# A Study of Layout Design for Historical Museum in China—Take Mengcheng Museum Design Project as an Example

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Abstract
Times endows museum more new social responsibilities except for information storage and spreading, thus enabling it to achieve wide promotion in China as a kind of new industry that integrates historical culture and commercial development. However, under the rapid development, China's exhibition & design academia had not established corresponding theoretical system and scientific operation mode yet for reference and comparison.Therefore, this research aims to understand how to design the exhibition space of a historical museum by participating in practical projects with attentions focused on the layout of exhibition space and exploring how to combine the finite building space with exhibitions smartly to achieve the goal of effective information transition.

Keywords
Museum design; Space layout; Visitor viewing; Visitor behavior

## Introduction

The Chinese Society of Museums-Professional Committee for Regional Museums 2020 held in Nanjing, Jiangsu in China released that the number of museums registered rapidly had grown to 5,535 by the end of 2019, and with an annual growth of about 100 (The number of Chinese, 2012). Since the free access to museums in China, about 400 million visitors have been received every year and the number of visitors in each museum has increased by 50%-70% on average.

However, there is a common problem in the face of China's museums: "bustlingly built, but deserted and quiet" (Serious Problems, 2012). Experts believe that the development of museums put more focus on the result instead of the process, which leads to the sameness of exhibition halls that

cannot attract people's interest to visit; and plus the poor post-stage operation makes museums a decoration.

This is a complicated social problem. And this study endeavors to make exhibition planning from spatial design, aiming to attract more visitors through the humanized space layout. Therefore, this paper discusses an idea of layout that is fit for architectural structure and relevant to the theme as well as can put an end to the deserted and quite situation through the practice of project.

## Study Objective

Every museum tells a complete story, which contains three parts: space, objects and people (Lin, 2013). Generatrix arrangement of space determines the process of visitors' visiting. Objects lead visitors to the space and open a talk and make visitors part of the museum finally. The layout of exhibition space is an important tie linking people and Objects, so a reasonable layout of displays can bring people wonderful visiting experience. For example, in The Tate British reconstructed from a power plant, visitors need to walk a down-ward slope as long as one hundred meters before entering into the turbine hall as high as 5-store from a short and narrow entrance, and then go to the small exhibition halls in the north side, which greatly increases the visit.

When the space outlay of a museum can accommodate and guide people just right and keep to the theme, the exhibition effect of the museum can be greatly improved with less efforts (Dean, 1994), thus more visitors will be attracted. To some extent, this will help to solve the common problem mentioned above.

Study object falls on the exhibition space of historic museums. In this paper, the focus is on studying the space layout and rhythm of historical museums to make the design and position. In China, there are 0.9 million unmovable cultural relics and over 20 million movable relics, so historical museums must be constructed and repaired in the long run.

Hereupon, the study objective in this paper is to discuss the influence of space layout in museums on visiting behavior and put it in practice through a project. It is a hope to win the bid in practice by producing an excellent plan work, and in theory, the design theory for historical museum construction in China can be updated.

## Project Background Introduction

The combination of real space and theory can be more convincing. In December, 2018, the author joined in a team to design a biding plan for The Museum of Mengcheng County which is located in

Anhui province, China. As the designer of the major plan, the author participates in the design of this whole project. In March, 2019, with the persistent effort of this team, the conceptual scheme of the museum was adopted and the detailed design will begin from April.

In the last 4 months, the scheme developed in such a process: problems found—argue—to solve the problems—new problems—analyze—problem solved. With the specific outline of exhibition contents and architectural space, the first problem for the scheme is naturally how to design the layout.

The concrete content in this paper is to: find out the most suitable plan of space outlay by analyzing practical problems from the root according to special features of project.

Since this project is still in process, the final results will be discussed and summarized in the future studies. In this paper, a plan in the initial stage is reported and analyzed.

## Mengcheng Museum

The purpose of clients is to make The Museum of Mengcheng County an important model of regional culture and history and a public activity center, integrating collecting, research, displaying, advertising, education, communication, leisure and entertainment and so on.

As the hometown of Chuang-Tzu (369 BC—286 BC), a founder of China's ancient philosophical thought, Mengcheng county has a time-honored history. Yuchi Temple primitive village relics discovered in this county is a classical site containing factors of Dawenkou Culture and Longshan Culture in north plain of Anhui province. Through 13 archaeological excavations in two stages: 1989-1995 and 2001-2003, 73 sintering soil houses in 14 rows, 300 mausoleums and lots of relics of ash pits and sacrificial pits represent Dawenkou Civilization have been discovered, and precious cultural relics such as various stone artifacts, pottery, bone artifacts and mussel artifacts have been unearthed as well. All these provide valuable references for understanding the nature and feature of the Neolithic Age in north Anhui of China. In June of 2001, Yuchi Temple relic was officially announced as a key national preservation of cultural relics by the State Council of PRC.

Since Yuchi Temple relic is the most important geological feature of Mengcheng; and along with major exhibition items, Museum of Mengcheng County can be designated as a typical historical and archaeological site museum.

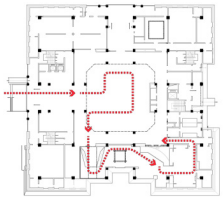
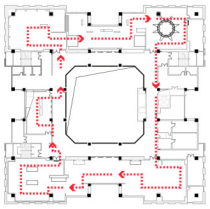
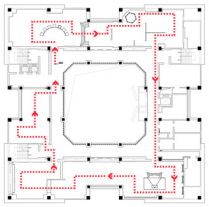
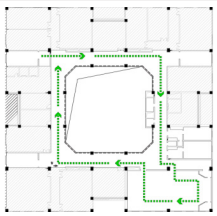
### Space Analysis

This building was finished in 2019 by a construction company as the third party. There are 4 storey,

with space atrium as the center pole, each layer is helically distributed one after another until the top layer. The architectural space is helically surrounded and this feature is conspicuous.

The floor area reaches 12,000 centiares with a visiting area of 3,000 centiares. The first, second and third storey are the space for exhibits. The fourth one is the supplementary space including the temporary exhibition hall, reception and meeting room to meet various requirements for a multi-functional exhibition hall (see Table 1).

*Table 1. the Space Areas and Plane Graphs*

| Floor | Exhibit Area (Centiare) | Route (Metre) | Plane Graph |
|---|---|---|---|
| 1 Floor | 550 | 110 |  |
| 2 Floor | 1022 | 260 |  |
| 3 Floor | 945 | 273 |  |
| 4 Floor | 0 | 0 |  |
| SUM | 2517 | 643 | |

1. Spatial Characteristics of Spiral Shape

Spiral line is a curve which is formed by spinning outwardly around a fixed point (pole). The visual image formed by the rotation is the most prominent feature. Since ancient times, spiral shape has been regarded and favored by architects as an ideal spatial round. This is partly because of the beautiful shape formed by the rigorous mathematical logic of the spiral line and partly because of the diachronic characteristics brought by the rotational feature formed by spinning around the pole.

The earliest architecture whose internal space is built in spiral shape can be dated back to the Tower of Babel Bible recorded in the Bible. This is an imaginary building in Western legend, which is spiral-shaped and hovering along the outer wall upward to the sky. Existing Spiral Minart in Samarra (848-852) is with a similar architectural space with it. For religious purposes, the introduction of spiral architecture space could greatly extend the flow line for the pilgrims and moreover, it makes a full psychological preparation for the worship. For the museum, space atmosphere is of equally importance, which can ultimately affect the visiting experience.

The spatial structure of the project is generally in line with the helicity space to make the visiting interesting and enrich the visiting experience. Therefore, to learn more about the characteristics and application formed by the spiral space could provide a firmer theoretical foundation for the spatial layout of the exhibition.

2. Diachronic and Synchronic

The drawing process of helix could naturally remind people of certain links existed between the rings. All of them share the same geometrical features and are divergent from the central point.

In the illustration of rotation, time spreads along the direction of the spiral line, forming a typical diachronic feature (see figure 1). In the illustration of radiation, the relationship between the central point of the space and any surrounding point is evenly antagonistic. And the space is of synchronic characteristics (see figure 2).

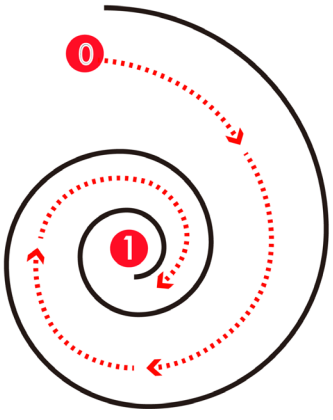



*Figure 1. Diachronic*

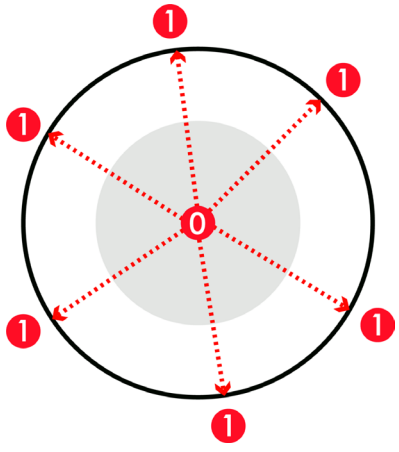



*Figure 2. Synchronic*

In 1929, Le Corbusier once showed one design for "World Museum" which is similar to later Solomon R. Guggenheim Museum in New York. The audiences enter into the museum from the top and hover down along the spiral ramp. This sets time, place and exhibits, such three elements in syn-

chronization, providing perfect diachronic spatial experience.

The program makes a try in the following aspects: in spiral-shaped exhibition space of Mengcheng museum, how to make the layout planning to allocate the unique narrative order and its content of the historic exhibition hall rationally? Especially, in the same historical unit, how to reflect the synchronic characteristics?

## Mengcheng Museum Content

Exhibition arrangement outline is fundamental to the spatial layout of the museum. The outline of exhibits has been written by the expert team from Anhui Provincial Bureau of Cultural Relics. As the design party, we are responsible for filling the content in the space, so it is a premise to get familiar to the content.

According to the current collection situation and characteristics of cultural relics in Mengcheng County Bureau of Cultural Relics as well as the archaeological excavation in latest years, the exhibition content planning can be divided into five significant cultural elements: 1-Yuchi Temple Relic, 2-Traditional Mengcheng County, 3-Chuang-Tzu Hometown, 4-Fine Celics Collections and 5-Intangible Project. They are going to displayed in three major exhibition areas: the first one is the Yuchi Temple Relic—"the first primitive village"; the second one is Traditional Mengcheng County; the third one is the Folk Customs of Mengcheng County.

Among the three, Yuchi Temple Relic—"the first primitive village" is the most important one and is composed by three parts: Old Settlement, Large-size Moat and Sintering Soil Houses (see Table 2).

*Table 2. Museum Contents on Each Floor*

| Exhibits | Themes | Sub - Themes |
|---|---|---|
| First Part | A. Yuchi Temple Relic "the First Primitive Village" | 1. Old Settlement |
| | | 2. Large-size Moat |
| | | 3. Sintering Soil Houses |
| Second Part | B. Traditional Mengcheng County | 1. Traditional Mengcheng County |
| | | 2. Chuang-Tzu Hometown |
| Third Part | C. Folk customs of Mengcheng County | 1. Fine Celics Collections |
| | | 2. Intangible Project |

Reading the outline carefully and repeatedly can help designers get a correct understanding of the theme, which is conducive to grasp the key point and make a reasonable planning: know when to allocate important area to the important content (Song, 2007). I have deeply felt in the process of

planning that it is not difficult to get to know important content but it is the most important to know how to combine and balance the space limitation and architectural structure when the two meet.

## Methods

With the specific outline and building, to win the bid, we hope we can make new breakthrough in the outlay to enlarge the distance with our rivals and show our unique designing idea. To realize these, a series of market survey and data collection become the most important part in this project's first stage.

Firstly, have an interview with visitors to know their visiting behavior and experience in historical museums. In this way, the current situation of museums' space outlay in China can be known objectively.

Secondly, analyze and compare the interview data to know what visitors concern the most in the whole process of visiting. And then, summarize the root of problems.

Finally, work out the designing plan to solve these problems, taking into consideration special features of exhibition in Mengcheng Museum.

### Interview

To know the current situation of museums home and abroad, a special interview has been designed. Different interviewees have different demand for, concern over and sensitivity to exhibitions. Thus, in order to get more comprehensive information, we have visited many public places: universities, designing institutes, companies, streets and museums and chosen five groups of representative. They are altogether 80 persons including 20 university students, 20 scholars, 20 common people, 20 foreign tourists (see Table 3).

Questions in our interview are:

1. Have you had a leisure visit in the museum? When is the latest visit?
2. What's your impression on the space outlay of the museum?
3. If you are satisfied with the outlay, what kind of space feeling does it bring to?
4. If you are not so satisfied with the outlay, what's the space planning you expected?

We have been divided into two teams and interview them on weekends. In our interview, we recorded every answer with our video camera. At first, interviewees were not so accustomed to, but they became talkative so quickly that they shared with us their visiting experience. Most of these

answers are worrying: they love and hate historical museums. They love the cultural relics and history, but they hate the boredom and dull during the visiting and they do not think high of space layout.

*Table 3. The questionnaire of audience's demand, attention and sensitivity to exhibition.*

| | Q1 | | | Q2 | | | Q3 | | | Q4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Frequently | Occasionally | Never | Great | Good | Bad | Comfortably | Relaxed | Interesting | Pent | Oppressive | Boring |
| Students (20) | 11 | 9 | 0 | 2 | 11 | 10 | 1 | 2 | 2 | 5 | 3 | 7 |
| Scholars (20) | 13 | 7 | 0 | 1 | 4 | 5 | 0 | 3 | 2 | 5 | 6 | 4 |
| Common People (20) | 5 | 15 | 0 | 5 | 14 | 6 | 3 | 1 | 3 | 4 | 4 | 5 |
| Foreigner (20) | 6 | 12 | 2 | 6 | 9 | 5 | 2 | 3 | 2 | 2 | 5 | 6 |
| Sum | 35 | 43 | 2 | 14 | 38 | 26 | 6 | 9 | 9 | 16 | 18 | 22 |
| Percent | 43.75 | 53.75 | 5 | 17.5 | 47.5 | 32.5 | 30 | | | 70 | | |

## Analysis

According to the interview, more people are unsatisfied with the design of museums. They complain that they cannot understand the exhibits; it is outdated; there is no space rhythm; the order is in a chaos; and so on. Hereupon, we begin to consider whether we can have some try in this project to solve these problems.

1. For Students, they concern clear direction most. They come to the museum with the hope that they can get more information knowledge to finish their assignments or subjects they are interested in. Therefore, the space they expected can be explored freely.
2. For Scholars, their major concern is the logic and scientific nature of the outlay. They hope they can find new inspirations from the museum and see a cautious and greatly logic exhibition arrangement in terms of space planning.
3. Designers concern more over rich experience of visiting. They hope there is a sense of rhythm in the inner layout of exhibition because the ups and downs of a space rhythm can reduce the weariness during their visit and inspire their visiting mood.
4. What ordinary citizens concern is the humanized visiting experience. The majority response is that it is tiring to visit museums, both physically and emotionally.

5. Foreign tourists have higher requirement for the logicality of space planning. The importance of an exact transmission of space information can be protruded when interpreter guide is not available.

Based on the on-site interview, it can be summarized that the reason why museums cannot meet the need of public lies in three main problems:

1. The messy layout bears no sense of direction
2. Visitors can easily get fatigue because of the layout
3. With large amount of information, the rhythm of layout is excessively tense

In order to avoid the same situation with the other museums, designers use these problems as the starting point, trying to find a suitable space layout of this project in hand.

### Result

Based on the above unique features, we have thought about: although this archaeological museum enjoys popularity inside the circle, it serves for ordinary people, so it is easy to fall in the situation of being "caviar to the general". It is not uncommon for such phenomenon in China: The Museum of Jincheng which has been invested 38.87 million RMB in is deserted now. The Museum of Kunming can be described as "with complete absence of visitors"; and the situation of The Museum of Yuxi which cost nearly 50 million RMB is not so good as well (Chen, 2011). If university students and senior intellectuals cannot understand the exhibits, nor will the ordinary people. What's more, this project is a typical archaeological museum. In order to avoid the situation of fewer visitors, the position in our planning is set: to make the public understand this museum. And a reasonable outlay is the breakthrough of this design planning. Based on a series of survey, interview feedback and the feature of this project, starting from the layout, this design planning solves the problems from exhibition space's layout structure in three aspects:

1. Seize the overall layout
2. Control the rhythm of layout content
3. Arrange reasonably the rest area

## Project Design

### The Overall Layout

The program hopes that in the typical museum space, the exhibition arrangement can be complet-

ed in a mixed way, which can combine macroscopic units in chronological order with the units of the same historical period. In other words, the program will try to arrange the exhibition in a spiral structure from diachronic and synchronic perspectives.

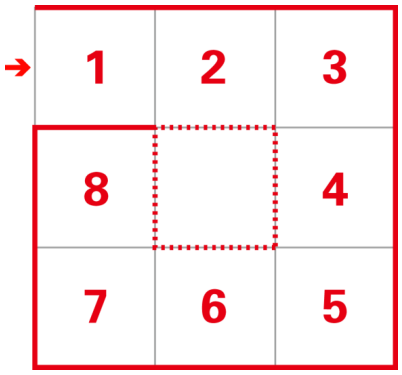



*Figure 3. 2F Layout Pattern*

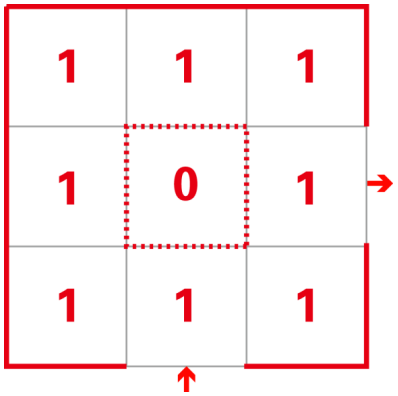



*Figure 4. 2F First Exhibition Space Layout Pattern*

The museum's space structure is with spiral features. Based on the exhibition arrangement outline of the museum, combing with spatial structure and applying the diachronic elements of spiral-shaped space into the structure, we can get the following layout (see figure 3). In the picture, time spreads along the direction of the spiral line, forming the series development from 1 to 8. As a result, a typical diachronic characteristic is shaped. Behind spiral special structure stands the function-based "strong tie" mode, where the utility relationship of the building is fixed and cannot be changed. The main narrative sequence of Mengcheng museum is made exactly in accordance with this "strong tie" exhibition sequence.

According to the outline, the exhibition is divided into three halls and seven units in total. Each unit independently stands for a specific stage in history. The program believes the synchronic spatial relationship is suitable for the narrative technique. We try to create a "weak tie" spatial pattern, where the visiting sequence can be explored by the visitors themselves and changed at their will.

Radioactive geometry feature has been applied to each unit, as shown in the figure 4. The relationship between the central point of the space and any adjacent point is a separate correspondence of 0-1. This presents a "stationary" state where there is no sequence. At this time, the space is of synchronic characteristics. When this is applied into the space of the museum, such a "natural" space will be the exact place which could encourage visitors to explore freely and arrange their own flow line according to their own interests.

Therefore, at the macro level, a spiral-based diachronic layout could help visitors clarify the visiting procedures, understand the logics of exhibition arrangement, and identify the exit/entrance or rest area; at the micro level, radiation-based synchronic layout will encourage visitors'autonomy, make

the visits more funny, and enhance interactivity. A combination of the two layout techniques could not only meet the narrative needs of history museum, but also take into account the experience of visiting at the same time. Therefore, it can ultimately attract more visitors and operate successfully.

## The Rhythm of Combining Content with Space

Diachrony-oriented spiral space also has its disadvantages. It limits the visions and behaviors of human in the axis which spreads along the spiral line. This is actually a compulsory flow line, whose "selectivity" is obviously limited. But the existing architectural space cannot be changed. The program hopes to make breakthrough on this basis.

In this part, we are forcing on how to integrated rhythm between content and space. Tow solutions have been created to fit the building structure.

1. Reorder the Sequence

More recent space syntax research has also tried to go beyond questions of layout to incorporate the positioning of objects and exhibits, including attention to what they refer to as the way in which the visitor's perception is 'staged' (Hillier & Tzortzi, 2006). According to the interview feedback, we rearrange the exhibition content in order to avoid the starchiness and dull as well as to inspire visitor. The store on the second floor at the south side has been transformed into a Rest Area where is the summery of exhibition halls (see Figure 5).

Construction is closely related with time and space on the users experience. As for visiting rhythm, this space is an important point. Visitors can regulate their rhythm after they visit the first and second floor. In terms of content, this area is the summery of archaeological relic exhibition. In terms of function, it provides a place for kids and aged people to have a rest. After visitors have a talk and enjoyed meals and games, they can continue their journey on the third floor.

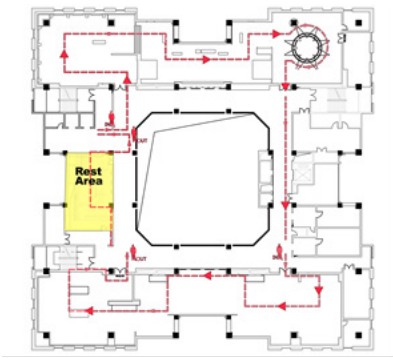



*Figure 5. 2F Rhythm of Layout*

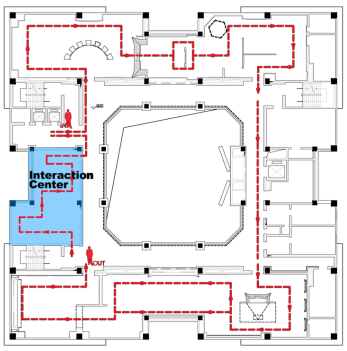



*Figure 6. 3F Rhythm of Layout Pattern*

On the third floor, original studios have been changed to an Interaction Center when all exhibition content has been visited (see Figure 6). This center is the second point for the visiting rhythm. After visitors finish their visit, they will feel fatigue with less feeling of freshness (interview reveals), so they cannot or are unwilling to remember the content they has visited. At this time, they need to have a rest to relax themselves when a space without board, text or relics is necessary. As an interaction place, parent-child interaction chamber, pottery making bar and games conveying much professional information should be designed.

2. Contract Technique

Plane layout can decide the inner structure and the whole layout, so the planning of plane layout needs combing and the density and rhythm should match the content. In this aspect, we have realized this. We have borrowed the technique of "Contrast" in traditional Chinese garden, which is in fact the contrast technique in the size of space. In the part to the main space, a large contrast in space is designed on purpose. Through such a space, visitors' view can be limited and when they enter into the main space, the sharp contrast can produce unexpected effect on their visual sense and mind. With such a theory, we have found out the existing feature of the building's space facilitate the realization of such an effect.

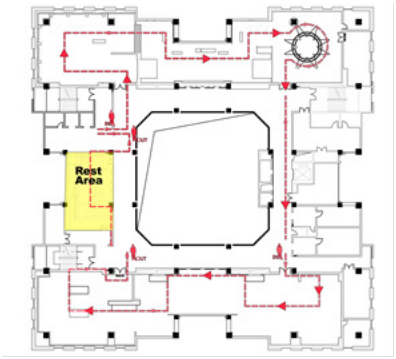



*Figure 7. 1-3F Contract Layout*

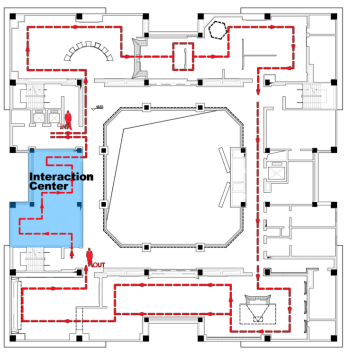



*Figure 8. 1-3F Rest Area Seeting*

Key display items have been put in the four corners of the rectangle space, which makes the wide intersection of two sides fully used. Secondary content has been arranged before the key one to achieve the effect of "contrast" which can stimulate visitor's feelings and control their emotion (see Figure 7).

## The Rest Area

Ergonomics tells that the average visiting time node of visitors is 30-45 minute. It is shorter for aged people. That is to say, visitors need to have a rest after half-an-hour visit. According to this museum's environment, it is not a small task for a strong adult to visit such a museum with a floor

area of 12,000 centiares and a distance of nearly 2,000 meters, let alone young students and aged men.

To build separated rest areas inside the exhibition space is not reasonable. That's because the rest visitors can be in the way of others' visit, which can affect the unity of content displayed.

Many of our studies suggest that more attention needs to be paid to user-centered design at all scales, from the precise affordances of exhibit controls to the layout and orientation of the surrounding environment (Allen, 2004). Our solution is to remove all rest areas to the ambulatory of the atrium. The surrounded atrium has the space central force with sunlight, so people would like to come here for a rest and it is easy to find such a place. The most important is that visitors can enter and exit the rest space freely during their visit, which preserves the unity of the inner exhibition space and reflects the randomness of time (see Figure 8).

## Conclusions

Using space layout as the starting point, we have invested much effort in specific means of display, for instance, how to show the meaning of each relic through the space. I have deeply experienced that the process of designing is a process of overthrowing and establishing. After designing this project, I have made several conclusions on the space layout of historical museums:

The program hopes that in the typical museum space, the exhibition arrangement can be completed in a mixed way, which can combine macroscopic units in chronological order with the units of the same historical period. In other words, the program will try to find out a group of layout pattern in a spiral structure from diachronic and synchronic perspectives.

Add the element of time into the space layout and pay attention to the rhythm. Visiting is a process of sports. During this process, subtle change of various factors such as physical strength, attention, curiosity and patience can affect seriously people's visiting experience. Grasp visitors' mind and regulate their visiting mood through the layout in order to transmit information.

Combine space with content effectively. To present all information in front of visitors can not ensure a full acceptance. An effective communication is to tell the story with rhythm and to know when to display primary content and when to display secondary one.

Finally, our plan of designing won the bid. Doubtlessly, to win a bid involves many factors besides the design itself. However, the application of this concept of design is a significant beginning. The project of The Museum of Mengcheng is undergoing and we are waiting to see the effectiveness of our plan.

## Funding

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