Spatial characteristics analysis of Eaves Gallery along the street in China: take Hubei, Bashu, Jiangzhe areas as examples

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ABSTRACT
The Eaves Gallery (EG) along the street as a form of Chinese traditional dwelling was special architectural form for preventing pedestrians from rains and snows while walking through or shopping which has played important roles in the ancient commercial activities. In the past, the study about EG focused on architectural history, style, evolution in the separated specific local area. It helped the promotion of social attention to EG for protection and renewal. However, the protection and renewal conditions of EG are different in various regions of China. Few studies have done to compare and overview the characteristics of EG in these various regions. In this study, typical EG along the streets in Hubei, Bashu, Jiangzhe along Yangtze River regions from east to west of China were taken as case studies and are explicaded based on the comparison and analyzing field distribution mode, space combination, spatial scale, and function. Thus, the spatial functional characteristics of EG in these three regions are divided into unitary type, conversion type and mixed type. The outcome will serve as a comparative basis for the existentials form and spatial characteristics of extant traditional EG accompanied by optimum protection and renewal policy discussion in the future.

1. Introduction
In China, the Eaves Gallery (EG) street could be summarized that it is a pedestrian space, a shopping space or an entertainment space of shelter under the roof of building along the street (Yan 2018a). The top is an extension of the eaves, which are mainly distributed in southern China and used for preventing rain and sunshine. This form of EG is frequently seen in some prosperous towns with commercial activities in regular market days, which were once regarded as the economic function within the dwellings.

At the beginning of reform and opening-up (1978), it was due to weak sense of protecting about these typical timber construction buildings by the local that those EG buildings were torn down and replaced by brick buildings. In recent years, some of the EG streets were not so prosperous as before, which was caused by the lack of people. And it was partly due to that more people flowed into the city remaining a few citizens. It is said that some external styles of EG streets are well preserved, but some frontage are blocked by bricks. Therefore, this typical building loses its space meaning because of lacking connection. Then, it raised concerns of the governments and scholars within China.

Over the past few years, there have been a lot of researchers done on the protection and renewal of historical traditional cities. In 1999, the publication which title is Historic City Protection Theory and Planning was written by Ruan (1990); In 2001, Zhang (2001) who wrote a book called Introduction to Conservation of Historic Cities. On 28 October 2002, The Standing Committee of the 9th National People’s Congress worked out the Cultural Relics Protection Law of People’s Republic of China. In April 2012, the ministry of housing and urban-rural development, the ministry of culture, the state administration of cultural heritage and the ministry of finance jointly launched an investigation into traditional Chinese villages. By the end of last year, six batches of 276 state-level historic and cultural villages1 and four batches of 4,153 traditional Chinese villages2 had been announced.

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1Famous historical and cultural towns in China: The famous historical and cultural towns in China are jointly organized by the Ministry of Construction and the State Administration of Cultural Heritage since 2003. The preservation of cultural relics is particularly rich and has great historical value or commemorative significance. It can more fully reflect the historical features of some historical periods and towns with local ethnic characteristics. The first batch, published on 8 October 2003, a total of 12; the second batch, announced on 16 September 2005, a total of 24; the third batch, announced on 31 May 2007, a total of 36; the fourth batch, announced on 14 October 2008, a total of 36; the fifth batch, announced on 22 July 2010, a total of 61; the sixth batch, announced on 7 March 2014, a total of 107.

2Chinese traditional villages: Traditional villages refer to those villages with both material and non-material cultural heritage and high historical, cultural, scientific, artistic, social and economic values. Traditional villages carry the essence of traditional Chinese culture and are the non-renewable cultural heritage of agricultural civilization. Traditional villages embody the spirit of the Chinese nation and are the link to maintain the cultural identity of Chinese descendants. Traditional villages retain the diversity of national culture, which is the foundation for the prosperity and development of national culture. However, with the rapid development of industrialization and urbanization, the decline and disappearance of traditional villages are becoming increasingly obvious. Therefore, it is imperative to strengthen the protection and development of traditional villages. The first batch, published in 2012, a total of 646; the second batch, announced on 6 August 2013, a total of 915; the third batch, announced on 17 November 2014, a total of 994; the fourth batch, announced on 9 December 2016, a total of 1598 (The Traditional Chinese Villages Catalog, 2016).
However, the protection and renewal condition of traditional EG varies in different districts of China according to politics and economic issues. The EG streets in Bashu and Jiangzhe regions are well preserved, while most of the EG streets in Hubei province have been demolished or damaged. The existing examples include Xiaohao town and Shuangqiao town and so on. And few studies have done to compare and overview the characteristics of EG in these various regions. The previous studies about EG along the streets were imbalanced in the areas which mainly concentrated in Zhejiang, Jiangsu and other provinces and cities where the economy more developed; the traditional towns of Bashu area due to its unique geographic environment, folk customs and architecture were brought to the attention of the academia; the study of ancient EG towns in the middle of China was relatively insufficient.

The authors summarized the structural characteristics of the EG street in Hubei province, used the method of architectural typology, extracted and convert the prototype of EG and arcade in the application of modern architecture, so as to provide some reference for the regional architectural design (Yan, Wang, and Liang 2015). Also based on the analysis of existing distribution situation of the EG street in China from the perspectives of history, economic, climate and geographical distribution (Yan 2018b) and according to a large number of literature review collection of EG street in each area of China and the existing research status, this study analyzed that there are three typical districts, (1) Hubei plain area; (2) Bashu area; (3) Jiangzhe areas, which have EG were selected as three representative types for revealing the current situation (Figure 1).

The method for this study includes a review of past reports and relevant literatures; field investigations of typical cases which were selected from the three representative types; a questionnaire survey and interview of the related participating groups. In this study, 10 typical EG along the streets in Hubei, Bashu, Jiangzhe along Yangtze River regions from east to west of China were taken as case studies (Table 1).

The reason of selected 10 cases are listed in the Chinese traditional villages which has retained a relatively large historical evolution, namely, there is no major change in the architectural environment, architectural style and village site selection, and they also have unique folk customs, significance of inheritance in respective regions. Based on comparison and analyzing field distribution mode, space combination, space scale and spatial function in the 10 cases, the spatial characteristics of Chinese EG were proposed. This study aims to conduct preliminary basic research regarding protection and development for the spatial characteristics of Chinese traditional EG villages in the future.

2. Historical causes

2.1. The climate

According to the related documents, we know that weather influences the buildings a lot. In some area with a series of EG streets where the climate environment is more rain and the sunshine are intense. For example, we may find a lot of eaves gallery streets in Bashu area, Hubei province and some other place in China, which are near the middle and lower reaches of Yangtze River and belong to subtropical monsoon climate. These districts will enter the plum rain season at the middle of March. At that time, people will experience a series of wet day which may last about two months. And it indeed causes a lot of difficulties to the traffic. But according to the researches, we learn that EG streets can solve this problem. When facing the coming summer, people may live in a hard life, because most southern provinces of China enjoy the strong sunlight and hot temperature. But the EG streets provide the shade with people. In general, it is rainy days with hot temperature that induce the prevailing of the EG streets in the southern parts of China. And it is the reason why people may find more EG streets in northern provinces of China other than that in northern parts of China.

2.2. The historical causes

When referring to the historic reasons of the EG streets, it is closely related with the development of commerce. In the Northern Song Dynasty of China, Li-Fang unit system (Residential area) was broke up, which made the layout of the neighborhood began to transform into the free style of urban roads and the dense shops. And it thus induces the shops which are along the main streets to prevail. In addition, there is a series of books about EG streets in Northern Song Dynasty (960-). A good example about the painting called Along the River During the Qingming Festival which is a picture of Bian River in Dongjing (Figure 2). In this picture, we can see that the most of residential buildings located in both sides of EG street. And researcher Tan Gangyi just analyzed part of the

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1 Hubei Plain Area: it located in the middle reaches of the Yangtze River, in the middle and southern part of Hubei Province. It stretches from Zhijiang in the west to Wuhan in the east, from Zhongxiang in Jingmen in the north, and connected to the Dongting Lake Plain in the south. It covers an area of 46,000 square km. In April 2014, I conducted a field survey in Huaxi street, Xiaohe town, Hubei province, and mapped parts of traditional houses of the EG street.

2 Bashu Area: it located in southwestern China, and its general scope includes Sichuan, Chongqing and its neighboring areas. In history, its scope also includes the Hanzhong Basin, which is closely related to the culture of the Sichuan Basin. In June 2015, I conducted a field survey in Xiaoqi old street, Shangxin street, Fuling street, Qinghe street in Bashu area, and mapped parts of traditional houses of the EG street.

3 Jiangzhe Area: it refers to the area around the Yangtze river and Zhejiang. To the south of the Yangtze river and north of the Qiantang river in Jiangsu, Shanghai, Zhejiang and surrounding areas. In August 2014, I conducted a field survey in Wuqian and Xitang in Jiangzhe area, and mapped parts of traditional houses of the EG street.
whole picture. Judging from the roofs of houses, there are 18 buildings in the picture including 14 buildings along the streets and 4 residential buildings. What’s more, the local can carry out the commercial, entertainment as well as some daily activities on the EG streets. It is also recorded in the book of “Continued Zi Zhi Tong Jian Chang Bian” which is the largest chronicle ancient Chinese writings that many records of EG style buildings in the Northern Song Dynasty are called “Fanglang,” or “Langfang” in Ming Dynasty. In conclusion, we may refer that the EG streets have already owned its basic form in Northern Song Dynasty.

3. Field distribution mode

The different ways of field distribution have a direct impact on the block pattern, block scale, and the plane relationship between EG distribution and street in different geographical regions is not the same. According to the different distribution relations, it can be divided into three types of distribution types: (1) Continuous type; (2) Distributed type; (3) Piecewise type (Figure 3).

3.1. Continuous type

Continuous type refers to the architectural style of the whole street is almost all EG along the street, and the corridor continuity rate is very high. Continuous type is represented by (N1) Huanxi street of Xiaohe town on Jianghan plain of Hubei province. The main street of ancient town is EG. The length and width of street are almost 1600 m and 5 m, respectively. The width of EG is almost 2 m. The residence basically maintains the style of the Ming and Qing dynasties, mostly the two-story brick structure attic. It is typical of the commercial street space of traditional small town of central China.

In region of Hubei province and Jiangzhe area, the site distribution mode of EG is more continuous distribution; the site distribution mode of Bashu area is flexible which has a variety of forms, formed a rich field town style, divided into dispersive type, segmented type, as well as the continuous three kinds of distribution type.

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*Boat type*: Interviewed with local residents during the survey who described the shape of the street as “boat,” which was also mentioned in the study of “The Distribution and Spatial Characteristic of EG Street in China.” (Yang 2010).
Table 1. List for case study of this paper.

| No. | Street Name    | Location                                      | Longitude  | Latitude  | Area Types          |
|-----|----------------|-----------------------------------------------|------------|-----------|---------------------|
| N1  | Huaxi Street   | Xiaohe Town, Xiaochang County, Hubei Province | 114°03'    | 31°20'    | Hubei plain Area    |
| N2  | Shuangqiao Street | Shuangqiao Town, Dawu County, Hubei Province | 114°09'    | 31°53'    | Hubei plain Area    |
| N3  | Xiao Old Street | Xiao Town, Guangan County, Sichuan Province  | 106°52'    | 30°41'    | Bashu Area          |
| N4  | Shaxing Street  | Huaian Town, Chongzhou County, Sichuan Province | 103°31'    | 30°44'    | Bashu Area          |
| N5  | Fuling Street  | Fuling Town, Dashun County, Chongqing Province | 107°03'    | 20°30'    | Bashu Area          |
| N6  | Qinghe Street  | Qinghe Town, Dazhu County, Sichuan Province  | 107°14'    | 30°54'    | Bashu Area          |
| N7  | Dahe Street    | Lukong Town, Longchang County, Chongqing Province | 105°38'    | 29°29'    | Bashu Area          |
| N8  | Zhongshean Street | Zhongshan Town, Jiangjin County, Chongqing Province | 106°19'    | 28°50'    | Bashu Area          |
| N9  | Nvhoung Street | Wuzhen Town, Tongxiang County, Zhejiang Province | 120°29'    | 30°44'    | Jiangzhe Area       |
| N10 | Xitang Street  | Xitang Town, Jiangshan County, Zhejiang Province | 120°53'    | 30°56'    | Jiangzhe Area       |

1Huaxi Street: it is located in Xiaohe Town, Xiaochang County, Hubei Province and was built in the song dynasty, a long history. An existing ancient street of the Ming and Qing dynasties is 1600 m long and 5 m wide, with more than 300 buildings of the Ming and Qing dynasties on both sides of the street, covering an area of more than 200,000 square meters which was listed in the list of the second batch of Traditional Chinese Village Catalog.

2Shuangqiao Street: it is located in Shuangqiao Town, Dawu County, Hubei Province, and it was already a village as early as the southern and northern dynasties. The street is about 350 m long and 5 m wide. It used to be a developed commercial street with shops standing on both sides which was listed in the list of the forth batch of Traditional Chinese Village Catalog.

3Xiaoxi Old Street: it is located in Xiaoxi Town, Guangan County, Sichuan Province, and it is built near the mountains and beside the water, with a total length of more than 450 m that the middle spacious, gradually narrow to both ends, into the shape of a fishing boat. Another feature of the old street is its wide EG that with a width of 8 m on one side at its widest point which was listed in the list of the third batch of Traditional Chinese Village Catalog.

4Shaxing Street: it is located in Shaxing Town, Huaian County, Sichuan Province that belongs to famous historical and cultural town in Sichuan province. Facing the street, front hall, backyard and EG are the basic style of Huaian town.

5Fuling Street: it is located Fuling Town, Dashun County, Chongqing Province which was listed in the list of the third batch of Traditional Chinese Village Catalog.

6Qinghe street: it is located in Qinghe Town, Dazhu County, Sichuan Province. In 2002, it was awarded as the provincial ancient building group protection unit in Sichuan province. In 2005, it was awarded as the historical and cultural town in Sichuan province. It has been awarded as “Beautiful environment township” in Sichuan province.

7Dahe street: it is located in Lukong Town, Longchang County, Chongqing Province. The ancient town was built along the mountain. In the southern song dynasty, Lukong town became a water wharf and a material distribution center. All the money and grain weapons of the government needed to pass through here. In 2010, it was awarded the honorary title of the fifth batch of “famous historic and cultural towns in China” by the ministry of housing and urban-rural development and the state administration of cultural heritage. In March, it was ranked as one of the first “famous towns of landscape tourism with Chinese characteristics.” In December 2010, it was named as a famous historical and cultural town in China.

8Zhongshean street: it is located in Zhongshean Town, Jiangjin County, Chongqing Province. Zhongshean ancient town has a long history, the best preserved in the southwest of the Ming and Qing commercial street. The old town of Zhongshean town is built along the bamboo shoot river, with a total length of 1586 m and 453 shops. Now preserved 1,132 m, shop 307. It was approved as a famous historical and cultural town in Chongqing in 2002 and a famous historical and cultural town in China in 2005. On 5 June 2015, Zhongshean town of Chongqing was awarded “the most beautiful town in China.”

9Wuzhen street: it is located in Wuzhen Town, Jiaxing County, Zhejiang Province. Wuzhen is one of the first historic and cultural towns in China and a typical ancient water town in the south of the Yangtze river. It became the permanent site of the world Internet conference on 19 November 2014. Dongzhe scenic area was officially opened to the public in 2001. The first phase of Dongzhe scenic area covers an area of 0.46 square km with a travel distance of 2 km. It is composed of Dongzha old street, Guanqian street, riverside corridor.

10Xitang street: it is located Xitang Town, Jiangshan County, Zhejiang Province. Xitang is one of the first famous historic and cultural towns in China and has been included in the preparatory list of China’s world cultural heritage protection by UNESCO. There are well-preserved 250,000 square meters of Ming and Qing dynasties buildings in the old town, the size of the well-preserved is rare in Jiangnan. The folk houses are built near the water. The 1.01 square km old town area has 27 stone Bridges, 122 ancient EG more than 1,000 m long.
boat type street space is unique feature, and the far-reaching eaves and corridors along the street gradually gather at both ends of the street which strengthens the spatial image. The street length is 405 m, and the shortest and widest width of street are 4 m and 6.5 m, respectively (Yang 2010). The width of EG is almost range from 2 m to 5 m. The typical case of Jiangzhe area is located in (N9) Wuzhen Nvhong street, Zhejiang Province. The length of investigation street is 273 m. The width of EG is 2.35 m. It’s beside in the north of Xishi river which is maintained old traditional Jiangnan style. During the Ming and Qing dynasties, there was a gathering of exquisite embroidery in the area of Jiangzhe area. No matter be plain field town or hill country field town, successive EG has much imposing manner.

### 3.2. Distributed type

The distributed type refers to that the length of the EG appears in the units of the size of the bay of the folk house. Some of the EG of the folk house are connected into one piece, but the length into pieces is limited, which is not enough to form the image of the EG street, and is regarded as the individual image attached to the folk house. The representative of this

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**Figure 3. Site Distribution Pattern of EG.**

a - The plan of Lukong town street was drawn by Zhuo Yang whose master’s thesis called The Space Research on Gallery of Sichuan’ Town with gallerystreets. b - The plan of Zhongshan town street was drawn by Zhuo Yang whose master’s thesis called The Space Research on Gallery of Sichuan’ Town with gallerystreets. Other diagrams and photographs without special descriptions are drawn by the author.

| Area          | Site distribution pattern                                                                 |
|---------------|------------------------------------------------------------------------------------------|
| Hubei Plain Area | (N1) Huansi Street, Xiaohe Town, Xiosheng County (Almost 1600 meters) (1) Continuous type |
|                | (N2) Shuangqiao Street, Shuangqiao Town, Dawu County (Almost 350 meters) (1) Continuous type |
| Jiangzhe Area  | (N3) Xiasi Town, Guang counties, Sichuan Province (Almost 450 meters) (1) Continuous type |
|                | (N4) Shangjin Town, Hualin County, Sichuan Province (Almost 471 meters) (1) Continuous type |
|                | (N5) Fuling Town, Dadun County, Chongqing Province (Almost 184 meters) (1) Continuous type |
|                | (N6) Qinghe Town, Dadu County, Sichuan Province (Almost 495 meters) (1) Continuous type |
|                | (N7) Lukong Town, Rongchang County, Chongqing City (Almost 324 meters) (1) Continuous type |
|                | (N9) Wuxian Town, Tongxiang County, Zhejiang Province (Almost 213 meters) (1) Continuous type |
|                | (N10) Xitang Town, Jiahan County, Zhejiang Province (Almost 153 meters) (1) Continuous type |

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- Continuous type
- Distributed type
- Piecewise type
kind road is (N7) Lukong town. Only a few households in the middle of the main street of Lukong town have EG in front of their doors.

### 3.3. Piecwise type

9Piecwise type refers to a certain length of EG covering the street surface. The both side’s eaves extends to cover the roof above the street which forms a structure of inner street. The roof of EG and the main building is an integrated composition. For example, the northern section and the southern section of (N8) Zhongshan town are overhanging eaves and residential buildings, while the middle section is about 30 m long. The piecewise EG streets form the image are in sharp contrast with those of the streets without gallery.

### 4. Space combination

There are various types of landforms in Hubei province, including mountain, hilly and plain. EG streets are mainly distributed in the Jianghan plain which in the south and central of Hubei. The styles of space combination between EG and street within the Hubei province are unitary because of its smooth plain. And the typical style is narrow EG with wide street (N.E.W.S.). The width of the open street is much larger than that of the space under the eaves, and the cohesion of the interface on both sides is weak. But in some occasions, we can also see the width of EG which is equal to the street width (E.E.S.). In the balanced street space, the crowd under the EG and the crowd in the street do not interfere with each other, but they are closely related. The boundary between semi-private space under eaves and street public space is obvious. What’s more, the altitude difference between EG and street is comparably smaller within this area.

Compared with the Hubei province, the terrain of Bashu area is complex which is up and down and has a big altitude difference between EG and street. Therefore, there are various forms such as:

1. The width of EG is almost equal to the street (E.E.S.),
2. Narrow EG with wide street (N.E.W.S.),
3. EG with none street (the center of the street is drain) (E.N.S.),
4. Upper EG and lower street (U.E.L.S),
5. EG and street are combined (E.S.C.).

For example, Langpeng\(^7\) style is the special form of E.S.C which combined street into EG buildings. The typical case is located in (N8) Zhongshan town. The roof covers the whole street surface, and the street section space is enclosed in all directions, which is similar to the indoor space with a roof. The spatial attribute under the eaves is the conversion between private space and public space. And the typical form of E.N.S. is in Fuling street case (N5), the EG presses the space of street as a line. Therefore, the eaves space is used as the main traffic channel to provide daily activities. The distance between the eaves on both sides was narrow, and small ditch was dug in the middle of the street for drainage. Besides that, some EG streets of U.E.L.S (N6) are divided into two parts and altitude difference of the two sides up to half meter. The spatial form of the EG is similar to that of the arcade building. The Eaves pillars directly support the eaves of the second floor. This form is the result of the integration of Bashu culture and Lingnan\(^8\) culture.

And when talking about the corridor streets in Zhejiang province, it also has its own special styles of corridor streets: (6) corridors – streets – rivers (C.S.R.), (7) corridors – rivers (C.R.) (Lu 2001). It is because of the numerous water ways within the cities, this EG style which haven’t found in the Hubei area and Bashu area (Figure 4).

### 5. The spatial scale

Spatial perception is the inner description of the relationship between structure, entity and space, as well as the reconstruction and inner reflection of space and thought (Golledge and Stimson 1999). Street space, as an external space of architecture, is a space delimited from nature and a purposeful external environment created by people (Ashihara 2006). Therefore, from the perspective of spatial perception, the author will further analyze the scale perception of D/H value regarding the EG space.\(^9\)

The spatial pattern of EG street is relatively complex, and its spatial types are varied. Regarding the space relationship between street gallery and road, three types from the five types of table 3 in the last chapter are examined. They are the EG that is almost equal to the street (E.E.S.) type, narrow EG with wide street (N.E.

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\(^{1}\)Langpeng: in fact, is a street with a roof, the more famous is in Xitang. Some are near the river, some have roofs over the streets. They are different, but they both protect residents from the sun and rain.

\(^{2}\)Lingnan: it refers to the south area of the five ridges, mainly the Han nationality. The five ridges are composed of Yuecheng ridge, Dupang ridge, Mengzhu ridge, Qitian ridge and Dayu ridge, which are generally distributed from the east of Guangxi to the east of Guangdong and the junction of Hunan and Jiangxi provinces.

\(^{3}\)In the “External Space Design” of Ashihara Yoshinobu, the D/H value is used to analyze the space and point out that the ratio of face to pitch D/H = 1 is the “turning point of space quality.” It also introduces D/H index in the study of spatial scale street. That is, when D/H is greater than 1, especially when D/H is greater than 2, the street space has a broad sense; when D/H is less than 1, the street space has a narrow sense (Ashihara 1985).
W.S.) type, EG with none street (the center of the street is drain) (E.N.S.) type. The height of the border is defined as $H_1$, the height of the eaves is $H_2$, the width of the street is $D_1$, the total width of the street along the corridor is $D_2$, and the feeling index of street space is $D_1/H_1$.

Thus, typical regional cases among these 3 types which are Shuangqiao Town and Xiaohe Town in the flat area of Hubei, Dashun town in Sichuan Fuling are extracted (Figure 5). From the Figure 4, the three types of gallery street $D_2/H_2$ ratio are almost the same in the combination of gallery and street, the ratio of the street width to the cornice height is quite different, so the main factors influencing the psychological feeling is $D_1/H_1$, the ratio bigger, the space more open, on the other hand, it more depressed.

Through comparative analysis of actual case data, it is obtained that the spatial scale of the EG in the plain area of Hubei (N2) is wide. $D_1/H_1$ is open-type street larger than 1. For example, the ratio of cases is larger than 1 in the Shuangqiao Town Dawu County in Hubei (N2), the interface on both sides is less enclosing and feels open. The EG, as the facade of the building, makes little contribution to the shaping of the spatial form of the street. The N.E.W.S type EG street space is often found in areas

| Area  | The Spatial Organization Mode of Corridor and Street |
|-------|-----------------------------------------------------|
| Hubei Plain | ![Image of gallery street](image1.jpg) |
|        | (1) E.E.S. Huanxi street case in section(N1). |
|        | (2) N.E.W.S. Shuangqiao street case in section(N2). |
| Bashu | ![Image of gallery street](image2.jpg) |
|        | (1) E.E.S. Xiaohe old street case in section(N3). |
|        | (2) N.E.W.S. Shangxin street case in section(N4). |
|        | (2) N.E.W.S. Lukong street case in section(N7). |
| Jiangbei | ![Image of gallery street](image3.jpg) |
|        | (3) E.N.S. Fuling street case in section(N5). |
|        | (4) U.E.L.S. Qinghe street case in section(N6). |
|        | (5) E.S.C. Zhongshan street case in section(N8). |
|        | (6) C.S.R. Xiang street case in section(N9). |
|        | (7) C.R. Wuzhen street case in section(N10). |

Figure 4. The Spatial Organization Mode of Corridor and Street.
of plain land. The open street surface is much wider than that under the EG street surface, and the interface on both sides is less enclosing. In this type, the semi-private space under the eaves is emphasized. The residential and commercial functions in the EG are much more than the traffic functions.

If the specific value of $D_1/H_1 < 1$, it is depressive style which space is often seen in hilly areas. The use of land is limited and the space formed by both sides of the interface has a strong enclosure. Such as the case in Sichuan Fuling Dashun town (N5), its specific value is 0.64, the visual space is limited because of the street inter space is high and narrow. When we are in this kind of streets, the visual width is restrained, the main street activities happen in the gallery, this type of gallery does not have strong territory feeling.

In the balanced street space, the crowd in the EG and the crowd in the street do not interfere with each other, but they are closely related to each other. In this space, people neither feel depressed nor open. If the specific value of $D_1/H_1$ is close to 1, when people located in the center of the street who can easily feel the eaves on both sides of the street. The interface on both sides has a certain enclosure. Such as the case in (N1) Xiaohe town in Hubei, its specific value is 1.2, the visual space limit is less, and people’s sight is free, the defined feeling of space is quite strong. When people are in the center of the street, they can easily feel the presence of EG on both sides of the street, and the interface on both sides has a certain enclosure. The boundary between semi-private space under eaves and street public space is obvious, and the activities in eaves corridor are diversified, which can give full play to its residential and commercial functions. This kind of space has a strong cohesion, the communicating measurement is suitable, people will feel balanced and not depressive, it is the best measurement.

6. The spatial function\textsuperscript{10}

The scale of human body is the basis of architectural space scale. Therefore, the activity behavior of people under the EG is an important basis for determining the

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\textsuperscript{10}The sixth part of this paper content: "The Spatial Functional Characteristic of the Eaves Gallery Street in China: Take Hubei, Bashu, Jiangzhe Areas as Examples" will be published and presented at the annual meeting for the Society of AIJ, Japan, September 4–6th, 2019.
spatial scale of eaves and corridors. On the contrary, according to the different EG space scale, there are corresponding to the use of EG space behavior.

Edward (1990) divides the communication distance among people into intimate distance (0–45 cm), personal distance (0.45–1.20 m), social distance (1.20–3.75 m), public distance (> 3.75 m) and a series of social distance in the book “Hidden Differences,” each distance represents the emotional communication among different people. The investigation shows that the Hubei EG width is between 1.85 m and 2.6 m (Zhuang and Ding 2007), the range in Bashu region is 1.5–4 m (He 2002) in EG space, and in Jiangzhze area the width range of EG is 1.2 m – 2.25 m.

6.1. EG spatial function

In order to adapt to the local life gradually, the EG transformed from the initially extending eaves protecting the wall into lining up street that keeping out sunshine and rain and convenient for pedestrian traffic. In addition to the basic function mode of the above traffic function, the development of EG also appears two functions as living model and commercial model.

(1) Traffic Function

The semi-outdoor space provided by the EG provides pedestrians with the convenience of shading, which is also an important reason to promote the development of the EG and arcade. This convenient also let with EG along the street, endowed with new functions, highlights the practical value of EG.

Except for keeping out sunshine, wind and rain, the traffic function mode is mainly divided into walking, shopping, and free movement and walking, outing and so on and moving the process itself for the purpose of flow.

(2) Commercial Function

When referring to the historic reasons of the EG streets, it is closely related with the development of commerce. In the Northern Song Dynasty of China, Li-Fang unit system (Residential area) was broke up, which made the layout of the neighborhood began to transform into the free style of urban roads and the dense shops. And it thus induces the shops which are along the main streets to prevail. The early EG street is the place where the local residents set up stalls on market day.

(3) Living Function

In the non-market period, the EG street is the place for the daily activities of local residents. With a large number of young people go out to work, it quickly into the aging, empty-net social state. The elderly attaches great importance to the comfort of outdoor space. Safe, pleasant and easily accessible places to meet and interact with others are important features of outdoor spaces that meet the needs of the elderly. Because of the lack of light in the residence, the lack of ventilation, and the desire to communicate with others, the residents open the door, putting the bench in front of the door, greeting with the past acquaintances, chatting and eating, entertainment and other behavioral habits are very common, we call it “the living mode of behavior in the EG.”

6.2. The spatial functional characteristics

The characteristics of spatial functions under eaves are not only influenced by geographical factors, but also closely related to spatial scale of EG and street cultural traditions.

The geographical features of the three regions are different. Hubei province is generally surrounded by mountains in the east, west and north, with a low level in the middle which average altitude is about 27 m. The EG distributed in Hubei province is mainly located in the Jianghan plain which is one of the lowest plains in China and it is an important part of the middle and lower Yangtze river plain, with extremely flat terrain. Compared with the Hubei province, the natural geographical space of Bashu includes Chongqing municipality and the area dominated by Sichuan basin. The mountainous landform is the most prominent landform feature. The terrain of Bashu area is complex which is ups and downs and has a big altitude difference between EG and street. Therefore, the activities under the gallery are very rich. There are many lakes and rivers in Jiangzhze area. In addition to abundant rainfall, the Yangtze river and the Qiantang river which are connected by canals. The most obvious features of landform are hilly, plain and watery. EG are mostly distributed along the river side.

The street cultural tradition of “Periodic markets” in EG refers to the regular gathering of commodity trading activities. Mainly refers to the commodity economy is not developed in the era and regions, a common form of trade organization. The traditional periodic markets are close to the river which is built on water and thrives on water. For the convenience of passenger flow to conduct commercial transactions, the EG street of periodic market form was built along the river which promoted the development of local economy. EG in all three areas are centralized commercial streets, but the market day in each area varies according to local customs. Therefore, it commonly divided for market day and non-market day.

According to the geographical characteristics of each region, the scale of the corridor and the traditional street culture, the spatial functional characteristics of EG in these three regions are divided into three categories: unitary type, conversion type and mixed type (Figure 6).
Compared with Bashu area, the horizontal width under the EG in Hubei is relatively narrow, it can reach 2.5 m in a wide area, which can meet the requirement of one person stopping and two people walking.

On market day, shopkeepers along the street begin to open their businesses. At this time, the public nature of the space under the corridor is larger than the private one. It has two main functions: traffic and commerce. When the weather is more comfortable, the store owner will display the goods under the gallery space as much as possible, so that customers can choose in the street. But when the weather is rainy or hot, the shop owner will sell goods in the store that creating a comfortable space for customers to pass.

On non-market days, the private attribute of the gallery space is greater than the public attribute. The identity of the vendor is transformed into a local resident, and the function of the gallery space is also transformed into a living mode, such as chatting with neighbors in front of the door, eating and doing handwork.

Due to the flat terrain and limited space scale under the corridor in Hubei province, the function is relatively single, so it belongs to unitary type.

(2) Hybrid Type

Due to the wide space range under the corridor in Bashu area, the maximum width can reach 4 m.

On market day, depending on the size of the width, there are three main functions: traffic, commerce and a hybrid of the two. What slightly different from other areas it is that because of the mountain terrain, some EG street terrace has a height of up to half a meter in Bashu region, thus the half meter table became temporary stalls available. In order to attract more customers, merchants sometimes display goods under the EG, which is “occupy the road operation” from the perspective of urban management. However, as the middle EG in the town is a semi-public and semi-private space, everyone acquiesces to this occupation of “own” in front of the road, so it seems reasonable to set up stalls in the EG.

On non-market days, the corridor has three functions: living, traffic and a hybrid of the two. The private attribute of the gallery space is greater than the public attribute. If the width of EG is wide, many residents can also play mahjong with neighbors which activity has become an old custom in Bashu area. At the same time, there is enough for pedestrians to pass through without disturbing residents’ life. So Bashu area belongs to hybrid type.

(3) Integrated Type

Jiangzhe region has a special geographical feature. The EG streets are located beside the river channel. Therefore, the public nature of the space under the corridor is larger than the private one. Generally living mode, traffic mode, commercial model exists at the same time. The spatial functional characteristic of Jiangzhe belongs to the Integrated type.

7. Conclusion

The EG along the street as a form of Chinese traditional dwelling was special architecture form for preventing
pedestrians from rains and snows while walking through or shopping which has played the important roles in the ancient commercial activities. Based on analyzing history, economic, climate and geographical distribution, three typical districts, (1) Hubei plain area; (2) Bashu area; (3) Jiangzhe areas, which have EG were selected as three representative types for revealing the current situation.

Based on comparison and analyzing field distribution mode, structure types, space combination, space scale and spatial function in the 10 cases which are selected from these three areas, spatial characteristics of EG were summarized:

(1) In region of Hubei province where the terrain is relatively flat and Jiangzhe area, the site distribution mode of EG is more continuous distribution. The styles of space combination between EG and street within the Hubei province are mainly N.E.W.S. and E.E.S. Through comparative analysis of actual case data, it is obtained that the spatial scale of the EG in the plain area of Hubei is wide or balance. Due to the flat terrain and limited space scale under the corridor in Hubei province, the function is relatively single, so it belongs to unitary type.

(2) The terrain of Bashu area is complex which is ups and downs and has a big altitude difference between EG and street. The site distribution mode of Bashu area is flexible which has a variety of forms, formed a rich field town style, divided into dispersive type, segmented type, as well as the continuous three kinds of distribution type. And about space combination Bashu area are various forms such as:(1) E.E.S., (2) N.E.W.S., (3) E.N.S., (4) U.E.L.S., (5) E.S.C. it is depressive style which space is often seen in hilly areas. Due to the wide space range under the corridor in Bashu area, the maximum width can reach 4 m, Bashu area belongs to hybrid type.

(3) Zhejiang province which landform are hilly, plain and watery. EG are mostly distributed along the river side. It also has its own special styles of corridor streets: (1) corridors—streets—rivers, (2) corridors—rivers. The EG streets are located beside the river channel. Therefore, the public nature of the space under the corridor is larger than the private one. Generally living mode, traffic mode, commercial model exists at the same time. The spatial functional characteristic of Jiangzhe belongs to the integrated type.

This study aims to conduct preliminary basic research regarding protection and development for the spatial characteristics of Chinese traditional EG villages in the future. In this paper, the spatial characteristics of Chinese EG in the different provinces were compared and each provinces characteristic were extracted from the aspect of relation between field distribution mode, structure types, space combination, space scale and function. The outcome will serve as a comparative basis for the existential form and spatial characteristics of extant traditional EG accompanied by optimum protection and renewal policy discussion in the future.

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