

Study on the Visual Quantification Control of Spatial Scale in Garden Landscape

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ABSTRACT From the most basic visual physiological characteristics among of the decisive factors of spatial scale, the control of stadia and visual angle on the garden space distribution and the common quantification control laws on spatial scale were analyzed and summarized.

KEYWORDS

Garden landscape
Spatial scale
Stadia
Visual angle

1. Introduction

From a private garden in the husband-foot mountain trees, bridges, to the north of the Royal Gardens magnificent lakes and mountains, balance, harmony and people's visual spatial scales organoleptic properties fit. Today, the modern landscape Grand Place, a large lawn after another, blindly follow the "big" scale trend, bring some of the negative consequences of urban development, therefore, it is necessary from the most basic physiological characteristics of the visual perspective of landscape reasonable control of spatial scales were discussed.

2. Spatial scales overview

2.1. Spatial hierarchical scales

Scale through size, scale and means of human vision, hearing, lines and other aspects of physiological sensation [1], the relative ratio of the expression of the relationship between people and things, things and things between them. Physiological adaptation focuses on the relationship between the spatial scale spatial and spatial scales elements matching relation, as well as with people viewing and other behavioral activity. The external environment of people's lives can be divided into three spatial scale levels: (1) Macroscopic scales. From the urban planning point of view of

a person living in the city's perception of the overall space of the city. (2) Meso-scale. It refers to the city's pedestrian visual experience in the comfort of walking on the city's public space. The main types include square space, commercial pedestrian street, parks, residential areas of public activity center, riverside trails and other recreation. (3) Microscopic scale. That people feel at the time of leisure activities and exchanges in the field of personal space size. Specific range of tactile sensations range from human to human facial expressions distinguish ordinary maximum distance (25 m), including visual interpersonal communication, contacts and exchanges between persons and things, between people, dialogue and exchange between people Wait. In line with people's basic physiological and psychological needs, it is a fundamental problem of micro-scale study [2]. Meso and micro spatial scale is needed most landscape designers to grasp, but also a combination of the richest areas of space, especially in the garden space, separated from the deep, smooth is shallow. Single large scale to people's only limited space, the visual process is short, and the use of terrain, water, rocks, plants, buildings and other structures carved out of space at different scales were interspersed superimposed contrast, people tour the space and Time has been extended, the visual information obtained greatly increased feelings in a limited space is unlimited.

2.2. Compare spatial scales

Space size is relative, not absolute, in the inch of land in the southern gardens, the scale can still feel the contrast delightful visual experience. Referring to the different spatial scales of each other, mutual contrast, hint at its master-slave relationship, naturally play a leading role, and with the retractable, light shade transform sight, was "small in the big" spatial effects. Lingering Garden as a narrow

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doi: 10.18686/wcj.v1i1.2

Received: January 12, 2012; Accepted: February 18, 2012; Published online: March 25, 2012

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field of vision narrow entrance space human being extreme compression, and a moment of clear insight into the main space, allow people to experience the spatial scale of change of visual interest. In addition, when people express Memorial, symbolic meaning, etc. often use exaggerated scale Superman, in stark contrast with the man's own scale, the sacred or sublime rendering of open space atmosphere.

2.3. Determinants of spatial scales

Scale the size of a space depends on many factors: the design area and the surrounding area environmental conditions and other objective factors; cultural factors of different ethnic, religious and other; social level factors; use of functional factor space of "human" physiological and psychological needs factors. Comprehensive analysis requires the designer, but it is certain that "person" is the basic physiological characteristics of factors that must be considered. In particular, human vision is to understand the world, access to information, a variety of sensing modes, the most important way, is one of the largest human consciousness to accept information tool.

3. Visual control of the space factor quantization scale degree

Ancient Greek Pythagoreans said: "Beauty is a manifestation of a certain amount of beauty is harmony." Ji Cheng in "Yuan Ye" set forth in "phase to decent, decent garden structure", "clever to borrow because, refined in the body should" and other landscaping principles, where "appropriate", "decent", "appropriate body" also contains the "quantity" of harmony, inter-element positions at all levels, the relative relationship between the distance, volume, angle, direction, etc. [3]. Between the sizes of the human visual spatial scale does have a lot of rules to follow.

3.1. The horizontal dimension of visual control

3.1.1. The level of visual perception characteristics of the human eye's line of sight

(1) In the flat, as the case, the human eye photopic distance of 25 m, you can see the detail of the object, the distance is generally recognize human faces, in the distance, the activities of others can lead to concern for the interaction between the behavior of different groups of people It offers the possibility of occurrence. Japanese architect Yoshinobu Ashihara also raised to 20–25 m for the modulus of the "external modulus theory"; as the material of the outer space, such as changes in elevation scale rhythm, thus breaking the monotony of the large space, creating a vivid sense of space [4]. Kevin Lynch also believes that about 25 m spatial scales is the most comfortable social environment and proper scale, is the formation of the kind of peaceful, friendly, good principles scales pleasant ambience. (2) At 70–100 m away, you can have a good chance to confirm the structure of an object and its image, Yoshinobu Ashihara called "social Horizon", in this distance,

people just can discern another person's body state, is "man Man" cap psychological needs, open space areas should be separated as the largest scale, organized activities and landscape [5]. (3) When the horizon is 250–270 m can see the outline of objects within 500–1,000 m of distance, people under the light, color, movement, background and other factors, you can see and tell about the outline of objects. Over 1,200 m, it cannot distinguish the human body, and the object retains only certain contour, also Bulu Man Fuerth believes the perceived limits of distance 1,220 m, called "public distance", and as far as 4 km when already see the object. (4) Meaning visual perception range on the horizontal distance lies in the relationship between the distance and emotional exchange of visual perception that is contact from the contacts and exchanges between the intensity [6]. Within 1–3 m distance can be cordial conversation, to experience meaningful interpersonal necessary details. In this small space divided scale, people's secrecy requirements are guaranteed, in the field of control satisfied, under such kiosks, chairs, trees, etc. linger space, it is to create a comfortable and pleasant exterior space important factor.

3.1.2. Scale control horizon of garden space layout level

Ancient with "step" as a measure of the length of the unit, on the macroscopic scale planning between classical imperial garden in the "Three Mountains and Five Gardens" on space constraints of each other [7]. Park outside the park's main attractions and scenery presence by the King from the relationship between the clear steps are controlled 800 (about 1,280 m), jade Quanshan Yufeng tower Qing Yi Park from the western end of the island about 800 clear step; The total size of each park to 800 scale also clear steps for the circle radius of control, such as the Yuanming three parks generally controlled in order to Fuhai Peng Island Yaotai of a circle, with a radius of 800 range clear steps; each main park Yamagata, horizontal scale water is also about 800 clear steps, jade and Longevity Yamagata Quanshan vertical movements, the mountain is basically the same scale, the average length of about 800 clear step, because each other by. On further meso-level spatial scale control, the distance between the centers of the park and other important scenic generally controlled to about 400 clear step (600–630 m) of the scale, depth construction group axis, between scenic garden gate spacing and other local spatial scales at 200 clear steps (about 320 m) of common control. At the same time, the reference "for the potential of a thousand feet, continuing to shape" in ancient China in the external space constitution followed to continuing to shape a thousand feet of potential space divided constitution, but also reflects the perception of human behavior and psychology grasp the law. Shape, almost finger close up, small, individual properties, localized, details of the Space and visual perception effect [8]. "Continuing" of about 23–35 m, and modern theories to see the human

face expressions and details of the action as the standard close-sight distance restrictions consistent. Potential, shall refer to a distance of a large, overall sexual contour of space groups of composition and visual experience effect [8]. “Thousand feet” of about 230–350 m, the distance between the people generally happy walking distance of 300 m with appropriate, and in this line of sight, people can form a clear outline of the object observed. From this, cordial and pleasant scenery will contain human visual physiology and fit the law.

3.1.3. Angle control in the use of garden space layout

Angle control of spatial scales in ancient China as early as urban planning, building layout, the garden and create a somewhat reflected. The main garden landscape layout around the composition center expansion, will construct King combination of elements main building, plant, island bridge, rocks, water, etc. within the field of view of 30° and 60° horizontal viewing angle, such as from Beijing to three mountains five Park land, water and controlling relationship Yuquan Hill 30° viewing angle, and the mountain, the water forms an angle to the main axis of the building is also controlled by the angle of 30° and 60°. Generally viewpoint distant scenery, requiring sight small viewing angle is 30°; the short distance of the scene, the more enriched within the field of view, angle of 60°. Meanwhile, in normal circumstances servant eyes while watching the scene visibility field of view is 120° and 60°, and a clearer vision of 30°. Watch thousand feet away at the time of hundred feet of the building or landscape shaped body, a viewing angle of 6°, it is also the most sensitive macular eye sight.

3.2. Control law perspective line of sight between the height and scenery

The human eye does not move, it is generally believed horizontal field of view of 120°, 50° vertical field of view is, under the 70°, and 60° cone within the range of optimal horizontal viewing angle, 27° to the ideal vertical viewing angle, lower is 35°. When the vertical elevation exceed 45°, the images can easily cause visual distortion. The human eye is a flat oval cone, horizontal viewing angle is theoretically twice the vertical viewing angle. The ratio horizon D / scene height H is generally the most widely used in the 1 to 3, the best visual viewing, while in some places in space can protect privacy. Yoshinobu Ashihara further proposed: D/H = 1 is a turning point in the nature of space. With the D/H > 1, the space will have to expand away from the sense; as the D/H < 1:00, the space is more and more sense of urgency; when D/H = 1, the height of the entities constituting space showing a sense of symmetry spacing co-ordination (Table 1) [9]. It can calculate the relationship between the width and height of the surrounding buildings landscape design relative size of a specific spatial scales, such as square, that square of scale. Camilo Hittite think: the minimum size of the square width equal to the height of the main building, the maximum size of not more than two times their height. D/H in the space of 1 to 2 balance, which is the most compact square size. If the width of the square adjacent to the building height exceeds 2 times, the people at which it will have empty feeling, the sense of separation, no polymeric; on the contrary, if the width is less than the height of the building plaza, the interference between buildings is too strong, is too closed, it gives rise

Table 1. Change law among stadia angle of view and observed objects.

D/ H	Vertical elevation angle	Observed scope	Horizontal angle of view	Enclosure
< 1 = 1	45°	Observed object prone to perspective distortion observer can see detail entities	90°	Horizontal viewing angle is too large to be observed in the dynamic Strong sense of spatial enclosure
= 2	27°	The viewer can see the facts as a whole	54°	Watch center in 60°, observe the landscape subject Ideal Ideal Space moderate sense of enclosure
= 3	18°	The viewer can see the facts and the surrounding background	36°	Observation overall building Minimum space a sense of enclosure
= 4	14°	The viewer can see the outline of the building	28°	Watch center in 30°, high-definition Space enclosed property tends to disappear Failure to give a sense of space open, failure to give a sense of space open
= 5	11°20'	The viewer can see the relationship between architecture and the environment	20°40'	Horizontal viewing angle is small, more decentralized vision -
> 5	-	Within sight target dispersion, interference factors, Only research scene in general momentum. In dynamic vision Give priority	-	-

to a sense of depression [10]. However, the general in front of the famous building has two times the height of the distance building, its purpose is to people can fully appreciate the main facade of the building. Of course, exaggerating the scale of the landscape is always eye-catching, such as monuments, towers, sculptures, landmarks and so on, but the attendant must have the appropriate spatial scales reasonable match, so that people can enjoy multi-faceted. Otherwise it will lose in coordination, visual perception and psychological effects of giving is negative, given the overall environment is devastating.

4. Visual spatial scales conversion

Macroscopic size of the city in the growing, but not replace, and fuzzy concept of the urban landscape, the presence of micro-level space. When the person is in the “white elephant” of the space, its behavior will be confused or visual, you can use the appropriate height of plants, architectural sketches, and other terrain and ground elevation above the 70-100 m or 25 m scale based on the principle so, The concept of space is further divided scale, it will not damage the integrity of the original large space as a whole. These added elements formed in the appropriate number of the visual center of the visual range, increase the readability of the space, in order to enhance the value of space, such as to improve some of the Plaza and monotonous situation, having a form more intimate feeling and a sense of scale fields level space environment. Treat relatively cramped space, compared to the space, divided on the basis of level, combined with inner borrow, lending and other practices by the King, can make the space smaller scale with the extension of the line of sight expand. Meanwhile, building, plants, rocks, water and other elements of the scale corresponding scaling, so the actual situation in proportion, scale and harmony.

5. Conclusion

As the saying goes: Distance produce beauty. This is the people in everyday life contacts the road, but also between people and the external environment should grasp. This does not mean absolute distance away, but relative, there are certain conditions. Design objects not exist in isolation, the designer should first understand the surrounding environment and the design limits of their own qualifications,

comprehensive privacy of the main line of sight to sight disturbances, viewpoint position and other factors, combined with people's physical and psychological characteristics of demand analyses. Appropriate spatial scales help to stimulate the exchange of people, man and the external environment, the imbalance of spatial scales cannot effectively serve people. Especially in urban gardens and other public spaces is that people experience, exchange of important places, but also make the city a major way toward humane, so trends in landscape design in the promotion of human visual physiological characteristics of the human should not be ignored.

Conflicts of interest

These authors have no conflicts of interest to declare.

Authors' contributions

These authors contributed equally to this work.

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