

THE URBAN EXPERIENCE

A people - environment perspective

Edited by S. J. Neary, M. S. Symes and F. E. Brown
Urban Renewal Research Unit
University of Manchester
Manchester, UK

Proceedings of the 13th Conference of the International Association
for People-Environment Studies held on 13-15 July 1994



Sponsored by
British Gas



E & FN SPON
An Imprint of Chapman & Hall

London · Glasgow · Weinheim · New York · Tokyo · Melbourne · Madras

37

Measurement of the multi-sensory information for describing sequential experience in the environment: an application to the Japanese circuit-style garden

Mesure de l'information multi-sensorielle pour la description de l'expérience séquentielle de l'environnement: application aux jardins de promenade

Ryuzo OIino and Miki Kondo

Les paysages dans les villes modernes au Japon sont remarqués pour leur pauvreté visuelle: ils sont souvent si chaotiques et quelquefois si monotones qu'on souffre d'un excès et d'une dépravation sensoriels. Les jardins de promenade au Japon ont depuis longtemps été appréciés pour leurs beaux points de vue séquentiels. Si nous pouvions retirer des enseignements de leurs arrangements spatiaux, nous pourrions concevoir nos espaces urbains de façon à offrir aux piétons des expériences esthétiques plus riches et un niveau optimal d'information. Pourtant, l'expérience esthétique du jardin a rarement été étudiée de manière scientifique. Cette recherche va tenter d'analyser l'expérience séquentielle par la mesure de l'information multi-sensorielle de l'environnement afin de révéler un ordre caché ou un rythme d'arrangement spatial. On a mis au point une série de programmes informatiques que l'on a appliquée aux données sur l'environnement de trois jardins de promenade célèbres, afin de mesurer les trois aspects suivants de l'information sensorielle: 1) l'information visuelle ambiante; 2) l'information visuelle focalisée; 3) l'information non visuelle, par exemple l'information tactile et kinesthésique. Les caractéristiques de chaque aspect sensoriel sont obtenues en mesurant les points consécutifs tous les 0.5m (un pas de promeneur) le long du sentier du jardin. Ainsi, les changements dans les caractéristiques d'information sensorielle sont utilisés pour examiner l'expérience séquentielle à mesure que les individus se déplacent dans le jardin.

Mots clé: jardins de proJenade au Japon, information multi-sensorielle; expérience séquentielle.

Key words: Japanese circuit-style garden, multi-sensory information, sequential experience

Urban landscapes in Japanese modern cities are notable for their poor visual scenes: they are often chaotic and sometimes too monotonous where **people** suffer sensory overload and sensory deprivation (Rapoport, 1980). On the other hand the Japanese circuit-style gardens have long been appreciated for their sequential scenes of beautiful landscapes. If we can learn from the spatial arrangements of the garden, our urban spaces could be designed to provide pedestrians with richer experiences and optimal levels of information. The aesthetic experience in the garden, however, has rarely been analyzed based on physical or objective data because it is difficult to explain by the characteristics of particular elements.

In the present study, the aesthetic experience is postulated to depend on the multi-sensory information from the environment, and a method for measuring the relevant variables was developed. By applying the method to circuit style Japanese gardens, the aesthetic value of which has traditionally been recognized, the changes of the physically measurable sensory variables as people moved through the path were objectively described. The changing profile was analyzed to reveal the hidden order or rhythm of the sequential experience.

Research Background

The present study mainly stemmed from Thiel's (1970) "notation" which is a time based description method of sequential experiences in the environment analogous to a musical score for an orchestra. His method was employed in this study to describe the profiles of multi-sensory information from the environment. Although some researchers (Miyauji, 1992; Kitamura et al., 1989) applied similar methods to such pedestrian spaces as a shopping mall, urban street and river-side landscapes, they did not quantitatively analyze environmental components.

An attempt to quantitatively describe spatial sequences was made by Funakoshi et al. (1988) for the approach path in the Japanese shrines, and Zaino et al. (1992) and Miyagishi et al. (1992) for the Japanese gardens. Although we share similar research interests, these studies dealt only with limited environmental components which were somehow arbitrarily chosen. In addition, the measured unit of spaces was too broad to examine the details of space sequence, and the research was mainly argued on visual sensory information. By contrast, Shinji et al. (1982) measured the **curvature** of the Japanese garden path and suggested the importance of non-visual factors in the experience of the gardens.

Although there are several descriptive analyses and explanations on the

fascinations of the circuit-style gardens (e.g. Watsuji, 1958; Hall, 1970), there is no scientific research analyzing the aesthetic experience based upon objective data. This lack of scientific research led to our present study.

METHOD

A set of personal computer programs was developed and applied to the environmental data extracted from the survey maps of three famous circuit-style gardens in order to measure the following three aspects of sensory information: (1) ambient visual information perceived from surrounding scenes; (2) focal visual information taken when focusing on symbolic objects; and (3) non-visual **information** such as tactile and kinesthetic senses perceived when walking through the garden paths. The profile of each aspect was obtained by assessing consecutive points every 0.5 m (one step of a pedestrian) apart along the garden path. Then, all of the profiles of the multi-sensory information were displayed in parallel like a musical score to reveal a hidden pattern or rhythm of the sequential experience as people moved through the garden.

Garden Selection and Environmental Data Creation

Three "noted" gardens were selected after considering the size and the era in which they were built: Katsura-rikyu villa, Shugakuin-rikyu villa (only the upper area was used in this study), and Saiho-ji temple (Figures 37.1 to 37.3). For convenience sake, we shall call them hereafter as Katsura, Shugakuin, and Saiho-ji respectively. The survey maps of these gardens (Shigemori, 1971; Shigemori, 1976; Takahashi et al., 1978) were used to generate the following data.

(a) Land configuration data and site plan data

Based on the survey map, the graphic data of land configuration was created in the frame memory of a personal computer by using an image scanner and CAD. The land height differences in every 0.5 m (1.0 m in the case of Shugakuin) change was identified by coded colors as shown in Figure 37.4. As for the site plan, building shapes and borders between different land covering materials were first drawn on the display, and then painted according to a color code to identify building height and land covering materials such as path, grass, and water as shown in Figure 37.5.

(b) Observation points data

The data of observation points (location and direction of movement) was created along the garden path every 0.5 m (one step of a pedestrian) apart.

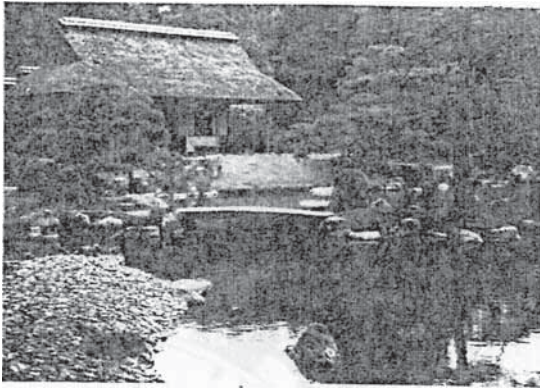


Figure 37.1 Katsura-rikyu villa.



Figure 37.2 Shugakuin-rikyu villa.



Figure 37.3 Saiho-ji temple.

(c) Tree data

Trees in the site were first classified into 14 types (7 different shapes, two different kinds: indeciduous and deciduous trees) with reference to the Landscape Handbook (ILLA, 1978). Tree data such as its type, size of crown and location was then put into computer memory. Figure 37.6 shows the indeciduous tree data in Katsura.

(d) Symbolic elements data

Graphic data was created in the frame memory for the symbolic elements (tea pavilions, gates, bridges and others) in the gardens which would attract the attention of people who walk through the garden.

(e) Garden path texture data

Graphic data was created for the garden path textures which were classified into 10 types such as soil, gravel, or stepping-stones as shown in Figure 37.7.

MEASUREMENT AND DESCRIPTION OF SENSORY INFORMATION

Ambient Visual Information

In a previous study by one of the authors, a personal computer program was developed to assess an array of visual surfaces which surround an observer (Ohno, 1991). A part of this program was improved to apply to the Japanese garden. The measurement procedure of the program is as follows.

- (1) From the observation point around which the visual state is to be assessed, a scanning line is drawn in each of the colored site plans on the display, and the land height, land covering materials and building heights along the line are identified by color code.
- (2) With this data, a vertical section along the scanning line is drawn on the other plane of the display. Using the tree data, a vertical section of trees cut along the scanning line is calculated and drawn on the above obtained section. In this section, many scanning lines radiate from the station point at eye level (1.5 m high). Each of the scanning lines extends until it reaches the outline of the sectional surfaces and reads the color code to identify whether it is, for instance, a path, building, water or tree. At the same time, the length of the scanning line is calculated (see Figure 37.8).
- (3) These operations are repeated by changing the azimuth of the scanning line by five degrees until all directions around the station point have been assessed.
- (4) A chart is generated which shows the array of visible surfaces of various components. Figure 37.9 shows an example of the results of these assessments. Two numerical measures were taken from the charts relevant to ambient information: a ratio (%) of total area of solid angle for each visible component and a measure of spatial volume shown by mean distance (m) from the surrounding surfaces.

The program was applied to a sequence of observation points along a typical path in the gardens. Figure 37.10 shows a part of the result which describes changing profiles of the solid angle for some visible components as we move through consecutive points every 0.5 m apart. Figure 37.11 shows a profile of the spatial volume. This figure, as an example, shows a sequence of the garden path from the Maple Path to Shokin-tei, a tea pavilion in Katsura. Leaving from the Maple Hill (a decrease of visible solid angle of deciduous trees), we pass through the Cycas Hillock, which is in front of a roofed bench, (an increase of building and decrease of deciduous trees). Soon we begin to see the garden pond (a gradual increase of water surfaces). By following the pond side path we pass under the maple tree (an increase of deciduous trees) and cross a stone bridge until finally we reach the open space in front of Shokin-tei (an increase of the spatial volume).

Focal Visual Information

The presence of symbolic elements in the visual field strongly affects spatial experiences in the garden. It depends upon their visibility rather than on how large they appear because these symbolic elements tend to attract the attention to people who move through the garden. Using the data, (a), (b), and (d), a program was developed which could identify visible elements and measure both direction and distance.

As an example, Figure 37.12 shows the case of Shokin-tei's visibility of the Miyuki-lane from the Miyuki-gate to Shoin, main house, in Katsura. In this figure, the direction where the element can be seen is shown by the relative angles from the direction of movement (top), and its distance (bottom). The distance 0 m in the bottom figure indicates that the element cannot be seen. In this example, one can peep at Shokin-tei 90 degrees to the left through the Maple Path for several steps after the 155 step-point. Upon reaching the soil covered arched bridge, one can see it again over the hedge from the raised viewpoint. As one follows the garden path which turns to the left, it now appears again in the front. The visual line to the Shokin-tei then moves to the left when one makes a turn to enter the Chumon gate.

Every symbolic element in the garden was measured in the same way. This data, having both distance and direction, is regarded as the vector of visual line which connects the observation point and the focal element. The vector is drawn on the site map by an arrow.

Non-visual Information

The senses of touch and pressure experienced by foot when we walk through garden paths of different surfaces and the motion or kinesthetic sense experienced when following the change of the direction and the height of garden paths are also significant factors of the sequential experience. Thus, we developed a program which could identify changes of texture, altitude and directions of garden paths.

(i) Textures of the garden path

Ground textures were measured by using the observation point data (b) and the garden path textures data (c). Figure 10 is an example showing the garden path from the soil covered bridge in the Valley of Firefly to Shoin through Shoka-tei, a tea pavilion. The numerical value of the vertical axis of this figure is a classification number shown in Figure 4. This figure clearly shows the changes of textures from the soil covered bridge, soil, stepping-stones, soil covered bridge, soil, and finally to the paving stone.

(ii) Height differences of the garden path

The changes of relative altitude as we move through the garden path were measured by using the observation points data (b) and the land configuration data (d). Figure 37.14 shows up-and-down changes of the garden paths in the vertical axis by a relative altitude (m) to the garden pond level. This figure shows changes from the soil covered bridge to Shoka-tei on the top of the small hill which is raised 5m from the garden pond level, and then goes down to the Shoin. It can also show the pitch of an upward and downward slope.

(iii) Direction of garden path

The direction of movement along the garden path was measured in absolute azimuth (north: 0 degree) by using the observation point data (b). In addition, it was expressed by the relative azimuth difference from the previous point (right: +, left:-) in order to show the curvature of the garden path. Figures 37.15 and 37.16 show examples of a result by absolute azimuth (degree), and by the azimuth changing rate (degree/step) respectively. This example shows that it first makes a turn to the left from the soil covered bridge in the Valley of Firefly, then turns to the right, then passes in front of Shoka-tei along the gentle curve, then curves gently to the right, then proceeds practically in a straight path to Shoin, then turns to the right in front of Shoin, and finally swings largely to the right and to the left.

CONCLUSION

This paper proposes a method of measurement for the multi-sensory information in the environment. It was applied to consecutive observation points along the garden paths to measure ambient visual information, focal visual information and non-visual information based upon environmental data extracted from the survey map. Thus, profiles of multi-sensory variables were obtained for each garden.

In order to formulate general rules of spatial arrangements in the garden, further examination of the profiles is necessary concerning the patterns of periodic appearances of each variable and the correlation between variables. Although the present study is still in its infant stage, the method proposed here may be a useful tool for environmental researchers and designers to evaluate the quality of the environment based on objective data.