A Study on the Spatial Composition of Pavilions and Landform-water in the Chengde Summer Resort, China

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Abstract: This study examines the pavilions and landform-water in the Chengde Summer Resort. The pavilions and the spatial composition of pavilions and landform-water nearby were classified and analyzed, and the representative characteristics were examined. The following conclusions were obtained: the pavilions are widely distributed and mainly situated in the Lake and Mountain Zones, showing that the Lake Zone combines natural and artificial scenery, while the Mountain Zone was mainly designed according to a natural style; the pavilions have abundant shapes and ordinary pavilions are used widely; the many functions of the pavilions indicates the comprehensiveness of the imperial garden; 8 types of spatial composition of pavilions and landform-water were obtained, pavilions and various types of spatial composition diversified spaces and scenery; the shapes, sizes and openness of pavilions vary according to functions and the spatial composition of the pavilions and landform-water.

Key Words: Chengde Summer Resort, pavilions, landform-water, spatial composition.

INTRODUCTION

Buildings, landform-water (山形・水) and plants are the three basic elements of Chinese classical gardens, of which the pavilion is the most important building type in the gardens (Jin, 2006). Pavilions are widely used in Chinese classical gardens, and they feature various shapes and layouts. It has been said that "gardens can not be separated from pavilions" (Gao et al., 1996), therefore, a study of pavilions is integral to research on the spaces of Chinese classical gardens.

The Chengde Summer Resort, a resort for the emperors of the Qing Dynasty, is the largest extant natural imperial garden in China. In 1994, the resort and its outlying temples were added to the World Heritage List by UNESCO. It is one of the most important examples of Chinese classical gardens, boasting a total of 120 scenic spots, and 67 of those are composed of pavilions. Research on the pavilions is important for a better understanding of the scenery and spaces in the resort.

Previous studies on pavilions have mainly focused on their histories, shapes, and structures as well as the layouts, spatial compositions and characteristics of representative pavilions (Zhou, et al., 1996; Gao et al., 1996; Lu, 2004). However, there has not been a study of all the pavilions in a garden and their spatial compositions. In previous studies of the pavilions of Chengde Summer Resort, the shapes, locations, characteristics and culture of representative pavilions have been explained (Chen, 1996; Fan, 2003). By focusing on the pavilions and landform-water in the resort, this study will clarify the spatial compositions and characteristics of pavilions and landform-water.

1. RESEARCH OBJECT

The Chengde Summer Resort, also known as the Jehol Resort, is located in the northern part of downtown Chengde in the Hebei Province of China. The construction of the resort took 89 years, from 1703 to 1792, during the reigns of Emperors Kangxi and Qianlong. Covering an area of 564 hectares, the resort is divided into four parts: the Mountain Zone, the Lake Zone, the Plain Zone and the Palace Zone. The Mountain Zone includes many mountain springs and streams,
and the Lake Zone includes many artificial hills.

A large number of buildings were damaged in wars and other historical events. Thirty-five pavilions were in poor condition during the author's field visits, although renovation work was underway. Comparatively, the landform and water in the resort have been well preserved. At the time of the author's visit, some streams and waterfalls in the Mountain Zone had not been restored. In this study, descriptions of unrestored pavilions and waters were taken from paintings and historical literature (Emperor Kangxi, 1984; He, 1986) of the resort in the Qing Dynasty and restored maps (Meng, 1985; Wu, 2005).

2. METHODS

2.1 Investigation Method

A survey of relevant literature and documents was carried out at the National Library of China and the Beijing Forestry University from Feb. 22 to Mar. 9, 2010. A similar survey was undertaken at the Chengde Municipal Bureau of Cultural Relics from Mar. 22 to 23, 2010, in which an updated building distribution and topographic map of the resort was obtained.

Two field investigations were conducted at the Summer Resort from Mar. 18 to 21, and Mar. 28 to 31, 2010, to verify the locations, shapes, landform-water and preservation of the pavilions.

2.2 Analysis Method

(1) Based on the field investigation data and the historical literature, the names and locations of all the pavilions were determined, as shown in Figure 1.

(2) Based on previous research and investigation data, the shape, size, material, openness and function of the pavilions and the relationships between pavilions and landform-water were determined.

(3) The spatial composition types were determined. Furthermore, the spatial compositions and characteristics were analyzed and examined.

3. PAVILIONS IN THE RESORT

The shape of a pavilion in classical Chinese gardens generally dependant on the features of the plane and the roof, the plane shape includes the most common graphics (square, rectangle, circle, etc.), common graphics (hexagon, octagon, crosses, circufoil, fan, etc.) and uncommon graphics (combinations of several graphics, etc): the roof features are further divided into number of eaves, including single, double, triple, or more eaves (ranging from simple to complex), and roof shape, including the common pyramidal roof, round ridge,
### Table 1: Shapes, Sizes, Materials, Functions and Openness of Pavilions and Landform-water

| No. | Name of Pavilion | Type | Roof 1 | Size 1 | Material 1 | Function 1 | Openness 1 | Water 1 | No. | Name of Pavilion | Type | Roof 2 | Size 2 | Material 2 | Function 2 | Openness 2 | Water 2 | No. | Name of Pavilion | Type | Roof 3 | Size 3 | Material 3 | Function 3 | Openness 3 | Water 3 |
|-----|-----------------|------|--------|--------|-----------|------------|------------|--------|-----|-----------------|------|--------|--------|-----------|------------|------------|--------|-----|-----------------|------|--------|--------|-----------|------------|------------|--------|-----|-----------------|------|--------|--------|-----------|------------|------------|--------|
| 3   | East Yiqin Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 6   | West Yiqin Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 7   | North Yiqin Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water |
| 4   | East Qiwan Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 8   | West Qiwan Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 9   | North Qiwan Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water |
| 5   | East Qiwen Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 10  | West Qiwen Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water | 11  | North Qiwen Pavilion | P1/E1/E2 | 4/5/6 | 5/8 | Clay/tile | Study | Open | Water |

#### Notes
- **Openness:** 0- Open, 1- Open, 2- Opened
- **Water:** 0- No water, 1- Near water, 2- Extends water
- **Function:** 0- Study, 1- Study, 2- Study
- **Material:** 0- Clay, 1- Clay, 2- Clay
- **Roof:** 0- Study, 1- Study, 2- Study

The common structural materials (wood, wood-brick, stone, bamboo, copper, etc.) and roofing materials (tile, grass, copper, etc.) were determined in the previous research on materials of representative pavilions in classical Chinese gardens (Zhou et al., 1998). Based on the relevant data, the materials used to construct the pavilions in the resort were classified into 4 categories: wood-tile, wood-brick-tile, wood-grass, and copper. The openness of pavilions was classified as open, half-open, or closed according to whether there were windows, walls, and doors. Open and half-open pavilions referred to as cool-pavilions, and the closed pavilions are referred to as warm-pavilions (Gao et al., 1996). Based on research on the function of the architectural spaces in the Summer Palace, which was also a resort for the emperors of the Qing Dynasty (Zhou, 1999), and research on Chaoqun space in resorts of the Qing dynasty (Ju, 2003) and the specific function of pavilions in the Chengde Summer Resort, the functions of pavilions were classified into 5 categories: sightseeing, protection, sightseeing-recreation, entertainment, and celebration.

After referring to the relevant literature on the various types of landform and water (Zhu, 1996; Lu et al., 2004) and the field investigation data, landforms, waters, and their respective relationships were defined and categorized for use in this study. Landforms were defined as plain, hill, mountain, and rockery. The relationships between the pavilions and landforms were further classified into 9 categories, as shown in Figure 2. Waters were defined as lake and pond (L+P), river and stream (R+S), and waterfall or winding canal. The relationships between the pavilions and waters were further classified into 10 categories, as shown in Figure 2.

According to the above classifications and criterias, the shapes, sizes, materials, openings, and functions of pavilions and the landform-water where they are located were defined and their relationships were classified (Table 1).

#### 4. PAVILIONS AND SPATIAL COMPOSITIONS
Table 2: Distribution Density of Pavilions

<table>
<thead>
<tr>
<th>Area (ha)</th>
<th>Palace Zone</th>
<th>Lake Zone</th>
<th>Plain Zone</th>
<th>Mountain Zone</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10.4</td>
<td>1.9%</td>
<td>20.4</td>
<td>10.5%</td>
<td>55.2</td>
</tr>
<tr>
<td>Number of pavilions</td>
<td>4</td>
<td>4.5%</td>
<td>40</td>
<td>44.9%</td>
<td>8</td>
</tr>
</tbody>
</table>

4.1 Analysis of pavilions and characteristics

There are 89 pavilions in the resort, and they are distributed throughout the four regions (Table 2). The pavilions are concentrated in the Lake Zone, which has the highest distribution density. The Mountain Zone has the second largest number of pavilions, but the distribution is the least dense. The pavilions in the Plain Zone are relatively few in number, and they are mainly situated in transition areas. The distribution of pavilions shows that the Lake Zone combines natural scenery with artificial scenery, while the Mountain Zone was designed according to a natural style.

The pavilions in the resort come in many shapes, and the most common plane shapes are square, rectangle, and circle. The single cave design is the most popular, and most pavilions had pyramidal roofs. It is shown that the tendency of the pavilion's shape is mainly simple, supplemented by unique shapes. Most of the pavilions were small-sized. In terms of material, the majority of pavilions were built with wood-tile; two woodgrass pavilions that embody the civilian colors of the imperial garden were respectively built in the Lake and Mountain Zones. The only copper pavilion is in the Zhuyuan Temple, a buddhist temple in the Mountain Zone, which suggests the emperors of the Qing Dynasty attached importance to Buddhism. Cool-pavilions are more common than warm-pavilions. Simple, small-sized cool-pavilions built with wood-tile make up the majority of the pavilions at the resort, indicating that ordinary pavilions are used widely in the resort (Figure 3).

The majority of pavilions are intended for sightseeing, followed by those for sightseeingentertainment, celebration, protection, and religion. This reflects the basic functions of the pavilions and the comprehensive features of the imperial garden, which not only realized the emperors' requirements for sightseeing and entertainment, but also met their needs for celebration, religion, and culture.

4.2 Analysis of the spatial composition of pavilions and landform-water and characteristics

In order to grasp the overall tendency of the spatial composition of the pavilions and landform-water, the types of special composition were classified using cluster analysis. First, the relationships between 89 pavilions and landform and water were transformed into figures' subsequently, cluster analysis was conducted. The method of clustering is Ward's method and the binary measure is the Squared Euclidean distance. To clearly grasp the characteristics of the spatial composition types, the 89 pavilions were divided into 8 categories (Figure 4). The shapes, sizes, materials, openness, functions, and the relationships between pavilions and landform-water were rearranged according to the 8 categories (Table 3). The spatial composition of the pavilions and landform-water and the related characteristics were analyzed and examined.

1) Type 1: Mountain-Side, No Water

There are 14 pavilions in this category, accounting for 15.7% of the total. These pavilions are all located in the Mountain Zone. These pavilions were all located on the mountainside and were not near water, so this special composition is called Mountain-Side, No Water.

The pavilions of this type have abundant shapes, and they include all plane shapes and roof shapes (except other roof shapes). The number of small pavilions is equal to the number of medium-large ones. The pavilions in this area represent four categories of materials and three categories of openness; wood-tile pavilions are the most prevalent and the numbers of cool- and warm-pavilions are the same. Sightseeing pavilions are the most common, followed by those used for religion and sightseeingentertainment.

2) Type 2: Mountain-Top, No Water

There are 7 pavilions in this category, accounting for 7.9% of the total. They are all located in the Mountain Zone. These
These pavilions feature fewer shapes, and simple and medium-large pavilions are the most common. All of them were built with wood-tile. In terms of their function, pavilions intended for sightseeing are the most common, and there others for religion and sightseeing/entertainment.

(3) Type 3: Plain and Mountain Foot

There are 17 pavilions in this category, accounting for 19.1% of the total. Their locations can be divided into plains and at the foot of the mountain, so the spatial composition is referred to as Plain and Mountain Foot. In this category, the pavilions on the plain far from water are the most common, and they are mainly distributed in the Palace and Plain Zones; the pavilions in the plain extend cross L+P; mountain foot close extend L+P; mountain foot no water categories are mainly located in the transition areas between the Lake and Palace Zones, Lake and Mountain Zones, and Plain and Mountain Zones.

The pavilions in this category do not greatly according to shape, and simple and small pavilions are the most common. In terms of material, these pavilions were mainly built with wood-tile. In terms of openness, the cool pavilions are the most common. In terms of function, these pavilions were used for all functions except religion.

(4) Type 4: Cross L+P

This category features the largest number of pavilions (19), which accounts for 20.2% of the total. These pavilions are located near L+P, so the spatial composition is referred to as Cross L+P. These pavilions are mostly distributed across the Lake Zone and the transition area between the Lake and Plain Zones.

The pavilions in this category come in many shapes, including all plane shapes and roof shapes except for triple eaves. Small pavilions are the most common, and all of these pavilions were built with wood-tile. In terms of openness, all these categories are found in this category, but cool pavilions predominate. In terms of function, the pavilions used for sightseeing are the most common, and there is a pavilion for protection and another one for sightseeing/entertainment.

(5) Type 5: Close R+S

There are 8 pavilions in this category, accounting for 9.0% of the total. These pavilions are all close to R+S, so the spatial composition is called Close R+S. Most of these pavilions are mountain valley close R+S, and they are located in the Mountain Zone.

The pavilions in this category do not vary greatly in shape; simple and small pavilions are the most common. In terms of material, all of them are wood-tile pavilions. In terms of openness, the cool pavilions predominate. In terms of function, those used for sightseeing are the most common.

(6) Type 6: Mountain Valley Near S+R

There are 5 pavilions in this category, and they account for 5.6% of the total. They are all distributed in the Mountain Zone. The locations of these pavilions are all in the mountain valley near R+S, so the spatial composition is called Mountain Valley Near S+R.

These pavilions do not vary greatly in terms of shape; simple pavilions are the most common. All of them are small, wood-tile pavilions. In terms of openness, warm pavilions predominate. In terms of function, all of them are pavilions for sightseeing.

(7) Type 7: Cross R+S

There are 5 pavilions in this category, accounting for 5.6% of the total. These pavilions all cross R+S, so the spatial composition referred to as Cross R+S. The number of pavilions in mountain valley close R+S is the greatest, and they are located in the Mountain Zone.

The pavilions in this category have fewer shapes, and simple, wood-tile construction is the most common. Because these pavilion were built across rivers or streams, they are generally medium-large in size. This category includes the three categories of openness, and the number of cool pavilions is equal to that of warm pavilions. All of these pavilions were designed for sightseeing.
There are 15 pavilions in this category, accounting for 16.9% of the total. They are all distributed in the Lake Zone. These pavilions are located near L+P, therefore the spatial composition is called Near-L+P. Many of these pavilions are hill-foot-near-L+P, which indicates that the designer used the combination of pavilions and artificial landforms to create vertical variety in the Lake Zone.

These pavilions do not vary greatly in terms of shape and small pavilions are the most common. In terms of material, wood-tile pavilions predominate. In terms of openness, roof-pavilions predominate. In terms of function, all pavilions were designed for sightseeing.

5. CONCLUSION

In this study, and the spatial compositions of pavilions and landform-water were classified and analyzed, the following conclusions were obtained:

(1) The pavilions are widely distributed and mainly located in the Lake Zone (with the highest density) and the Mountain Zone (with the lowest density), showing that the Lake Zone combines natural and artificial scenery, while the Mountain Zone was mainly designed according to a natural style.

(2) The pavilions have abundant shapes, and simple, small-sized, wood-tile, cool-pavilions predominate, indicating that ordinary pavilions are used widely in the resort.

(3) The multiple functions of the pavilions, including sightseeing, entertainment, celebration, protection and religion, reflect the comprehensiveness of the Chengde Summer Resort integrated with politics, religion and culture.

(4) Eight types of spatial composition of pavilions and landform-water were obtained. In the Mountain Zone, the number of pavilions in the mountain-side and mountain-top categories is equivalent to that of those in the mountain-valley category. In the Lake Zone, the number of pavilions in the close-L+P type is equivalent to that of those in the near-L+P category. The pavilions of Type 3 are widely distributed across the Palace and Plain Zones as well as in a number of transition areas. It can be observed that pavilions and various types of spatial compositions diversified spaces and scenarios in the Chengde Summer Resort.

(5) In the Chengde Summer Resort, the shapes, sizes and openness of pavilions vary according to functions and the spatial composition of the pavilions and landform-water.

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