

YU FANG**Topic: Architecture****Authors:****Yu Fang**

Tongji University
College of architecture
and urban planning
P.R China
www.tongji.edu.cn

References:

[1] Shao Zhong, “Art of Traditional Chinese Garden”, China Forestry Publishing House, Beijing, 2005

[2] Kostas Terzidis, “Algorithmic Architecture”, Architectural Press, 2006

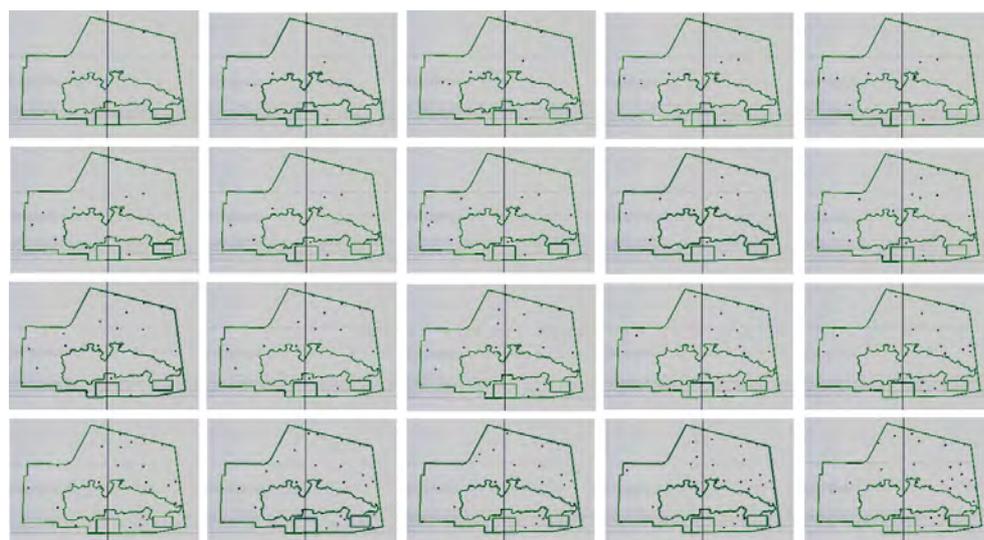
[3] A. van der Zee, B. de Vries, “Design by Computation”, 11th Generative Art Conference, 2008

paper: Generative method in Traditional Chinese Garden Design**Abstract:**

Chinese Classical Garden, also called Chinese Scholar's Garden, is a place for solitary or social contemplation of nature. Among the long history of china, the design of gardens always took the same position as architecture design especially to the bureaucracy. Nowadays, less people would pay attention to old, traditional methods of garden design which once was fashionable in china. Yet, in this paper, a research investigating main elements in traditional way of designing of Chinese gardens would be conducted, and furthermore, these results would be applied into a generative tool which was aimed to gain poetic imagery of Chinese garden by new means.

In the first part of this paper, several elements in traditional Chinese garden design would be listed and analyzed to search how they constructed conception of garden design; and then these elements selected would be applied into a generative way, based on certain principle of generation, elimination and mutation, through the use of system defined by certain algorithms. This processed were not aimed to search for the similar mechanical or randomized autonomous results, it was an attempt to investigate the possibility of generative methods in other fields of design.

The results generated were complex forms of combination of high-density spaces and low-density spaces. Sometimes it was unpredictable or unexpected. Yet, as the process's advancing, the algorithms innovated simultaneously. The generative tools could help designers to gain the complexity by studying, analyzing and applying existing elements or behaviors into dynamical system.

*Image of generating viewing spots in garden***Contact:**

Fangyu25@sina.com

Keywords:

Chinese garden, generative methods, space density

Generative Method in Traditional Chinese Garden

Design

Y. Fang

*College of Architecture and Urban Planning, Tongji University, Shanghai, P. R.
China*

e-mail: fangyu25@sina.com

Abstract

The Chinese Classical Garden, also called Chinese Scholar's Garden, is a place for solitary or social contemplation of nature. Among the long history of china, the design of gardens always took the same position as architecture design especially to the bureaucracy. Nowadays , less people would pay attention to old, traditional methods of garden design which once was fashionable in china. Yet, in this paper, a research investigating main elements in traditional way of designing of Chinese gardens would be conducted, and furthermore, these results would be applied into a generative tool which was aimed to gain poetic imagery of Chinese garden by new means.

In the first part of this paper, several elements in traditional Chinese garden design would be listed and analyzed to search how they constructed conception of garden design; and then these elements selected would be applied into a generative way, based on certain principle of generation, elimination and mutation, through the use of system defined by certain algorithms. This processed were not aimed to search for the similar mechanical or randomized autonomous results, it was an attempt to investigate the possibility of generative methods in other fields of design.

The results generated were complex forms of combination of high-density spaces and low-density spaces, sometimes it was unpredictable or unexpected. Yet, as the process's advancing, the algorithms innovated simultaneously. The generative tools could help designers to gain the complexity by studying, analyzing and applying existing elements or behaviors into dynamical system.

1. Routes in Chinese gardens

Chinese gardens, especially gardens of southern Changjiang delta, are different from western gardens in both forms and concepts. Traditional garden designers paid little attention to geometry forms, while which was a main stream in the design of western gardens, they focused on the feelings of the visitors wandering within the garden. A famous description of the principal of Chinese garden design is that “view changes with steps moving”. [1] The design of graceful landscapes mainly focused on two aspects---- “static landscapes” and “dynamic landscapes”. The description mentioned before distinctly characterized the latter. Generally speaking, “static landscapes” refer to the viewing spots, where visitors consumed more time to stay to enjoy the sight around, while “dynamic landscapes” contribute to the moving routes along which the designers arranged their elaborate elements. The majority of large-scale gardens gained vivid scenery and riveting charms by the organization of routes (figure 1.1.1).

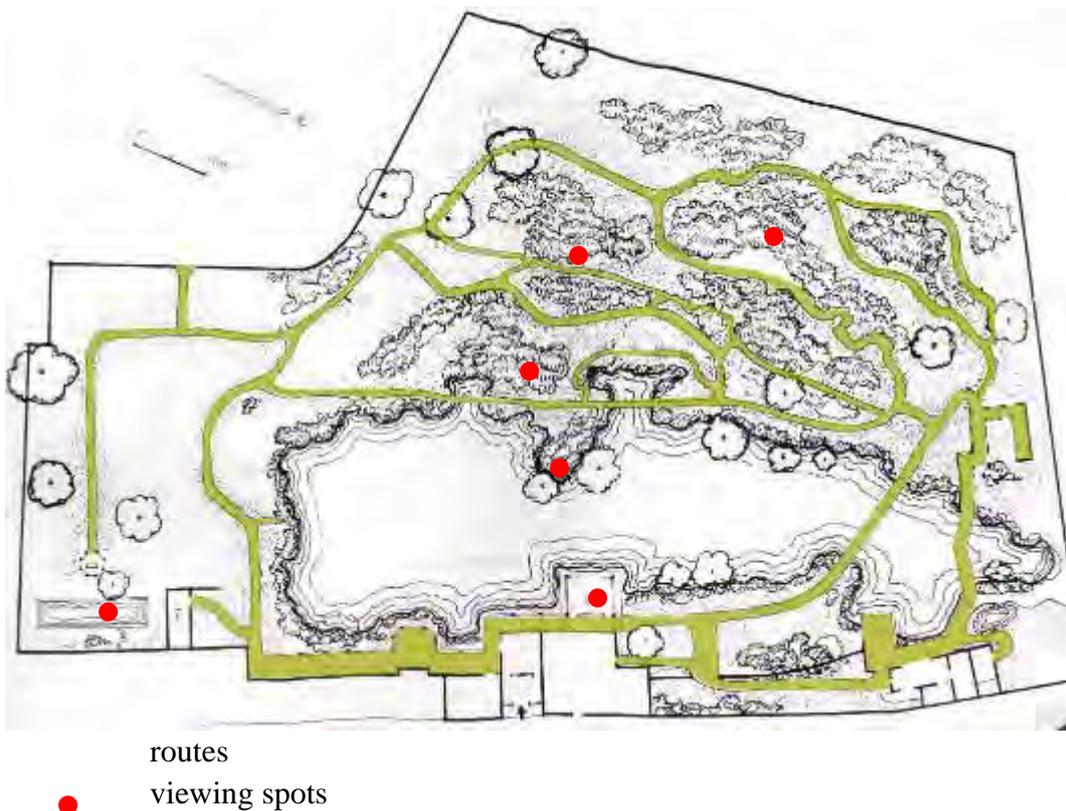


Figure 1.1.1

The routes themselves are easily to understand though the reading of the plans but it needs deeper description to decipher the connotation of these tortuous, seemingly irregular routes. Firstly, on the whole, garden designers followed traditional norms, from generation to generation, describing the space sequence of the routes, a sequence emphasized an insinuate and occluded

long entrance to form a dramatic contrast with an inspiring appositive scenery. While during the main course of wandering among the viewing spots, the routes turned succinct and open to provide enough viewing spaces needed to construct poetic imagery. Here, the direction follows the guidance formed by the dispersion of the force-field from each spots. Finally, the ending of the routes became circuitous and occluded again to gain the contrast with the wideness experienced before.

Actually, as a topic to a typical Chinese garden designer, there will not be such rational analysis and formalities, they called the formalities as some kind of fetters which confined their creativity[2]; but the great similarity of these features in the majority of Chinese gardens indeed provides us the chance to design a Chinese-style garden in an innovational way.

2. Related works –architecture phenomenon

Garden design was a fashion hundreds years ago in china, and nowadays, a similar idea ---- architecture phenomenon, focusing on the feeling of people while experiencing buildings, is gradually accepted. “Phenomenology” has an etymon coming from Greek, it referred to the subject to study the appearance, representation, indication and phenomenon of objects. It was first brought into architectural field by the work of Norberg Schulz ---- “Towards a Phenomenology of Architecture”.[3] Since then, it was applied by numerous architects.

The focus on the exploration of the field of spaces with materials to touch and the field of feeling and consciousness shares the same idea of the designs in Chinese gardens. There are some attractive issues correspond to the unnamed quality of the gardens. To construct the feelings by elaborate arrangement of different architectural elements such as the density of spaces, the combination of open and closed spaces and the placement of appositive scenery.....

In the layout of traditional Chinese gardens, the high density areas (mainly around the beginning and ending of routes) and the low density areas (where viewing spots dispersed) composed a fluctuation during the trip of visitors. And the distribution of the spots also results the direction of routes ---- a route leading towards the spot to show the viewings or a route circling around certain spot to serve as a prelude.

Rafael Moneo mentioned Siza in “Theoretical Anxiety and Design Strategies – In the Work of Eight Contemporary Architects”:’ We admired works of Siza

because we became conscious of that we can learn the architecture through our personal experience.' A significant method to build a place where we could gain personal experience is to compose the whole space in dramatic sequence. In the stage of natural scenery, the arrangement of routes played the most important role to guide visitors to across gardens.[4]

In this paper, I do not want to focus on the sense of touch, acoustic design or the viewing elements; I try to gain the intricacy and abundant diverse feelings by the layout of routes and viewing spots. And following are some attempts I have made to express the “poetic feelings” in Chinese gardens in a totally different way.

3、 generative methods

By analyzing essential components and patterns forming Chinese gardens, this research mainly investigate into the formation of paths. Even though focusing more on sensibility than ration in the progress of designing, there are still certain regularities under covers, which indeed vivid the routes of gardens. I tried to search for the inherent organizations and then represent them through generative methods. It's like the generation of some self – selection and development models, however, the principles I took did not mainly focus on the dynamic and developing process of themselves but on the feelings of people ---- what I expected them to encounter and feel about at certain points (even these points were not decided in advance). The results generated may not be visually aesthetic but they represent a possibility to experience.

The first part of this paper is to define the variables and parameters in the progression, taking the viewing spots as main objects to study.

The second and third part of this paper state the program process with mathematical algorithm. In this part, the progression of viewing spots and routes would be represented. Based on the sense-related principles, a modern garden with traditional elements was built by generative tools.

3.1 Variables and parameters

Among the analysis of Chinese garden design, the most important element to form the progress of experiencing is the construction of the routes. Otherwise, in conventional Chinese conception, the beginning and the ending took the most fundamental parts, related to the density of the space around them.(figure3.1.1).

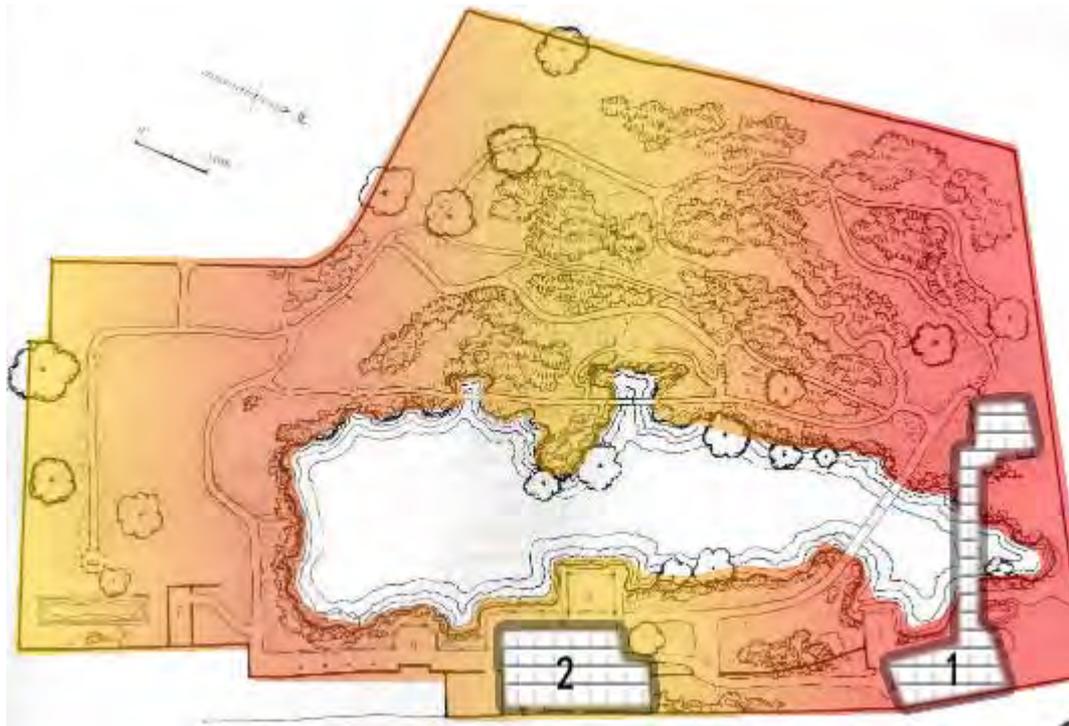


Figure 3.1.1

To gain dramatic experience that cause people feel closed before the grand view and form the contrast between opening and blocking, The density of space concentrated from the start point (area 1) and circled around inside the boundary, rarefied as the distance get longer, to concentrate again around the ending point (area 2). Wandering around the entrance, the closed space separated visitors from the main body of the garden and veiled most of the views (red area at the corner part of figure3.1.1). As the progression continuing, out of the occluded entrance was a wide viewing space with several branch roads presented to follow. The grand space here mainly aimed to form the contrast to the entrance and was influenced by the apposite scenery (view from area 2), we took as the most exciting climax during the experience of the garden. On the axis of the main viewing platform (area 2), a wide range of vision contribute to obtain scads of viewing communication with the viewing spots dispersed among the climax area, rarefying the density around the climax area (the yellow part on the axis of area 2).

As what mentioned before, the whole organization of the sequence of spaces could be influenced dramatically by the layout of the start point and viewing platform. Thus the generative method utilized the distribution of viewing spots as a reference to define the density of the spaces, and also the space generated from the viewing spots define the direction of the routes, determined by the influence of start point and grand viewing platform.

Taking the boundary of the layout and the pond as references, the generation of viewing points was based on the distance between the starting point and the

axis of viewing platform to determine the distribution of sequential spaces density along the routes.

3.2 Generating points and areas

The circular generation of viewing points focused on the influence of the attractors, where the density of the spaces fluctuated remarkably, which were organized according to the disciplines of settling, removing and mutation.

1. Settling:

Each individual picked up a land to settle while all points were dispersed organically within the boundary following certain rule of elimination.

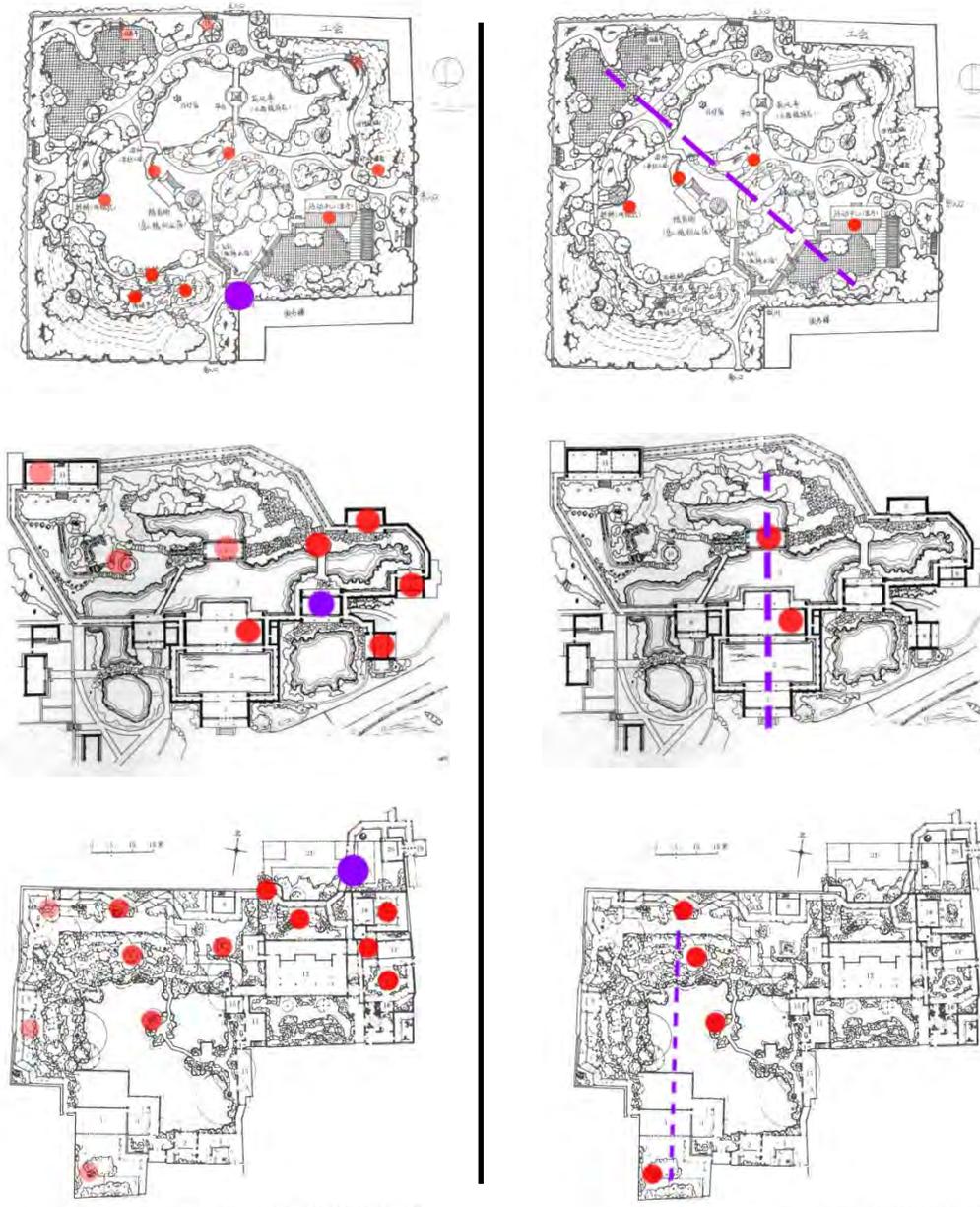


Figure 3.2.1

As seen from figure 3.2.1, the purple points represented the main entrances while the red points refer to the dispersed view spots, located to define the routes and a dotted axis. Through the observation, the red points tend to congest around the main entrance and become scattering as they are farther away from the entrance. Here we could take the density of the spots as a reference to the density of the space distribution, related to the influence by the location of entrance as an attractor; furthermore, when it turns to axis, there would be a different condition that the distribution of spots around the axis becomes rarefied to emphasize the importance of the main axis which acts as another influential attractor.

Thus I took three parts from the layout of traditional Chinese garden ---- the boundary, main entrance and the axis as predominant attractors to generate the routes.

2. Removing:

After each point took its own position on the screen, they would be chosen to be restored or removed according to the distance from the attractors.

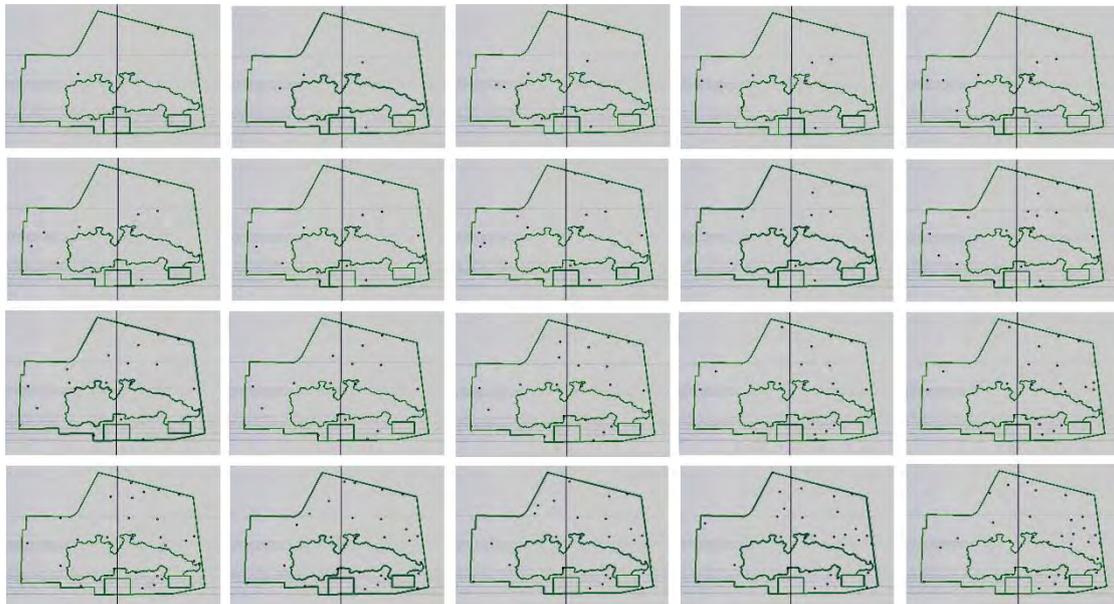


Figure 3.2.2

We can learn from figure 3.2.2 that these points accumulate around the right corner of the boundary and become rarefied when located around the axis and the left part of the map according to the rules set before which aimed to control the distribution of space density among the whole model. There was an interesting progress that sometimes the distribution of points cloud tends to diminish suddenly when there are too many points appear on the screen, thus I put a limit to limit the growth of spot points. The whole progress reached the final stage around sixty or seventy times of elimination and generation.

3. Mutation

During the progress, the distribution of points may become unbalanced ---- that it was too concentrated in high-density areas and too scattered when referring to the low-density area, my solution to this situation was the mutation of certain points when such a kind of unbalance occurred. If the space density was too high to insert other spot points here, the area would turn into a landscape unsuitable to stay and thus some points would be chosen randomly to be removed to other areas where space density was likely to become compact. In the same way, if a certain area was too broadened, points would be inserted randomly.

3.3. generating routes

The generation of routes was based on the algorithm of Voronoi. Firstly, it defined boundaries of each spot point and then generated such individual areas according to defined boundaries as represented in figure 3.3.1.



Figure 3.3.1

Routes were derived from established boundaries of each individual area and connected to each other. The final form of routes was determined by the number of spot points generated before, here we see, from figure 3.3.2, the graphic on the left part of the screen is different to the right one which contained more points generated to define boundaries and represented more distinctive distribution of space density.

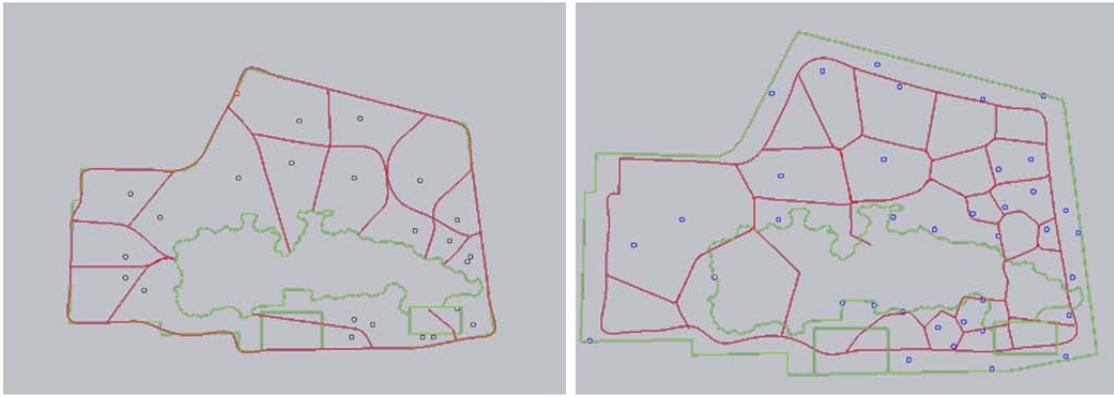


Figure 3.3.2

As tested before, to take points which have undergone the progress of elimination and generation about sixty to seventy times as a suitable reference to the density of space distributed into the gardens, thus we could get a generative routes to organize views in the garden as we could see in figure 3.3.3. Significant changes in the organization of spaces could be interpreted as reference points changed which could trigger massive changes in the progress of generation.



Figure 3.3.3

The whole routines encircle around garden area to construct different spaces with various density to construct interesting experience for tourists wandering among landscapes, basing on the principles that according to the attractors which greatly influence the distribution of reference points.

4. Conclusion and future study

The work presented in this paper focused on the progress of the generation of points and then to develop a route embracing the garden area through the generative methods. As far as I am concerned, generative tools and methods have been prevailing in architectural design and development processes.

These tools and methods do not provide a platform to act unlimitedly but are based on certain understanding of the progress how parameters and variables are defined and then they could cause dramatic influence to the final results. Furthermore, as what I have tried to do in this work, it reveals the possibility to gain generated results with the help of merely certain references along with some mutations and settled rules. And also this result indicates that an analysis of main characteristics and features of certain design patterns could be dealt with in a wider perspective to generate new designs.

Yet, there are still some steps to be improved. Among the whole progress, the generation of points and routes, to some extent, does not interact with each other closely, it is just a unilateral transition of information serving as the structure of a tree. If the linear progress of the project could be turned into a reversible one, then it would be possible to utilize the references more subjectively and reach more possibilities.

Another limitation among this work refers to the analysis of certain design pattern. It is the feeling of people about spaces that construct the whole frame of my design work, well, there still remains some other elements contributing to the poetic scenery of traditional Chinese gardens such as the scale of windows, the transmission of sound and the texture of materials..... it would grow into an endless list of design elements thus it's almost impossible to conclude all of them in one project, however, the combination of several aspects simultaneously in the progress of modelling may bring us other possibilities or results.

Reference

- [1] Shao Zhong, "Art of Traditional Chinese Garden", China Forestry Publishing House, Beijing, 2005
- [2] Cheng Congzhou, "Talking About Gardens", Tongji University, Shanghai, 2007
- [3] Christian Norberg-Schulz, "Genius Loci: Towards a Phenomenology of Architecture", Rizzoli, New York, 1991
- [4] Rafael Moneo, "Theoretical Anxiety and Design Strategies in the Work of Eight Contemporary Architects", MIT Press, 2005
- [5] Kostas Terzidis, "Algorithmic Architecture", Architectural Press, 2006
- [6] A. van der Zee, B. de Vries," Design by Computation", 11th Generative Art Conference,2008