yangtze River Bridge, and Han Street is more important

Table 4. Familiarity degree (1 is the highest in the ranking).

	Hankou Marshland	Jianghan Road Walkway	Guiyuan Buddhist Temple	Wuhan Yangtze River Bridge	Hubu Lane	Yellow Crane Tower	Wuhan University	Optical Valley Business District	East Lake Scenic Area of Wuhan	Han Street
Yangtze River New Town Area	5.38	5.72	6.16	4.10	6.48	3.72	5.00	6.78	4.72	6.94
Panlong Area	4.36	6.04	6.38	5.70	5.80	4.66	5.36	5.26	4.02	7.42
Dongxihu Area	6.70	4.98	3.82	7.14	4.20	5.76	5.16	6.44	7.30	3.50
Jiangan Area	6.24	5.48	4.98	5.54	5.50	5.36	5.20	5.68	5.80	5.22
Jianghan Area	6.04	5.84	5.06	6.42	4.88	5.74	5.62	5.38	4.86	5.16
Qiaokou Area	6.32	4.82	4.32	6.56	5.22	6.98	5.68	5.24	5.92	3.94
Hanyang Area	5.36	5.88	6.44	3.96	6.22	3.50	5.08	6.82	4.70	7.04
Economic development Area	5.28	6.22	8.16	2.78	6.34	2.26	6.84	7.24	2.22	7.66
Jiangxia Area	5.60	5.36	8.12	3.96	5.62	5.08	5.60	4.96	4.64	6.06
Baisha Area	4.74	4.34	8.20	4.28	6.28	5.44	4.82	5.96	5.32	5.62
Nanhu Area	5.52	4.42	8.28	3.58	6.44	4.58	3.98	6.46	5.98	5.76
Wuchang Area	6.18	4.52	8.46	3.78	6.04	4.56	4.34	5.16	4.64	7.32
Donghu New Technology Development Area	5.84	4.60	6.66	4.40	6.18	6.02	4.32	5.24	5.26	6.48
Donghu Ecological Area	5.82	5.22	8.38	3.98	6.28	4.30	4.06	4.94	5.98	6.04
Qingshan Area	4.78	5.30	8.48	4.58	5.36	6.56	5.78	4.84	4.04	5.28
Average	5.61	5.25	6.79	4.72	5.79	4.97	5.12	5.76	5.03	5.96

than East Lake Scenic Area of Wuhan. Similar situations also appear in the Dongxihu Area, Donghu New Technology Development Area and Qingshan Area. In Jiangan Area, Guiyuan Buddhist Temple and Yellow Crane Tower are at the same distance, but the former is higher than the latter at the importance degree. Similarly, in Qiaokou Area, Wuhan Yangtze River Bridge, Hubu Lane and Yellow Crane Tower are at the same distance, but the importance of Hubu lane is significantly higher than the other. In Hanyang Area, Han street, which is far away, has a high degree of importance, while Jianghan Road Walkway, which is closer, has a low degree of importance. Jianghan Road Walkway and Guiyuan Buddhist Temple both have high importance degree in Economic development Area, although they are at different distances. Wuchang Area has a similar evaluation of the importance degree of Guiyuan Buddhist Temple and Han Street (Table 5, Figure 8).

5. Analysis of data

5.1. Ranking analysis

Further topological analysis of the city image data obtained from the investigation, and horizontal comparison of liking, importance and familiarity, the following conclusions can be drawn.

Wuhan Yangtze River Bridge and Yellow Crane Tower rank top in all aspects, and they have always been the symbol of Wuhan. Wuhan Yangtze River Bridge is not only a symbol of the city, as a bridge, but also an important means of transportation. And the Yellow Crane Tower has existed for thousands of years, with an early history of construction and long history of reconstruction. Also, witnessed the development of Wuhan from ancient times to the present.

Hankou Marshland, Jianghan Road Walkway, Wuhan University, Optical Valley Business District, East Lake Scenic Area of Wuhan, and Han Street are
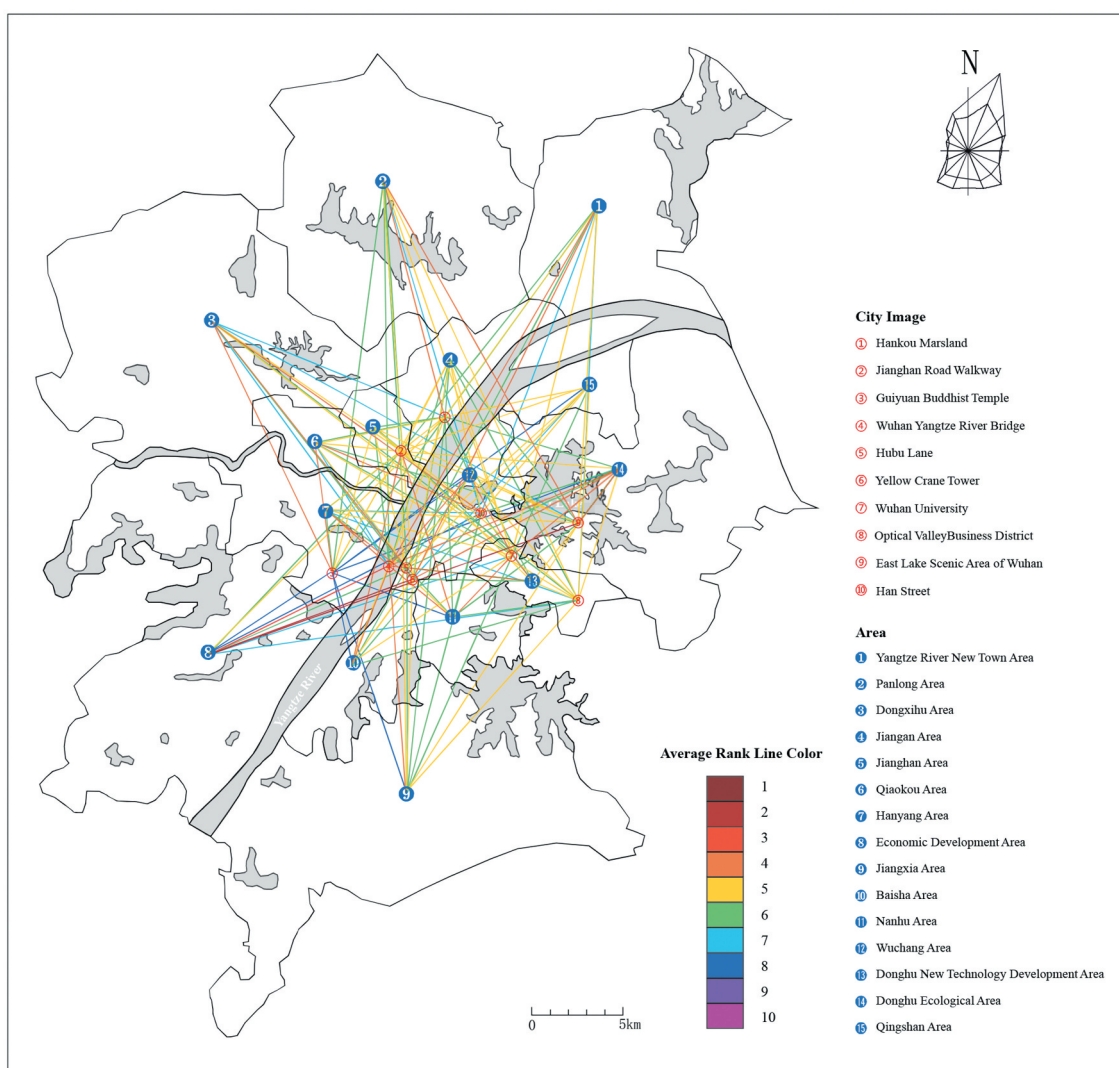

Figure 7. Chromatogram of familiarity degree.

Table 5. Importance degree (1 is the highest in the ranking).

|	Hankou Marshland	Jianghan Road Walkway	Guiyuan Buddhist Temple	Wuhan Yangtze River Bridge	Hubu Lane	Yellow Crane Tower	Wuhan University	Optical Valley Business District	East Lake Scenic Area of Wuhan	Han Street
Yangtze River New Town Area	5.92	5.86	6.8	3.78	7.06	3.26	3.8	6.42	4.54	7.56
Panlong Area	4.94	4.9	6.06	3.96	6.56	5.08	5.9	5.14	4.88	7.58
Dongxihu Area	6.48	5.22	3.54	7.4	4.14	5.1	5.22	6.96	7.22	3.72
Jiangan Area	5.44	5.12	4.5	6.24	5.32	6.42	5.78	5.68	5.78	4.72
Jianghan Area	5.88	5.56	5.24	6.44	5.56	5.44	5.86	4.58	5.54	4.9
Qiaokou Area	5.24	4.8	3.48	7.02	5.26	7.86	6.6	5.4	5.96	3.38
Hanyang Area	5.88	5.98	7.04	3.46	6.82	3.1	3.68	6.76	4.66	7.62
Economic development Area	5.78	5.92	7.84	2.74	6.86	2.76	5.84	6.04	3.22	8
Jiangxia Area	5.32	6.48	7.9	4.46	6.16	3.48	4.46	5.34	4.28	7.12
Baisha Area	5.34	5.38	7.18	3.6	6.58	4.41	3.36	6.76	6.45	5.94
Nanhu Area	5.44	5.72	7	3.12	6.28	4.04	4.42	6.52	6.26	6.2
Wuchang Area	5	5.52	7.64	3.38	6.08	4.62	4.12	5.62	5.72	7.3
Donghu New Technology Development Area	4.96	6	7.92	3.82	7.04	3.7	4.9	4.44	4.88	7.34
Donghu Ecological Area	6.14	5.68	7.74	2.76	7.4	2.56	3.56	6	6.3	6.86
Qingshan Area	5.46	6.12	7.58	3.9	6.74	4.64	4.44	5.38	4.06	6.68
Average	5.55	5.62	6.5	4.41	6.26	4.43	4.8	5.8	5.3	6.33
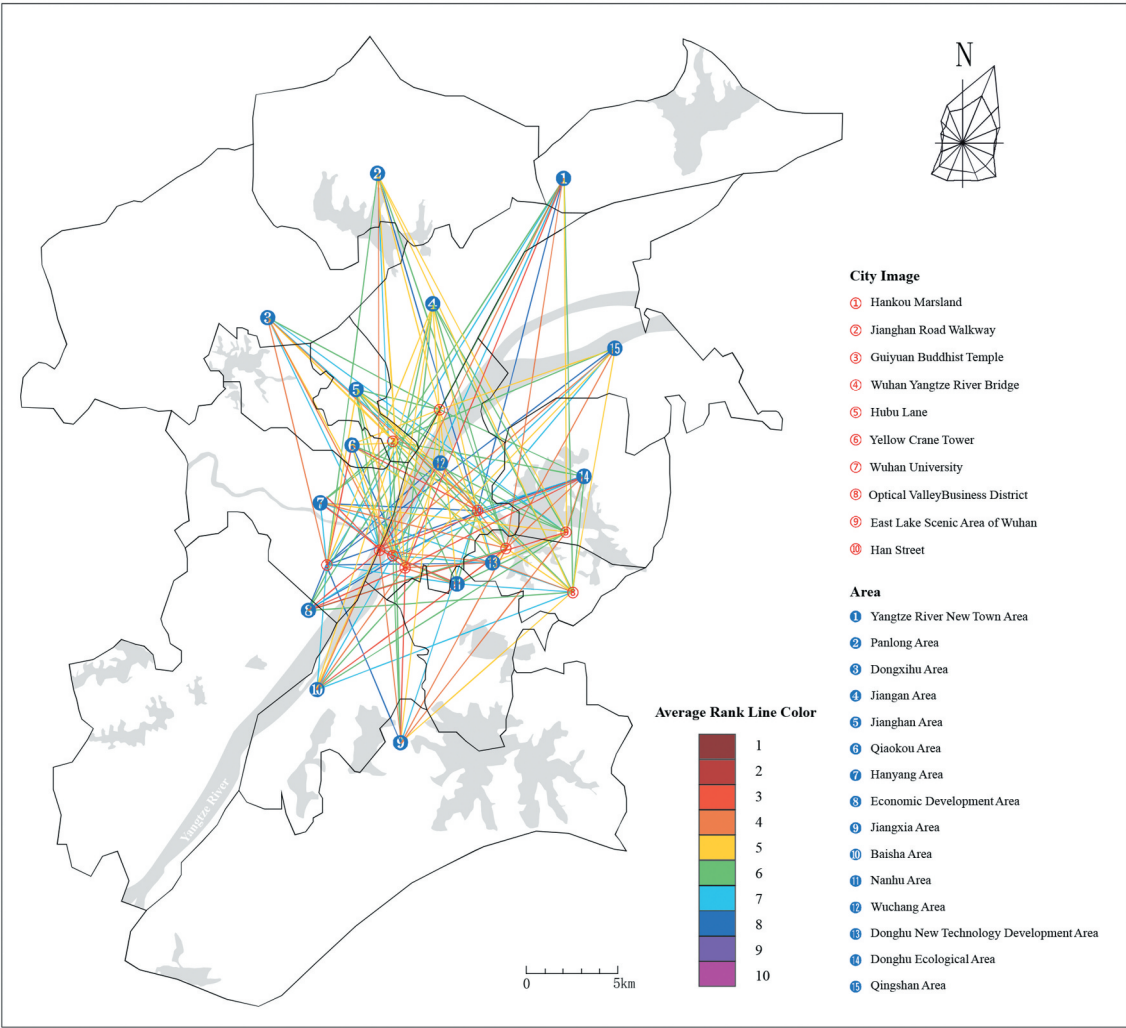
Figure 8. Chromatogram of importance degree.

all in the middle ranking. Hankou Marshland and East Lake are both natural scenic spots, the natural landscape is eternal, but its stability is difficult to cope with the rapid changes of people, so the overall ranking is in the middle. Wuhan University is a famous university. Although it is well known, due to the privacy of the University, even though the campus is open to the society, people still don't know much about it, resulting in its low ranking. Jianghan Road Walkway, Han street and Optical Valley Business District, as the walking street and business district at the forefront of culture and fashion, are deeply sought after and known by the public, especially the young people, and their positive impact on the city economy is becoming more and more important. However, their ranking is not high because they lack the corresponding cultural connotation of the city. They are emerging city images with good plasticity.

Although Guiyuan Buddhist Temple is a historical protection building in Wuhan, it has a strong cultural atmosphere and good cultural heritage value, which should have a high degree of cultural importance. However, due to the lack of effective publicity and the minority nature of religious belief, its ranking is not very high. Hubu lane with snack civilization, as a century old lane, is the epitome of old Wuhan city culture. However, due to the reasons of block management and other aspects, this lane has been controversial, resulting in its low ranking.

Analyze the location classification. In the three dimensions, some historical and cultural places are ranked first, such as Wuhan Yangtze River Bridge, Yellow Crane Tower, Wuhan University, etc. Most of them are historical buildings, they are fresh and clear. These symbols with strong historical and cultural flavor can often get people's sense of identity. The historical road, node, area, and landmark are the epitome of a city from each to the present, and are people's cultural dependence and pride on the city. However, historical blocks and buildings like Hubu lane and Guiyuan Buddhist Temple are gradually fading out of people's vision. They may not be well publicized, or they may lack effective management, which makes people reluctant to mention again. This is the loss of city culture. Therefore, good protection and planning of old landmarks is also an important part of city image.

Next are natural places, such as Hankou Marshland and East Lake Scenic Area of Wuhan. The natural landscape is always what people yearn for. In the process of city renewal and development, we should also rely on the terrain, supplemented by effective planning, build a green city core, and build a natural and harmonious city living environment with the natural environment and climate advantages of the city itself.

At the bottom of the list are some modern and commercial places, such as Jianghan Road Walkway, Han Street, Optical Valley Business District, etc. As a new city image, they play an increasingly important role in the city dominated by volume, but lack of cultural connotation makes them weak. At present, their performance is only the accumulation of capital and the imitation of form. They are in line with the "frontier". They have new ideas, new methods, and new images. They are conducive to shaping the new city image. They have great potential and development space.

The historical and natural images are still the main components of the city image. They all exist for a long time and store the memory of the city. However, due to various reasons, the historical image will be polarized, some will be remembered and some will be forgotten gradually, while the natural image is stable for the city image because the natural landscape is eternal. New city images need time to test, they have more development space.

5.2. Correlation analysis

In this research, the ranking and distance data of liking, familiarity, and importance of 15 regions are analyzed, and the following results are obtained.

There is a significant negative correlation between the liking degree and familiarity degree of Hankou Marshland and the distance data. The two-tail test is used in the research, and the correlation coefficients are −0.155 and −0.139 (Table 6). That is to say, the farther away from Hankou Marshland, the lower the ranking of liking and familiarity. It shows that the farther away from Hankou Marshland, the more people like it and want to know more about it from various aspects, but there is no correlation in importance. The familiarity ranking of Hubu lane is negatively correlated with the distance data, and the correlation coefficient is −0.100 (Table 7). That is to say, the farther away from the Hubu lane, the lower the familiarity ranking. It indicates that the farther away from the Hubu lane, the more information about Hubu Lane will be needed, and the more familiar with Hubu Lane will be, but there is no correlation in liking and importance.

The ranking of Wuhan Yangtze River Bridge shows a significant positive correlation with the distance data. The correlation coefficients of liking, familiarity, importance, and distance are 0.182, 0.178 and 0.130 (Table 8). That is to say, the farther away from Wuhan Yangtze River Bridge, the higher the ranking of liking, familiarity, and importance. It shows that the closer to Wuhan Yangtze River Bridge, the more people like and are familiar with Wuhan Yangtze River Bridge, and they think it's important to Wuhan. The ranking and distance data of Yellow Crane Tower also shows

Table 6. Correlation analysis of Hankou Marshland (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.386**	.323**	−.155**
		Sig. (2-tailed)		0.000	0.000	0.000
	Familiarity Degree	Correlation Coefficient	.386**	1.000	.221**	−.139**
		Sig. (2-tailed)	0.000		0.000	0.000
	Importance Degree	Correlation Coefficient	.323**	.221**	1.000	0.007
		Sig. (2-tailed)	0.000	0.000		0.846
	Distance	Correlation Coefficient	−.155**	−.139**	0.007	1.000
		Sig. (2-tailed)	0.000	0.000	0.846	

**. Correlation is significant at the 0.01 level (2-tailed).

significant positive correlation. The correlation coefficients of liking, familiarity, importance, and distance are 0.088, 0.084 and 0.082 (Table 9). The same as Wuhan Yangtze River Bridge, the closer the Yellow Crane Tower is, the more people like and know it, and think it is very important. As for the correlation analysis of Wuhan University, there are similar results. The correlation coefficients of liking, familiarity, importance, and distance of Wuhan University are 0.129, 0.116 and 0.075 (Table 10), showing a significant positive correlation. It indicates that the closer to Wuhan University, the more people like and know Wuhan University, and think it is very important.

For the correlation analysis of Jianghan Road Walkway, Guiyuan Buddhist Temple, Optical Valley Business District, East Lake Scenic Area of Wuhan and Han Street, the results show that there is no correlation (Table 11, Table 12, Table 13, Table 14, Table 15).

By comparing the results of relevance and uncorrelation, it is found that the accessibility of image affects the relevance between ranking and distance. Hankou Marshland, Hubu lane, Wuhan Yangtze River Bridge, Yellow Crane Tower, and Wuhan University mainly serve the pedestrian accessible people around them. However, the distance of the nearest rail transit station is generally above 1 km, which reduces the

Table 7. Correlation analysis of Hubu Lane (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.410**	.444**	−0.035
		Sig. (2-tailed)		0.000	0.000	0.340
	Familiarity Degree	Correlation Coefficient	.410**	1.000	.227**	−.100**
		Sig. (2-tailed)	0.000		0.000	0.006
	Importance Degree	Correlation Coefficient	.444**	.227**	1.000	−0.044
		Sig. (2-tailed)	0.000	0.000		0.232
	Distance	Correlation Coefficient	−0.035	−.100**	−0.044	1.000
		Sig. (2-tailed)	0.340	0.006	0.232	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 8. Correlation analysis of Wuhan Yangtze River Bridge (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.507**	.446**	.182**
		Sig. (2-tailed)		0.000	0.000	0.000
	Familiarity Degree	Correlation Coefficient	.507**	1.000	.468**	.178**
		Sig. (2-tailed)	0.000		0.000	0.000
	Importance Degree	Correlation Coefficient	.446**	.468**	1.000	.130**
		Sig. (2-tailed)	0.000	0.000		0.000
	Distance	Correlation Coefficient	.182**	.178**	.130**	1.000
		Sig. (2-tailed)	0.000	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9. Correlation analysis of Yellow Crane Tower (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.476**	.382**	.088*
		Sig. (2-tailed)		0.000	0.000	0.016
	Familiarity Degree	Correlation Coefficient	.476**	1.000	.254**	.084*
		Sig. (2-tailed)	0.000		0.000	0.021
	Importance Degree	Correlation Coefficient	.382**	.254**	1.000	.082*
		Sig. (2-tailed)	0.000	0.000		0.024
	Distance	Correlation Coefficient	.088*	.084*	.082*	1.000
		Sig. (2-tailed)	0.016	0.021	0.024	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 10. Correlation analysis of Wuhan University (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.440**	.413**	**.129****
		Sig. (2-tailed)		0.000	0.000	0.000
	Familiarity Degree	Correlation Coefficient	.440**	1.000	.341**	**.116****
		Sig. (2-tailed)	0.000		0.000	0.001
	Importance Degree	Correlation Coefficient	.413**	.341**	1.000	**.075***
		Sig. (2-tailed)	0.000	0.000		0.041
	Distance	Correlation Coefficient	.129**	.116**	.075*	1.000
		Sig. (2-tailed)	0.000	0.001	0.041	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

accessibility of the people far away. In the correlation analysis results, the ranking and distance will show significant correlation. Jianghan Road Walkway, Guiyuan Buddhist Temple, Optical Valley Business District, East Lake Scenic Area of Wuhan, and Han Street all have direct rail transit stations, with the distance generally less than 1 km. They not only serve the surrounding population, but also improve the accessibility of the people who are far away from them.

Therefore, in the correlation analysis results, there is no significant correlation between the ranking and distance (Table 16, Figure 9).

An independent test was conducted to further prove this conclusion. The distance from the nearest metro station is divided into two groups, group 1 is less than 1 km, and group 2 is greater than 1 km. It is concluded that there are significant differences in liking degree, familiarity degree and importance degree

Table 11. Correlation analysis of Jianghan Road Walkway (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.418**	.316**	0.050
		Sig. (2-tailed)		0.000	0.000	0.175
	Familiarity Degree	Correlation Coefficient	.418**	1.000	.255**	0.050
		Sig. (2-tailed)	0.000		0.000	0.169
	Importance Degree	Correlation Coefficient	.316**	.255**	1.000	0.071
		Sig. (2-tailed)	0.000	0.000		0.053
	Distance	Correlation Coefficient	0.050	0.050	0.071	1.000
		Sig. (2-tailed)	0.175	0.169	0.053	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 12. Correlation analysis of Guiyuan Buddhist Temple (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.628**	.594**	−0.065
		Sig. (2-tailed)		0.000	0.000	0.076
	Familiarity Degree	Correlation Coefficient	.628**	1.000	.509**	−0.046
		Sig. (2-tailed)	0.000		0.000	0.210
	Importance Degree	Correlation Coefficient	.594**	.509**	1.000	−0.048
		Sig. (2-tailed)	0.000	0.000		0.188
	Distance	Correlation Coefficient	−0.065	−0.046	−0.048	1.000
		Sig. (2-tailed)	0.076	0.210	0.188	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 13. Correlation analysis of Optical Valley Business District (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.424**	.504**	0.016
		Sig. (2-tailed)		0.000	0.000	0.661
	Familiarity Degree	Correlation Coefficient	.424**	1.000	.412**	0.065
		Sig. (2-tailed)	0.000		0.000	0.076
	Importance Degree	Correlation Coefficient	.504**	.412**	1.000	0.054
		Sig. (2-tailed)	0.000	0.000		0.137
	Distance	Correlation Coefficient	0.016	0.065	0.054	1.000
		Sig. (2-tailed)	0.661	0.076	0.137	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 14. Correlation analysis of East Lake Scenic Area of Wuhan (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.473**	.427**	0.017
		Sig. (2-tailed)		0.000	0.000	0.637
	Familiarity Degree	Correlation Coefficient	.473**	1.000	.413**	−0.052
		Sig. (2-tailed)	0.000		0.000	0.156
	Importance Degree	Correlation Coefficient	.427**	.413**	1.000	−0.038
		Sig. (2-tailed)	0.000	0.000		0.300
	Distance	Correlation Coefficient	0.017	−0.052	−0.038	1.000
		Sig. (2-tailed)	0.637	0.156	0.300	

**. Correlation is significant at the 0.01 level (2-tailed).

**Table 15.** Correlation analysis of Han Street (n = 750).

			Liking Degree	Familiarity Degree	Importance Degree	Straight Distance
Spearman's rho	Liking Degree	Correlation Coefficient	1.000	.655**	.505**	−0.056
		Sig. (2-tailed)		0.000	0.000	0.127
	Familiarity Degree	Correlation Coefficient	.655**	1.000	.523**	−0.025
		Sig. (2-tailed)	0.000		0.000	0.491
	Importance Degree	Correlation Coefficient	.505**	.523**	1.000	0.012
		Sig. (2-tailed)	0.000	0.000		0.752
	Distance	Correlation Coefficient	−0.056	−0.025	0.012	1.000
		Sig. (2-tailed)	0.127	0.491	0.752	

**. Correlation is significant at the 0.01 level (2-tailed).

Table 16. The shortest route distance from the nearest metro station to each image.

City Images	Hankou Marshland	Jianghan Road Walkway	Guiyuan Buddhist Temple	Wuhan Yangtze River Bridge	Hubu Lane	Yellow Crane Tower	Wuhan University	Optical Valley Business District	East Lake Scenic Area of Wuhan	Han Street
Nearest metro station	Toudaojie Station	Xunlimen Station	Zhongjiacun Station	Funxinglu Station	Xiaodongmen Station	Funxinglu Station	Guangbutun Station	Luoxionglu Station	Chuhehanjie Station	LiyuanStation
Routedistance	1.2 km	0 km	0.7 km	2.5 km	1.9 km	1.7 km	1.8 km	0 km	0.1 km	0.2 km
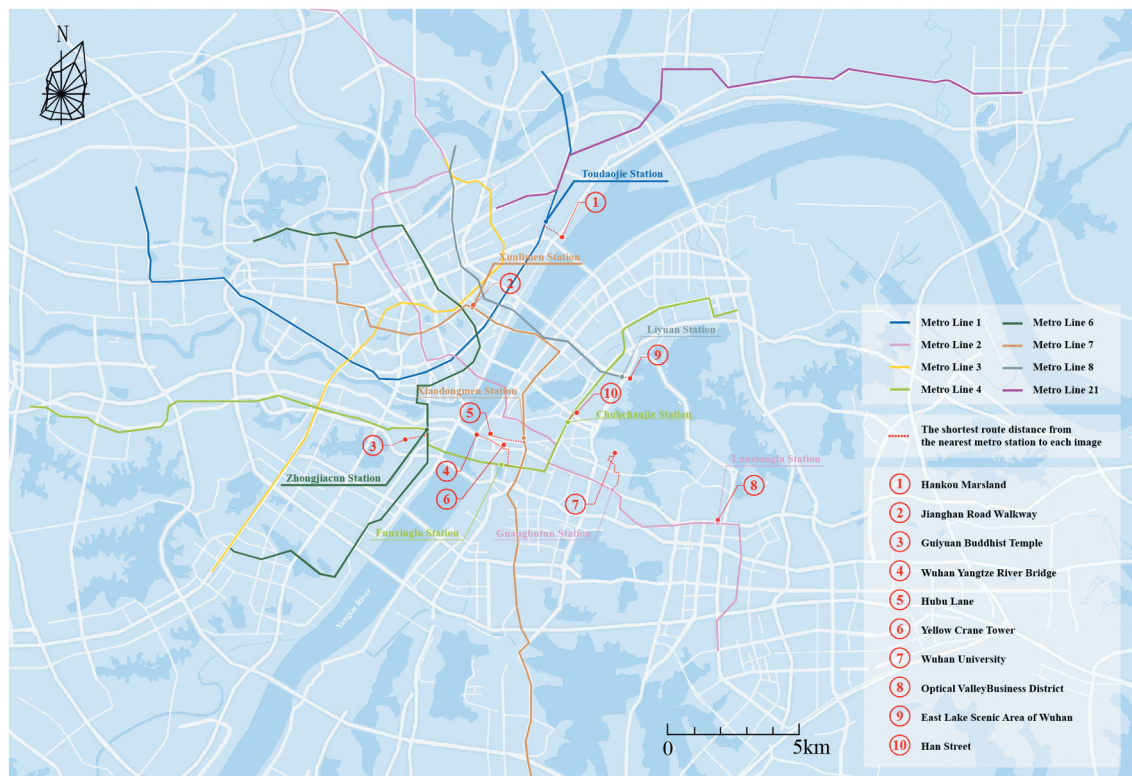
Figure 9. Route from the nearest metro station to each image.

Table 17. Group statistics on people's attitude between the city images which below 1 km away from the nearest metro station and those which above 1 km.

	Group	N	Mean	Std. Deviation	Std. Error Mean
Liking Degree	Below 1 km	3750	5.7024	3.01432	0.04922
	Above 1 km	3750	5.2976	2.70827	0.04423
Familiarity Degree	Below 1 km	3750	5.7584	2.95963	0.04833
	Above 1 km	3750	5.2416	2.75888	0.04505
Importance Degree	Below 1 km	3750	5.9107	2.87867	0.04701
	Above 1 km	3750	5.0872	2.80772	0.04585

Table 18. Independent samples t-test on people's attitude between the city images which below 1 km away from the nearest metro station and those which above 1 km.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Liking Degree	Equal Variances Assumed	93.122	0.000	6.117	7498	0.000	0.40480	0.06617	0.27508	0.53452
	Equal variances not assumed			6.117	7413.664	0.000	0.40480	0.06617	0.27508	0.53452
Familiarity Degree	Equal Variances Assumed	38.190	0.000	7.822	7498	0.000	0.51680	0.06607	0.38728	0.64632
	Equal Variances not Assumed			7.822	7461.307	0.000	0.51680	0.06607	0.38728	0.64632
Importance Degree	Equal Variances Assumed	1.595	0.207	12.540	7498	0.000	0.82347	0.06567	0.69474	0.95219
	Equal Variances not Assumed			12.540	7493.335	0.000	0.82347	0.06567	0.69474	0.95219

(Table 17, Table 18). When the distance between the city image and the nearest metro station is less than 1 km, there is no significant correlation between the degree of liking, familiarity, importance, and cognitive distance. When the distance between the city image and the nearest metro station is greater than 1 km, the degree of liking, familiarity, importance, and cognitive distance are significantly correlated.

5.3. Summary

As the container of city activities, city image carries people's diversified spatial behaviors, and it should be diversified itself. Now, Wuhan city image is developing in this direction. No matter modern, historical, artificial, natural, large area and small area, they are the public memory of people in the city, and the replacement of multiple city images in the space and function level, can also be used as the city space transformation strategy with high economic and cultural benefits, to create a good living environment and promote the dynamic renewal of the city. Wuhan is a constantly updated city. The development of rail transit has further facilitated the whole city residents. The convenience of transportation has improved the accessibility of city image, making the city image no longer limited to a single area, and the image accessibility has also become the influencing factor of city image of super large-scale cities.

6. Conclusion

l. Compared with the study of city image in Wuhan conducted by Lin Y. in 1990s, Wuhan has already become a mega city, the city images have changed greatly. For example, Guishan TV Tower and Wuhan Zoo have been replaced by new city images. Qingchuan Hotel, The Yangtze Hotel and Dadong Gate, have also been rebuilt or demolished. Yellow Crane Tower, Wuhan University and East Lake Scenic Area of Wuhan have been continued. The research shows that the city images will change with the expansion of the city and the development of traffic. The historical and natural images are still the main components of the city image. They all have existed for a long time and store the memory of the city. However, due to various reasons, the historical image will be polarized, some will be remembered and some will be in the urgent need for improvement. While the natural image is stable for the city image because the natural landscape is eternal. Some other city images need time to test, they have more development space. Other city

images, especially modern architecture, have a certain sense of the times, and reflect the needs of the people at that time. Such city images will change with the development and expansion of the city, they may be demolished, or be replaced by new modern architecture.

II. The research finds out the ten most frequently mentioned city images in Wuhan, and obtains a large amount of data on citizens' attitude towards them through the investigation. As for the average value of liking degree, East Lake Scenic Area of Wuhan, Wuhan Yangtze River Bridge, Yellow Crane Tower, Wuhan University, Hankou Marshland, Jianghan Road Walkway, Han Street, Optical Valley Business District, Hubu Lane and Guiyuan Buddhist Temple are from top to bottom. According to the average value of familiarity degree, Wuhan Yangtze River Bridge, Yellow Crane Tower, East Lake Scenic Area of Wuhan, Wuhan University, Jianghan Road Walkway, Hankou Marshland, Optical Valley Business District, Hubu Lane, Han Street and Guiyuan Buddhist Temple are from top to bottom. And for the average value of importance degree, Wuhan Yangtze River Bridge, Yellow Crane Tower, Wuhan University, East Lake Scenic Area of Wuhan, Hankou Marshland, Jianghan Road Walkway, Optical Valley Business District, Hubu Lane, Han Street and Guiyuan Buddhist Temple are from top to bottom.

III. In the research, plenty of subjects were selected from 15 districts in Wuhan. They were asked on the spot and filled out questionnaires face to face. Through these data, the research used chromatogram to express attitude data, which connected the questionnaire sending place and image center of gravity. According to the strength of attitude, ten color grades were divided, from 1 to 10 corresponding to different colors. It is found that chromatogram is more intuitive in expression and it is suitable for the research of city image. It can directly show the distance, the location of city images and the attitude of people.

IV. The research analyzed distance data and attitude data. Hankou beach shows a negative correlation and the correlation coefficients of liking degree and familiarity degree are −0.155 and −0.139. Hubu Lane also shows a negative correlate and the correlation coefficients of and familiarity degree is −0.100. Wuhan Yangtze River Bridge shows a significant positive correlation and the correlation coefficients of liking degree, familiarity degree and importance degree are 0.182, 0.178 and 0.130. Yellow Crane Tower also shows significant positive correlation and the correlation coefficients of liking degree, familiarity degree and importance degree are 0.088, 0.084 and 0.082. Wuhan University shows significant positive correlation and

the correlation coefficients of liking degree, familiarity degree and importance degree are 0.129, 0.116 and 0.075. The nearest metro stations around these five city images are generally above 1 km, therefor the people will prefer other means of transportation rather than the metro, so the attitude data shows correlation. However, for the correlation analysis of Jianghan Road Walkway, Guiyuan Buddhist Temple, Optical Valley Business District, East Lake Scenic Area of Wuhan and Han Street, the results show that there is no correlation. The nearest metro stations around these five city images are generally less than 1 km. The convenient transportation expands the service range and cognitive range, so the attitude data does not show correlation. When the distance between the city image and the nearest metro station is less than 1 km, there is no significant correlation between the degree of liking, familiarity, importance, and cognitive distance. When the distance between the city image and the nearest metro station is greater than 1 km, the degree of liking, familiarity, importance, and cognitive distance are significantly correlated. According to the results of independent test, when the distance between the city image and the nearest metro station is less than 1 km, there is no significant correlation between the liking degree, familiarity degree, importance degree and cognitive distance. When the distance between the city image and the nearest metro station is greater than 1 km, the liking degree, familiarity degree, importance degree and cognitive distance are significantly correlated. And, the people's attitude towards the city images which more than 1 km away from the nearest metro station is generally better than those which less than 1 km.

7. Discuss

Through the investigation of city images and the analysis of people's attitude towards city image, the research finds that when the scale of a city expands to a mega city, convenient transportation and people's cognition expand the scope of people's perception of the city. The historical and natural images are still the dominant ones, but people's cognition of city images is not limited to the inaccessible surrounding areas. In a mega city with a high degree of construction, the city image also tends to be diversified. The development of urbanization and the accessibility of image will become the focus of city image research.

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