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CASE STUDY

A brief analysis of spatial constitution and functional organization of museum architecture: A case study on museums in Hefei



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KEYWORDSMuseum architecture;
Exhibition Space;
Traffic space;
Rest space**Abstract**

Cultural architecture, specially, museum architecture, is of significant social value and importance for the improvement of city image, and for the optimization of people's living environment. Consequently, it is significant to analyze such kind of architecture from various perspectives so as to explore its spatial constitution and functional organization. This paper generalizes and puts forward methodology to design interesting exhibition space, convenient traffic space and diversified rest space.

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1. Introduction

Generally speaking, museum architecture, belonged to the category of public cultural architecture, consists of museum, exhibition hall, gallery, etc. It aims at research, education and appreciation as well as collects, saves, studies, transmits and exhibits witnesses related to human beings and their

environment (including objects or specimens of nature, history, culture, art, science and technology). (Tang et al., 2009)

Practically, museum architecture is able to present, collect and study collections. With the progress of era, it additionally possesses esthetic function.

In *An Introduction to Architecture for Comprehensive Engineering Schools in Paris* a monograph of Jean-Louis Dylan, he put forward the feature of museum architecture design, i.e., practical applicability. The audiences of museum architecture refer to the group that it serves. For audiences, the most intimate functional space in a museum architecture consists of three aspects, i.e., exhibition space (Henderson, 2001), traffic space and rest space (Henderson, 2001). Consequently, this paper focuses on investigating and analyzing these three spaces, so as to understand their characteristics and mutual relationship profoundly. By virtue of analyses of the data from

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the field investigation, the design methodology and philosophy is revealed, and can be provided as an essential reference for the design of museum architecture afterwards.

2. Field research

By consulting literatures, the investigation not only forms a preliminary understanding of the object but also puts forward problems to conduct field researches and questionnaire surveys specifically as well as acquire some knowledge about audiences' feelings and requirements for the museum architecture. Relevant data are screened and sorted out to reach the conclusion of the investigation.

2.1. Time of the investigation

March 2nd, 2012 (Friday) and March 4th, 2012 (Sunday).

2.2. Sites of the investigation (Table 1 and Fig. 1)

Hefei Kurume Friendly Art Gallery, Lai Shaoqi Art Museum and Anhui Museum.¹²³

3. Analysis of the space in the exhibition museum

3.1. Exhibition space

3.1.1. Exhibition space types of the layout of exhibition rooms

Exhibition space acts as both the basic space in architecture, for instance, museums and the carrier of the exhibition. In general, plane layout of a exhibition room is divided

¹The selection of the surveyed three exhibition architectures is made with cautious consideration. For the classification of the three exhibition architectures, they are art museum, art gallery and museum as well as belong to different types of exhibition architectures, respectively. The construction of the selected objects of the survey is from the 1990s to the beginning of the 21st century, the area of their structure is ranged from several thousand square meters to tens of thousands of square meters, and the building height is from less than 10 m to about 40 m. Thus, the covered scope is relatively comprehensive. To sum up, the selected objects of the survey have some representativeness and can explain some problems of exhibition architecture in the aspects of space composition and function organization.

²Giving consideration to various demands of office workers, students, nearby residents and other types of visitors, the survey selects two days, i.e., one workday and one rest day. In all, the survey issues 100 questionnaires. 15 questionnaires are given out at the three exhibition architectures each day, respectively, i.e., amounting to 90 questionnaires. The other 10 questionnaires are issued to people with basic knowledge about architecture in order to obtain more professional evaluation for contrast and reference.

³The survey research mainly aims at spatial and functional analysis of the areas available to the audiences, so the exclusive functions of the internal personnel are not listed in the survey scope. For functional space and storage space used by the internal personnel, since it is very difficult to get the approval from the staffs in the venues, effective survey and research cannot be conducted. Meanwhile, if necessary, the functional survey can be surveyed and analyzed otherwise as the derivative paper of this survey.

into the following types, i.e., tandem type, radial type and hall type (Zhang and Zhou, 1998). The tandem type aims at connecting all exhibition rooms; its visiting circulation is specific and coherent but less flexible. As for radial type, all the exhibition room are arranged around the atrium or set along the hallway etc., which has strong flexible and selectable peculiarity. Besides, the hall type centers on centralizing most exhibition spaces into a comprehensive hall, whose layout is well-knit and flexible. However, it inevitably tends to result in overlapping visiting routes and noise interference.

In the three cases of investigation, all exhibition rooms in Anhui Museum (Fig. 2) are distributed around the atrium and the central space, so they belong to the radial layout. There are only two exhibition rooms in the Hefei-Kurume Friendly Art Gallery (Fig. 3 left), which are connected by one narrow aisle, so they should be classified into the tandem layout. Because there is no wall between every exhibition room of Lai Shaoqi Art Museum (Fig. 3 right) and its rooms should be included in the layout of hall type.

3.1.2. Exhibition arrangement of in the exhibition room

Overall, the most common way to arrange exhibition is to display exhibits along the wall or in the central area of the room in showcases. Specifically, in a general exhibition room, plane exhibits or small three-dimensional exhibits are arranged against the wall; and special stands are set up so that some large precious three-dimensional exhibits or plane exhibits can be displayed (Ding, 2010).

In order to perform a comparative study, one exhibition room is selected from the above-mentioned buildings, respectively. As a result, we find that the layout of the exhibition room unit is rectangular and its spatial use rate is relatively high. There is no negative corner in the space so that it will be more conducive for the arrangement of the exhibition, compared to the other two. According to the arrangement of every exhibition room (Fig. 4), it shows that both ways of all the three exhibition rooms are validly utilized to display exhibition, i.e., against the wall and on the stands. Moreover, it is found that each of them has at least two exits and entrances and their visiting route is specific and flexible.

3.2. Traffic space (Table 2)

According to Yang and Yan (2009), traffic space is the bond that links other kinds of space, so it plays a critical role in organizing the streams of people and guiding visitors.

On the one hand, Designers of Anhui Museum (Figs. 5 and 6) make full use of the space of atrium to organize transportation; on the other hand, they place various vertical facilities of transportation around the atrium. These installations not only guide the streams of people in the vertical direction but also enriches spatial perception. In detail, such layout enables facilities of transportation to be part of decoration and landscape in the atrium, forming a central space with artistic conception. More importantly, the arrangement of traffic space around the atrium makes visitors have a clear view and brings convenience to audiences simultaneously.

As Lai Shaoqi Art Museum (Fig. 6) is not large-scale, the main hall is only composed of staircase, an elevator and a

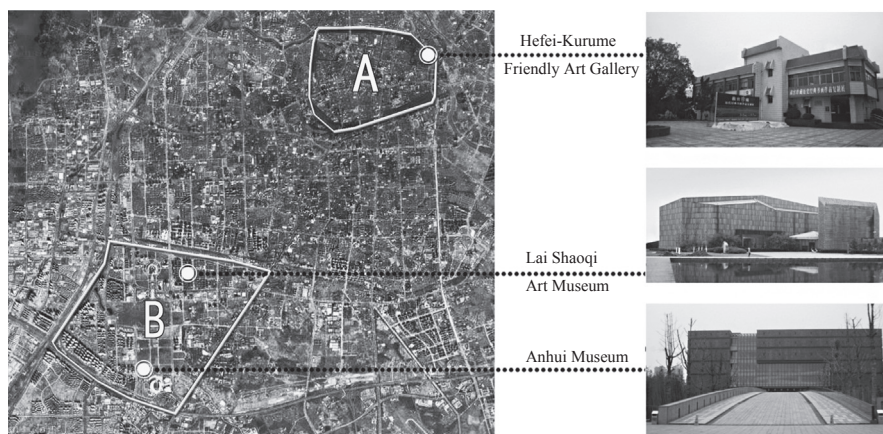


Fig. 1 Geographic locations of the foregoing Buildings. (a) Old Urban of Hefei and (b) New Governmental and Cultural District.

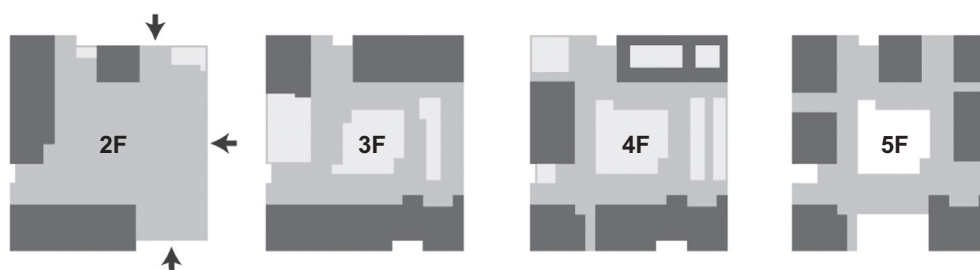


Fig. 2 Exhibition arrangement of Anhui Museum.

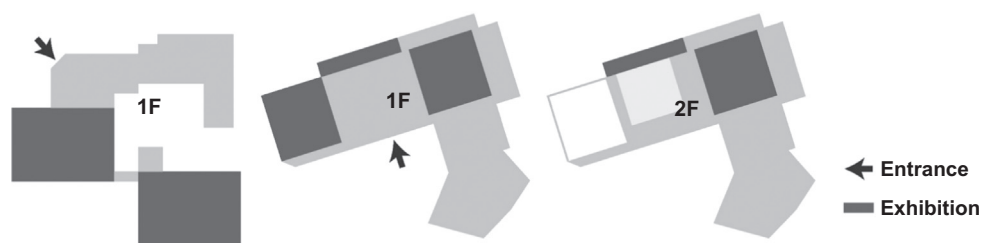


Fig. 3 Left: exhibition arrangement of Hefei-Kurume Friendly Art Gallery; Right: exhibition arrangement of Lai Shaoqi Art Museum.

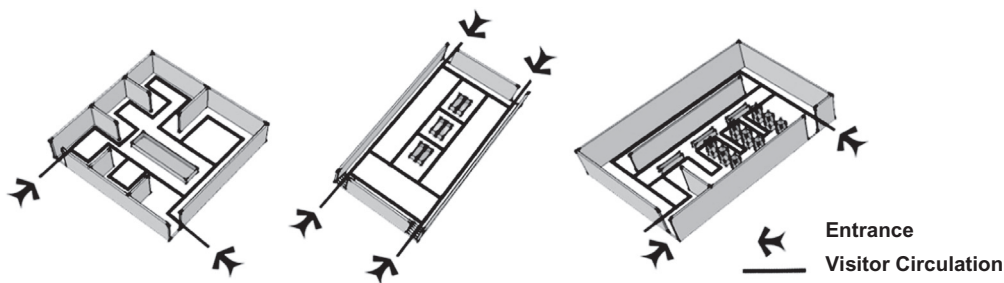


Fig. 4 Left: westward exhibition hall of Hefei-Kurume Friendly Art Gallery; Middle: eastward exhibition hall of Lai Shaoqi Art Museum; Right: the third exhibition hall of Anhui Museum.

ramp. Among such facilities, there is defect in the setup of the ramp. The reason for this is that the ramp is located in one invisible corner, where it is neither convenient for visitors nor esthetic to enrich the space. Since there are several floors in the museum architecture, the ramp takes up too much space, which results in spatial waste.

The exhibition rooms of Hefei-Kurume Friendly Art Gallery (Fig. 6) are settled on the first floor. Passing through the aisle, audiences can reach their destination. The staircase, hidden behind the wall, is mainly for emergency evacuation, and will not give any misguidance to audiences.

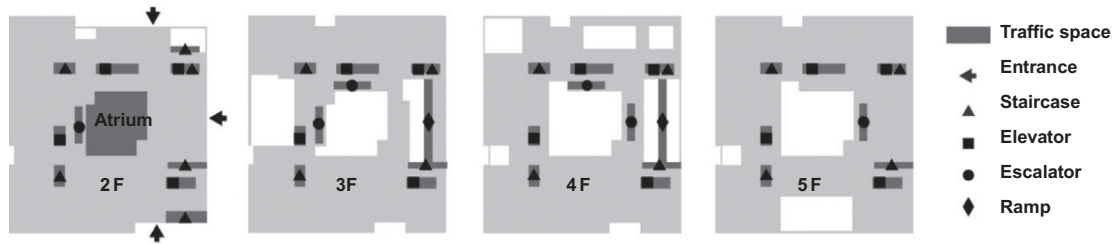


Fig. 5 Distribution of transportation means in Anhui Museum.

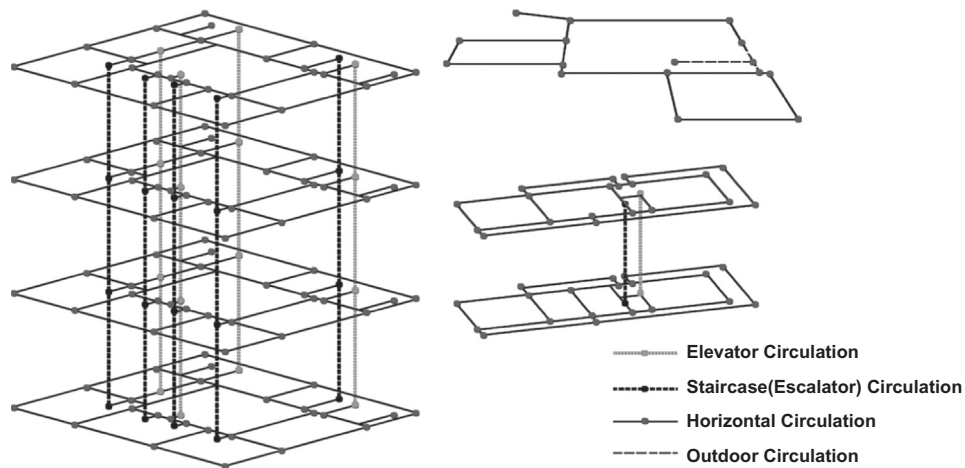


Fig. 6 Left: traffic streamline of Ancient Architecture in Anhui Museum; Upper right: traffic streamline of Hefei-Kurume Friendly Art Gallery; Low right: traffic streamline of Lai Shaoqi Art Museum.

3.3. Rest space

Relatively speaking, forms of rest space in museum architecture are diversified, which can mainly be divided into five types, as shown in the following content.

3.3.1. Specialized rest space

Because the position of this type of rest space is very important, it is often located in the area where there is concentrated stream of audiences and spatial overlap, such as atrium space and lofty hall.

By doing so, audiences can get a better view for appreciation around such kind of place accommodating rest. For example, there is an area against the window on the east side of the second floor in Anhui Museum, where people can have a rest, chat with each other, and obtain a broad view through French windows. Undoubtedly, such an area, specially designed, could be regarded as a paradise.

3.3.2. Rest space along the aisle

In most cases, rest space of this kind is arranged in places, where intersection of a double stream and spatial conversion occur, like corridor, aisle and staircase. And these spaces usually lie close to the exhibition room.

Under the premise of not obstructing visitors' passageway, it is often arranged optionally in order that audiences can stop and have a rest at any time. Although it is not easy to obtain a quiet environment for rest, it is important to ensure such rest space can be seen everywhere without a need to look for it specially. Such kind of rest space can be

found in all of the three investigated exhibition museums. In short, the requirement for rest can be satisfied by simply arranging simple seats along the wall in the aisle.

3.3.3. Utilizing remaining space to set up rest area

In order to obtain excellent indoor sensation toward space, most space in the architecture is diverse. Among such kinds of space, there may be some small jagged and interlocking space which can be used to set up an area for rest, which can not only enhance ratio of space utilization but also form a small visual center. In addition, a corner of the small space can be arranged as a retail section, supplying beverage or simple food to audiences. A refined and detailed design of the space is highly recommended and will definitely impress visitors with certain esthetic appreciation.

3.3.4. Rest area attached to other functional space

The rest space attached to other functional space aims at providing services. For example, the rest space around the Lavatory or beside the elevator affords ease and comfort. Although there are not many seats in such space, the concept of humanistic design can still be reflected sufficiently. Because architecture is not just to provide shelter away from wind and rain, a qualified architect should take people's behavior pattern into full consideration, and simultaneously devise suitable space, providing convenient service for people's various behaviors.

3.3.5. Rest areas set inside the exhibition hall

Although it is not common to see such kind of rest areas, we can find examples in many exhibition museums. With respect to the investigated cases, some teahouses are arranged with ancient furniture in the exhibition room of Anhui Museum so that audiences can have a rest. Similarly, Hefei-Kurume Friendly Art Gallery also places sofas and tea tables eastwards in its east exhibition room so as to offer a specific place for audiences to have a break after a long-time tour.

3.4. Syntagmatic relationship among exhibition space, traffic space and rest space

Being influenced by various factors, the layout of the public exhibition architecture, which is continuous in its spatial combination to satisfy the requirements of visiting routes, is diverse. However, spatial combination is basically divided into four types (Fig. 7), including tandem type spatial combination, radial type spatial combination, channel type spatial combination as well as spatial combination of comprehensive hall type (Zhang, 2008).

The spatial combination of Anhui Museum adopts both the radial type and tandem type. More specifically, every unit of its exhibition is arranged around the atrium in an emanative way and connected by aisles. For Hefei-Kurume Friendly Art Gallery, it purely uses the tandem type spatial combination with a circular streamline which is formed among hallway, western exhibition hall, eastern exhibition hall and courtyard. As for Lai Shaoqi Art Museum, it should be classified into the radial type spatial combination because all of its exhibition rooms directly lead to the atrium and cannot be linked directly by avoiding the atrium.

4. Analysis of investigated data

Questionnaire survey refers to a research method which puts forward problems and collects material in written form. The author designs a questionnaire in terms of visitors' satisfaction with museum architecture in Hefei. In detail, twenty pieces of questionnaires are distributed in each exhibition museum, respectively. At the same time, forty pieces of questionnaires are distributed in other areas. As a result, 87 effective questionnaires are taken back in all. Next, statistical analyses of their results are conducted.

4.1. In terms of Q1 to Q7, the data obtained by statistics (Fig. 8)

- (1) 65.5% of people pay a visit to museum architecture three times or more than three times a year (Q1), which reflects they have great demands for museum architecture. The reasons why people visit museum architecture can be generally classified into three categories. The first one is they want to get education and study, satisfy the requirements of his/her own study and work, or enrich their children's knowledge by taking them to such places. People hold such purposes account for 60.9%. The second kind is that they direct at recreation and travel. People having this kind of purpose take up 20.7%. The third one is for other purposes and people belonging to this kind account for 18.4% (Q2).
- (2) According to the transportation means people take to reach museum architecture, we can find 31.0% of people choose to drive their cars and 5.8% of people ride a bike (Q4). Hence, when the museum architecture is designed, issues, for example, parking, should be taken into full consideration and adequate parking space should be reserved to meet the needs of audiences. Meanwhile, it is also essential to establish bicycle parking lot on the ground. With the emergence of the low-carbon and green way that people adopt to go out, it is no doubt that riding will become a fashion.
- (3) 24.1% of people show much interest in the display of remarkable exhibits (Q3), which prompts that architects should take interestingness of space into full account and create more attractive areas so as to enhance the visit rate of exhibits.
- (4) According to related surveys, 81.5% of people stay in the museum architecture for more than one hour (Q5), which requests that the exhibition museum should provide rest space for them to relieve fatigue. At the same time, 35.7% of people like to have a rest at places, such as teahouse and coffee house where beverage is provided. In addition, 23.1% of people choose to have a rest near vertical transportation hub and 14.9% of people tend to rest on the benches at the corridor outside the exhibition rooms. Meanwhile, another 12.5% of people prefer to rest inside the exhibition room (Q7). All of the foregoing data remind designers to diversify the design of rest space and construct it at different positions in order to satisfy audiences' practical needs.
- (5) 55.3% of people tend to take an escalator, 21.8% of people take an elevator, 14.9% of people choose ramp and only 8.0% of people prefer staircase (Q6). Compared

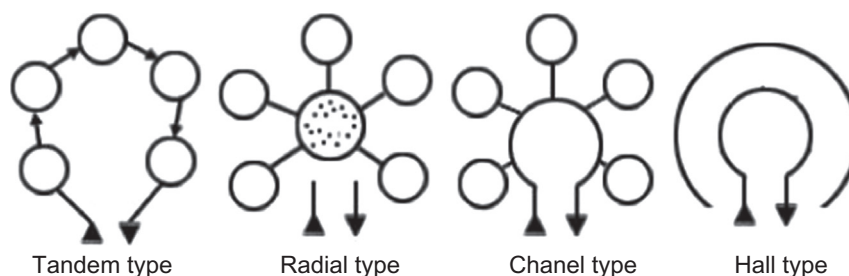


Fig. 7 Types of spatial combination.

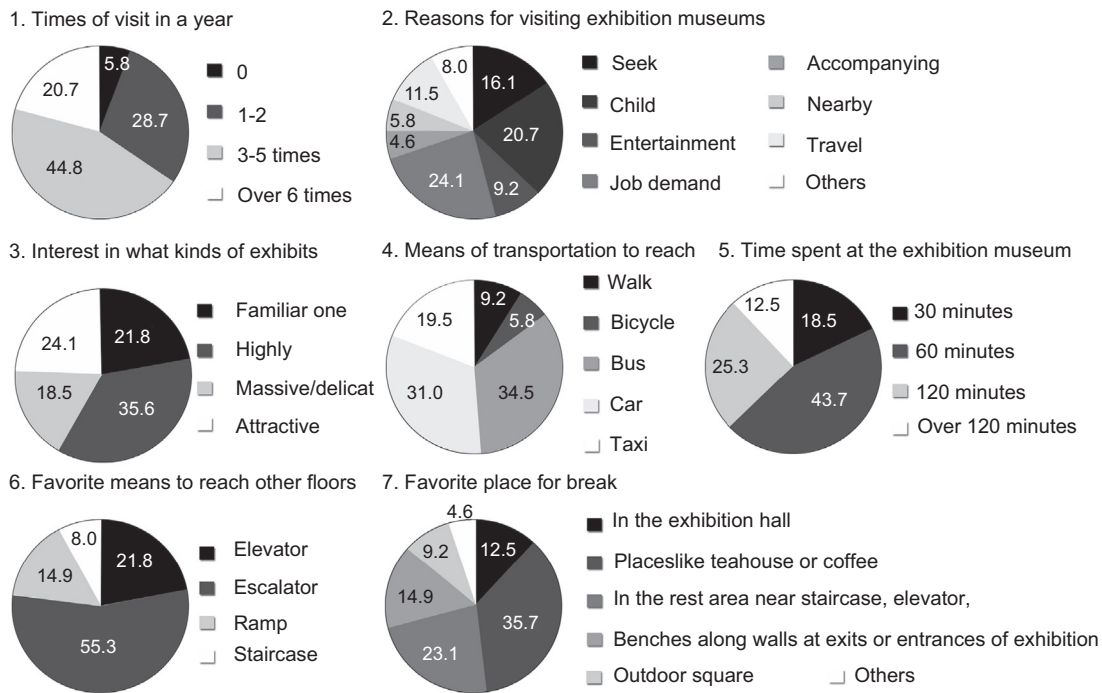


Fig. 8 Q1-Q7 Statistics of investigated data (unit :%).

Table 1 General situation in the investigated sites.

Investigated sites	Location	Complete time	Floorage	Floors	Height	Advantage of the landscape
Hefei-Kurume Friendly Art Gallery	Old city of Hefei	1992	1167 m ²	One floor for exhibition area; two floors for part of the area	8.4 m	It is located beside Xiaoyaojin Lake and on the shore of Nanfeihe River.
Lai Shaoqi Art Museum	The New Governmental and Culture Zone	2005	3200 m ²	Two floors	16.8 m	It is in the art park.
Anhui Museum	The New Governmental and Cultural Zone	2011	41,380 m ²	Six floors on the ground and one floor underground	37.7 m	Swan Lake lies on its north.

with vertical transportation means which are physically strenuous, for instance, staircase, people prefer labor-saving transportation means to a larger extent. Nevertheless, the elevator can only hold a small number of people and the time to wait for it is not specific. Additionally, the higher the story is, the longer the ramp is for the need of museum architecture so that the ramp is not so popular among audiences. Therefore, more than half of people would tend to take an escalator.

4.2. In light of Q8, data obtained by statistics (Table 3)

In order to reflect audiences' overall satisfaction with such investigated items of the exhibition museums directly, the author weights different degrees of satisfaction. In detail, two points, one point, zero point, minus one point and minus two points represent higher satisfaction, satisfaction,

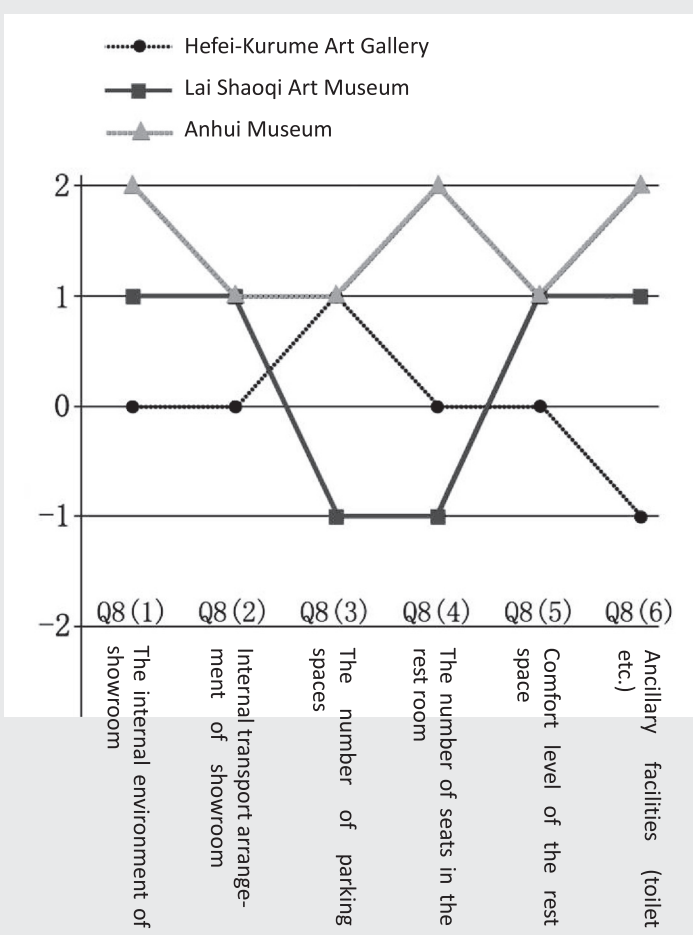
general satisfaction, dissatisfaction and heightened dissatisfaction, respectively. Besides, Table 1 is plotted after calculating the average of obtained points.

In accordance with Table 3, it is shown that the satisfaction with Anhui Museum is higher than that of the other two exhibition museums in terms of various indexes. The reason for this is that Anhui Museum is constructed latest compared with the other two exhibition museums. It was constructed after going through project bidding for a long time and optimizing design constantly. Although Anhui Museum is highly acclaimed, all kinds of ancillary facilities are not perfect at present because it locates at New Administrative Area which is a newly developed area in the city recently. Consequently, the number of its visitors is far less than that of other provincial-level museums. However, with the continuous development of New Administrative Area, there will be more and more audiences visiting Anhui Museum.

Satisfaction with Hefei-Kurume Art Gallery and Lai Shaoqi Art Museum is relatively similar. For Lai Shaoqi Art Museum,

Table 2 Distribution of transportation means.

Investigated sites	Atrium	Stair-case	Elevator	Escalator	Ramp
Hefei-Kurume Friendly Art Gallery		•			
Lai Shaoqi Art Museum	•	•	•		•
Anhui Museum	•	•	•	•	•

Table 3 Investigation on the satisfaction with exhibition museums.

there is no underground parking lot or ground parking lot in. Its parking mainly depends on the public square in the nearby residential area. Lai Shaoqi Art Museum is almost two times larger than Hefei-Kurume Art Gallery, but its rest area and the number of seats are less than that of Hefei-Kurume Art Gallery. Based on such reasons, it gets the lowest marks in both the items of Q8 (3) and Q8 (4).

Since there are only two exhibition rooms in the Hefei-Kurume Art Gallery, its visiting route has to start from the hall to the west exhibition museum and then to the east exhibition museum. After that, audiences return by the same route. In case they want to go to the teahouse, they will have to go through the aisle in the office area. In addition, Hefei-Kurume Art Gallery only sets one restroom on the first floor and second floor, respectively. On the basis

of the foregoing reasons, its marks are the lowest in terms of Q8 (1), Q8 (2), Q8 (5) and Q8 (6).

5. Conclusions of the investigation

By virtue of this investigation, the author has a more specific and more profound understanding of spatial constitution and functional organization of museum architecture. Meanwhile, by means of literature studies and analyses of field investigation, the author gives some advice on museum architecture:

- (1) Audiences not only pay attention to the exhibits themselves but also care the spatial environment around the

exhibits. 24.1% of audiences will visit the exhibition because exhibits are attractive. Therefore, it is essential to arrange visiting routes and build interesting environment for visitors in the design of exhibition space.

- (2) Considering the fact that 55.3% of audiences prefer escalator and 21.8% of audiences choose elevator, convenient and efficient means of transportation must be provided in the design of traffic space. Under the condition that the scale of the exhibition museum permits, a priority should be given to escalator and elevator. At the same time, the design of evacuation must be accomplished.
- (3) 85% of audiences choose to take a motor vehicle (including their own car, bus and taxi) to get to the exhibition museum, so adequate parking space should be provided. Meanwhile, arrange the transportation streamline of cars and taxies reasonably so as to avoid cross influence. Although only 5.8% of audiences choose bicycle as their transportation means, parking space for non-motor vehicles should also be provided in the design to encourage low-carbon lifestyle.
- (4) As we all know, comfortable rest space can help relieve fatigue faster. Thus, scattered setup of all types of rest space enables audiences to have a rest without having to go far, which enhances their favorable impression of the exhibition museum so that they will stay longer in the exhibition museum.

Based on this investigation, the researchers think that it is essential to create interesting exhibition space in the

design of museum architecture to improve visiting ratio of the exhibition. At the same, convenient and labor-saving transportation means should take precedence and diversified design of rest space should be paid attention to. Meanwhile, the researchers hope the conclusion of this research can act as guidance for the practical construction of museum architecture.

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