

Chapter 12

EXPERIENCING JAPANESE GARDENS

Sensory Information and Behavior

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INTRODUCTION

Japanese circuit-style gardens have long been appreciated for their sequential scenes of beautiful landscapes. It has often been mentioned that Japanese gardens have been designed so as to control visitors' experience, particularly the vistas, as they move along the garden paths (e.g., Hall, 1970). If we can learn from these sophisticated skills of landscape design, we could naturally direct people's attention to something we want to be viewed (e.g., signs in urban streets) without using harsh colors and brutal forms. With some exceptions (Miyagishi & Zaino, 1992), the relation between the physical arrangements and visitors' behavior in the garden, however, has never been analyzed based on objective data.

The present study attempts to explain visitors' behavior in the garden through sensory information in the environment. The following hypotheses were examined through a case study of a Japanese circuit-style garden in Kobe city:

1. People's behavior in terms of (a) change of moving pace including complete stop, and (b) change of viewing direction, which commonly occurs at certain places in the garden path.
2. These behaviors can be explained by the following two aspects of sensory information: ambient and focal visual information perceived from sur-

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FIGURE 12.1. General view of the garden.

rounding scenes, and nonvisual information such as tactile and kinesthetic senses perceived when walking the garden paths.

The roles of ambient and focal visual information in environmental perception have been distinguished (Ohno, 1991). Ambient visual information plays a role in orienting people in space and guiding their larger movements, while focal visual information is used for the detailed examination and identification of objects. Ambient vision can be regarded as a preattentive visual system, which cannot process complex forms, yet can almost instantaneously detect differences in a few local features regardless of where they occur. Julesz and Bergen (1983) noted that "the preattentive process appears to work in parallel and extends over a wide area of the visual field, while scrutiny by local or foveal attention is a serial process, which at any given time is restricted to a small patch" (p. 1638).

As for nonvisual information, the senses of touch and pressure experienced by the foot when we walk along garden paths of different surfaces, and the motion or kinesthetic sense experienced when following a change of direction and height of garden paths are also significant variables of the visitor's behavior. Hall (1970) has noted:

The designer makes the garden visitor stop here and there, perhaps to find his footing on a stone in the middle of a pool so that he looks up at precisely the right moment to catch a glimpse of a unsuspected vista. The study of Japanese spaces illustrates their habit of leading the individual to a spot where he can discover something for himself. (p. 154)

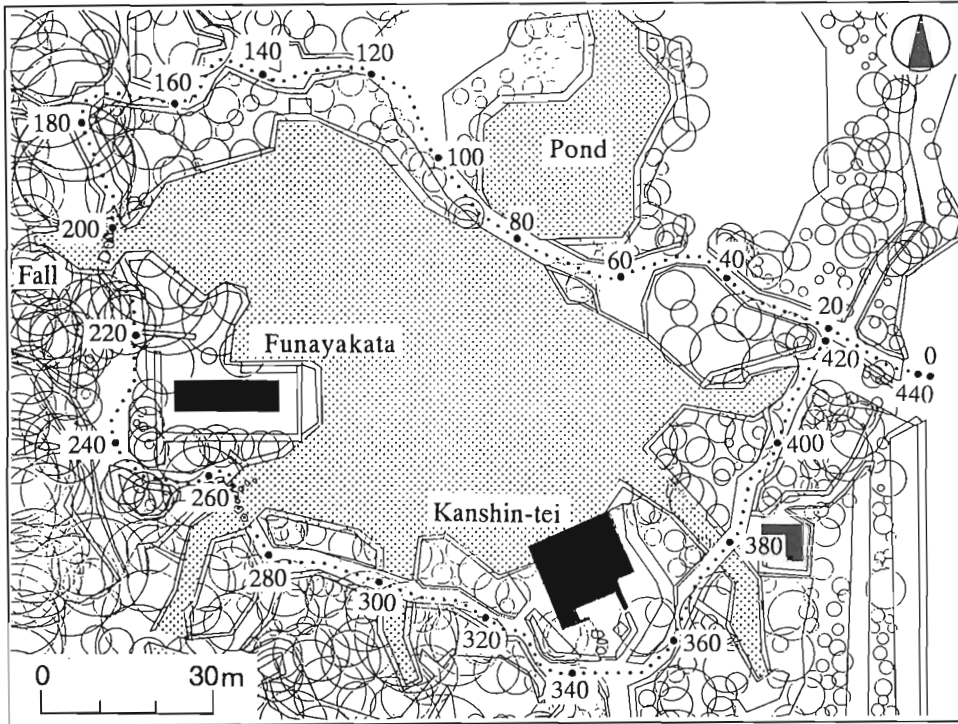


FIGURE 12.2. Site plan and main circuit path of the garden.

BEHAVIOR IN THE GARDEN

Study Site and Participants

A typical Japanese circuit-style garden, Soraku-en in Kobe city, was chosen as the study site (see Figures 12.1 and 12.2). A total of 21 participants, ten male and eleven female students who have never visited the garden, were employed in this experiment.

Experimental Design

Each of the participants was asked to stroll at will the main circuit path. The route to follow was shown to them beforehand on a map of the garden. Participants were allowed to spend as much time they liked. Participants' behaviors were recorded on videotape by a TV camera from a position of about 5 meters behind them.

Procedure

The experiment was conducted on both fair and cloudy days in October and November 1994. From the videotape each participant's motion (viewing directions estimated by head and body rotations) and walking pace were observed and re-

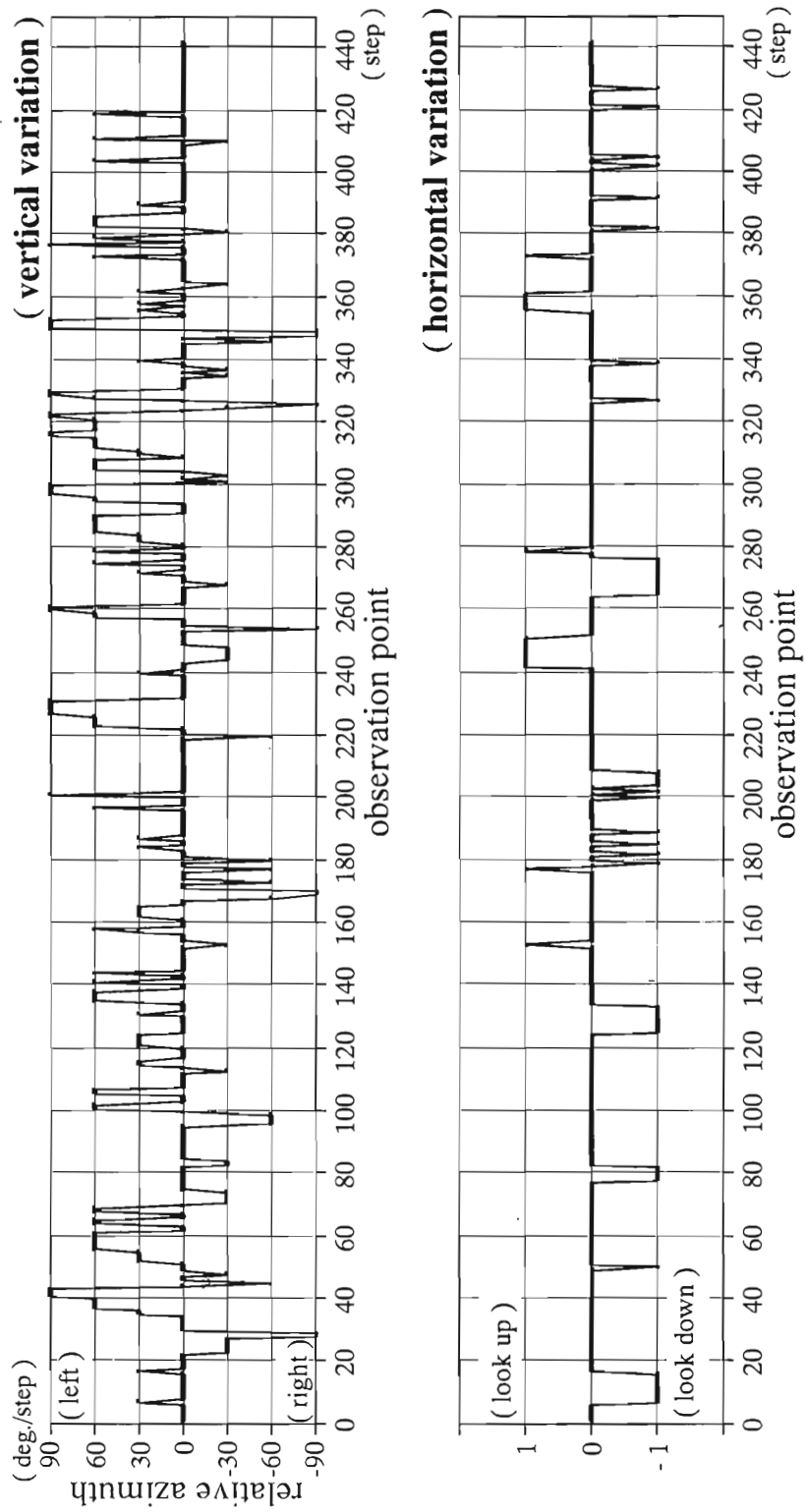


FIGURE 12.3. Changes in viewing directions along the path.

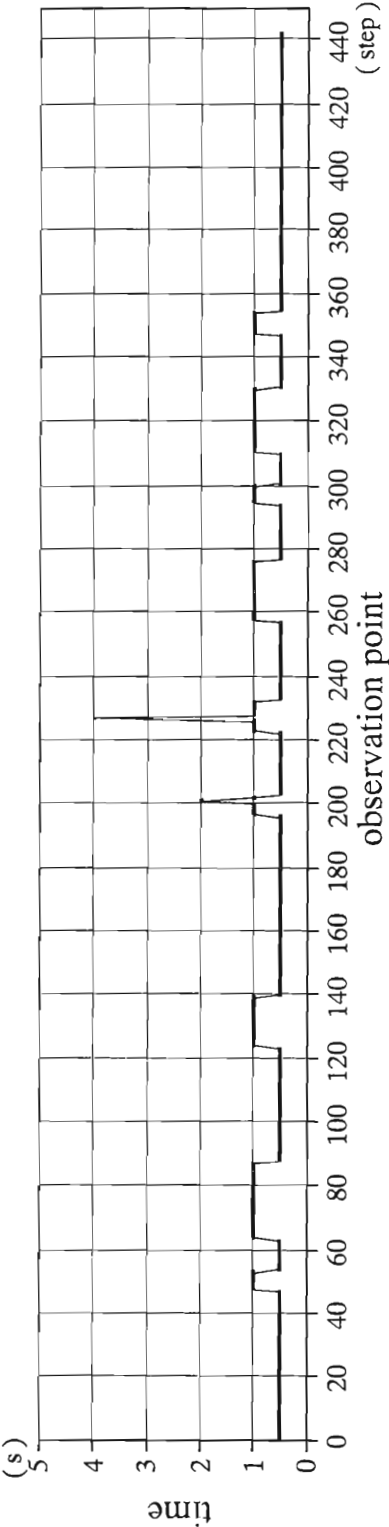


FIGURE 12.4. Changes in walking pace along the path.

corded at 0.5-meter consecutive points (one pedestrian step) along the garden path.

Results

The viewing directions estimated by head and body rotations were described by the relative azimuth from the direction of movement (left: +, right: -) in three grades (angles of 30, 60, and 90 degrees), while the vertical changes were described by upward (+1) and downward (-1). Figure 12.3 is an example of the results for one participant, in which the scale of the horizontal axis is the serial number of observation points along the path.

Figure 12.4 is an example of the results for a participant showing the estimated time spent in walking from previous viewpoints 0.5 m apart. In this figure, a slow pace (0.5 m/s) and a fast pace (1 m/s) were distinguished, and observation points where the participant came to a stop were indicated by a sharp rise in time spent.

To examine the general tendency of the results for all the participants, Figures 12.5 and 12.6 show the points where each participant looked to the left (+90) and to the right (-90), respectively. Similarly, Figure 12.7 shows the observation points where each participant looked downward. Figure 12.8 shows the zones where they slowed down, and the points where they made a stop.

These figures, in which dots form several vertical lines or clusters, indicate that the places where these actions tended to occur are fairly common among the participants. Furthermore, the tendency to choose similar places to stop and look in a certain direction is readily noted in Figure 12.9, in which the viewing directions are shown by arrows on the map. The length of the arrows indicates the number of participants who viewed the same direction from an observation point.

MEASUREMENT AND DESCRIPTION OF SENSORY INFORMATION

To analyze visitors' behavior in the garden with objective data, an attempt was made to describe the changes of measurable sensory input as people moved along the path. A set of personal computer programs was developed to measure some aspects of sensory information, and it was applied to the environmental data extracted from a survey map of the garden.

Environmental Data Creation

Based on a survey map of the garden, the following data were created in the memory of a personal computer by using an image scanner and CAD software.

1. *Land configuration data*: Graphic data of land elevation changes every 0.5-m were identified by coded colors.
2. *Site plan data*: Graphic data of building height and land-covering materials such as path, grass, and water, identified by coded colors.
3. *Tree data*: Numerical data recording location of trees on the site, their type (14 types : 7 different shapes, 2 different kinds) and size of crown.

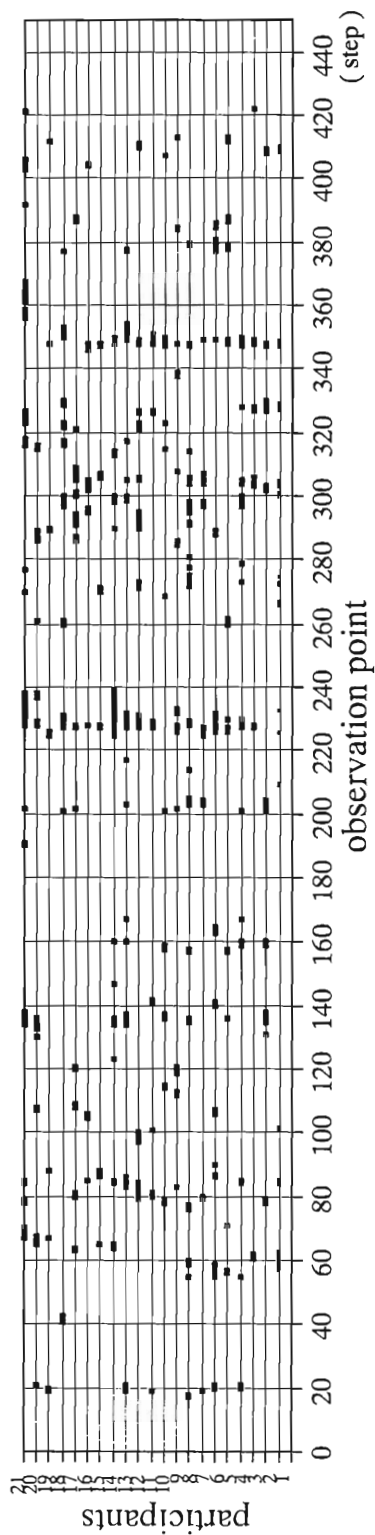


FIGURE 12.5. The observation points where each participant viewed to the left side (+90 deg.)

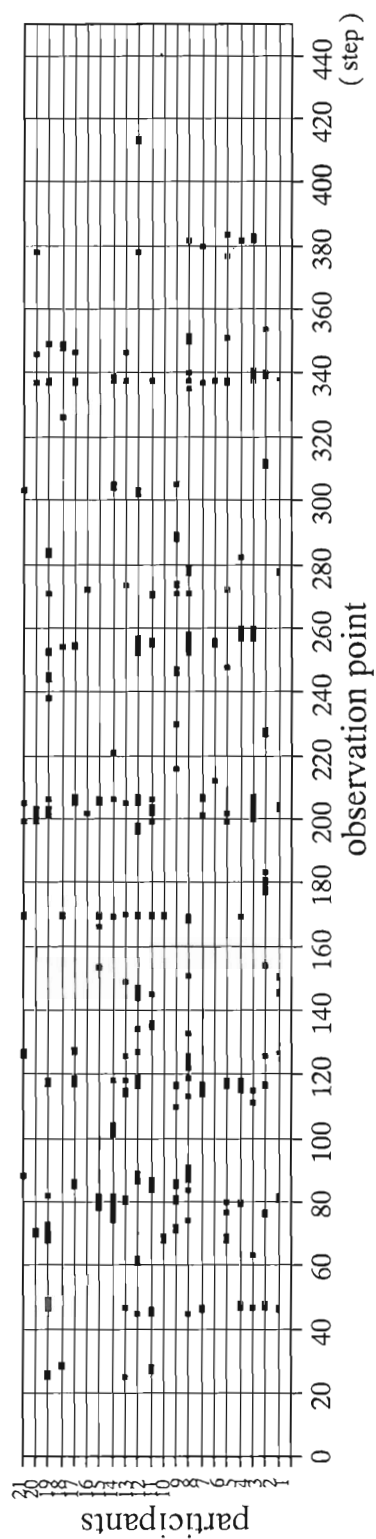


FIGURE 12.6. The observation points where each participant viewed to the right side (-90 deg.)

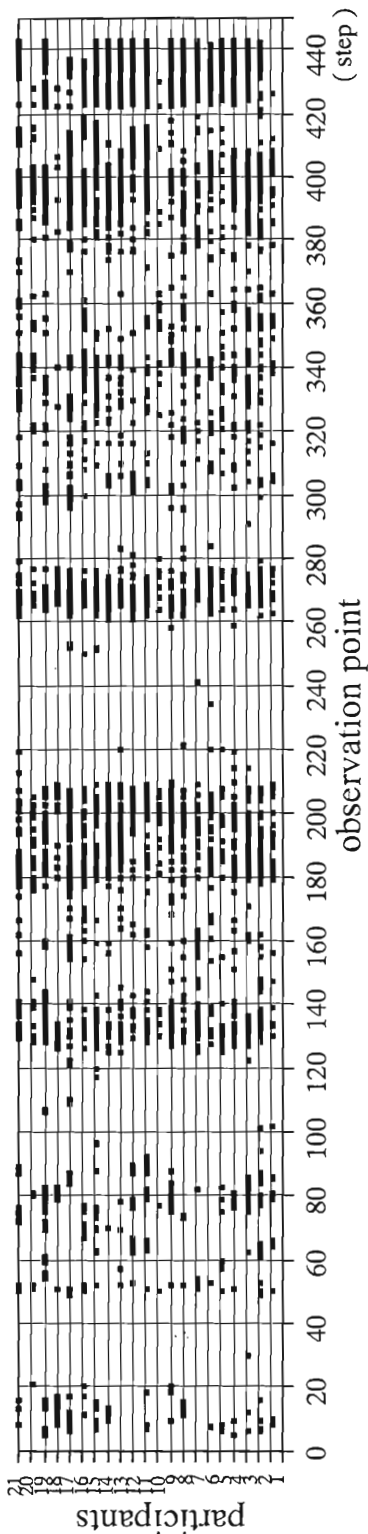


FIGURE 12.7. The observation points where each participant looked downward.

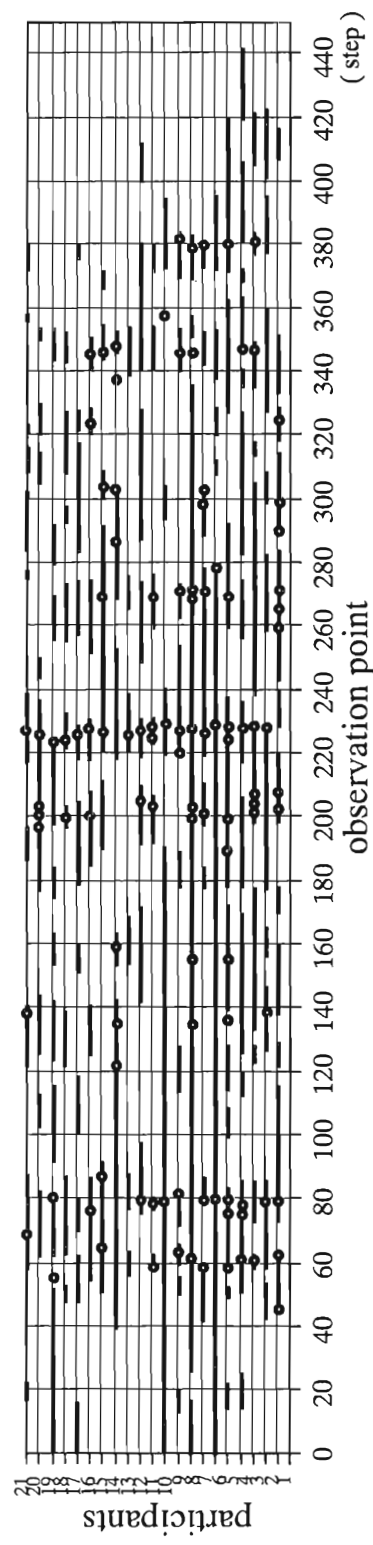


FIGURE 12.8. The slow walking zones and the points where the participants stopped.

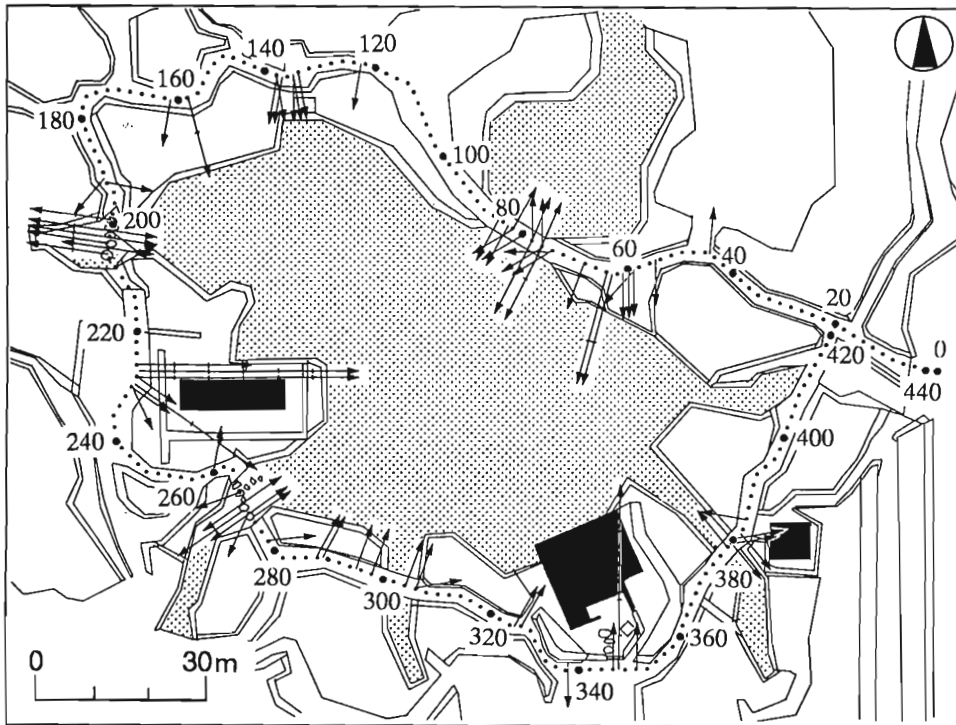


FIGURE 12.9. The stopped points and viewing directions.

4. *Observation points data*: Numerical data recording location and direction of movement created along the garden path every 0.5-m.
5. *Garden path texture data*: Graphic data for the ground textures of the path were classified into 6 types: soil, gravel, paving stones, bridge, stepping-stones, and steps and were identified by coded colors.

Description of Visual Information

In this study, continuous environmental surfaces were considered to be the source of ambient information. The basic units that convey ambient visual information were postulated to be areas of visible surfaces distinguished by differences in their meaning for basic human behavior, or their “affordance” (in Gibson’s [1979] term). The components are, in this study, path surface, grass, trees, building, water, and sky. Path, for instance, affords walking but water doesn’t.

In a previous study, a personal computer program was developed to assess an array of visual surfaces that surround an observer (Ohno & Kondo, 1994). The program, using the data (1), (2), and (3), assesses surrounding scenes by numerous scanning lines radiated from a station point in all directions with equal density, and records the array of visible surfaces of various components and the distance be-

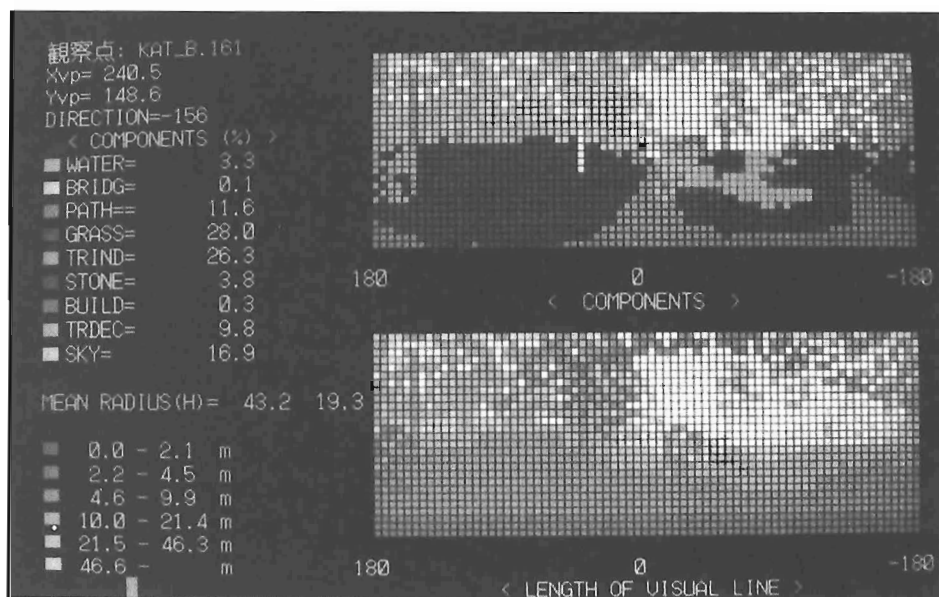


FIGURE 12.10. An example of the assessment results.

tween the surfaces and the station point. The assessment eventually generates two charts as shown in Figure 12.10. Two numerical measures were extracted from the charts that were relevant to ambient information: a ratio (%) of total area of solid angle for each visible component and a measure of spatial volume represented by mean distance (m) from the surrounding surfaces. The program was applied to a sequence of observation points along the path using the data (4). The results, which were described in a similar manner to Thiel's (1970, 1976) "notation," showed changing profiles of the solid angle for each visible component and the spatial volume as one moves along the garden path.

Description of Nonvisual Information

A program was developed to identify and record changes in texture and altitude of garden paths. Ground textures were measured by using the observation point data (4) and the garden path texture data (5).

The changes of relative altitude as one moves along the path were measured by using the land configuration data (1) and the observation points data (4).

DISCUSSION

Most obvious correspondences were noted between the behavior of looking downward and the changes of altitude of garden paths and changes in ground texture (compare Figures 12.7, 12.11, and 12.12). At those places where the path

descends (around observation points 52, 128, 181–197, 266, 340, 391–403, and 427–442), most participants look down continuously, and where it goes up (around 1–16, 142–166, 208, 274–277, 310–320, and 353–362), they also frequently look down. In level places participants look down while walking over stepping-stones (around 128–141, 198–207, 266–273, 326–339, and 343–352) and bridges (around 72–86, 302–308, 377–380, and 404–416). These clear relations were obtained because such behavior is required for safe navigation in space.

As to the basis for the horizontal changes in viewing direction, the results suggested that there were at least two different possibilities: one related to ambient or preattentive visual information, and the other related to focal or attentive visual information.

In the former case, ambient vision seems to detect the sudden changes in surrounding scenes (1) when a participant is moving from enclosed space to open space, and (2) when a participant is passing over water on a bridge or stepping-stones. The peaks of the profiles showing the spatial volume in Figure 12.13 (around observation points of 20, 48, 62, 82, 115, 228, 348, and 380) and the visible area of the water in Figure 12.14 (around 80, 203, 270, 305, 379, and 410) correspond with the observation points where the participants looked aside (see Figures 12.5 and 12.6). These changes in a wide area of the visual field seem to activate focal vision and lead it to those directions that should be attended. However, since the above two measures only indicate the average state of the surrounding scenes, they cannot be used to predict the direction to be looked at. Figure 12.15 compares the participants' viewing directions and an asymmetrical distribution of the mean distance from the surrounding surfaces measured by the program. This figure may suggest that people tend to extend their attention to open areas.

In the latter case, focal vision seems to detect such dominant objects as a tea pavilion within the visual field, and the participants tend to stop in order to acquire detailed information. Compare Figure 12.8 and 12.16, in which the visible area of buildings increases at around 135, 228, 326, 348, and 382.

Although most places where the participants looked aside can be explained either by sudden change in the state of surrounding scenes or the visibility of prominent objects, some exceptional cases were observed. At around observation point 205, where the path approaches a small waterfall, their attention was attracted by the sound, which is nonvisual ambient information. At around 255 and 338, where a branch path joined the main path, the participants tended to look in that direction.

In summary, one's viewing direction is first used to acquire information for safe movement in space, and then ambient information shapes the frame of visual field; if one detects something within the visual field, focal vision operates to get detailed information from it. With this interplay of two aspects of vision, we can acquire desired information from a wide area of the environment with limited attentional effort.

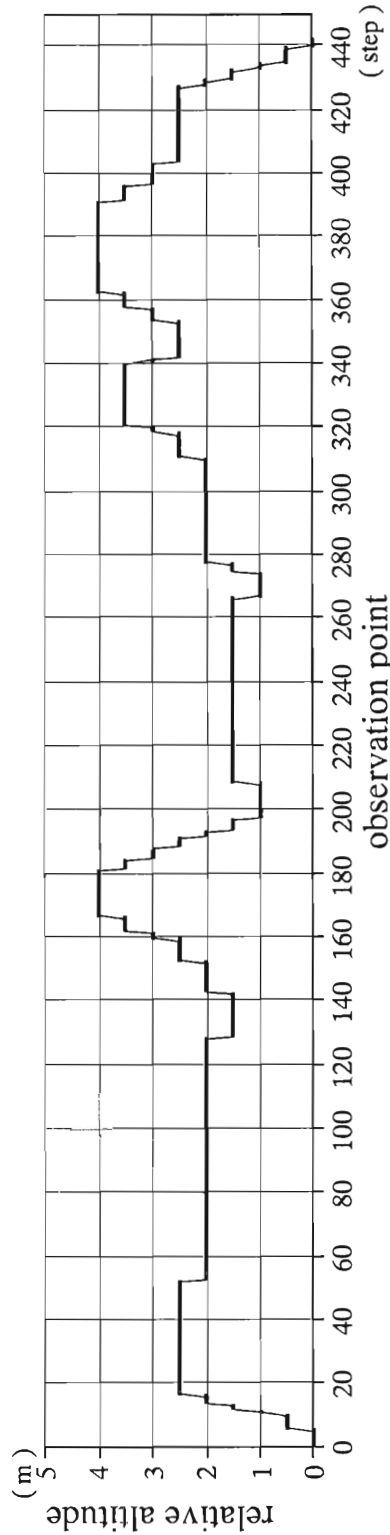


FIGURE 12.11. Changes in altitude of the path.

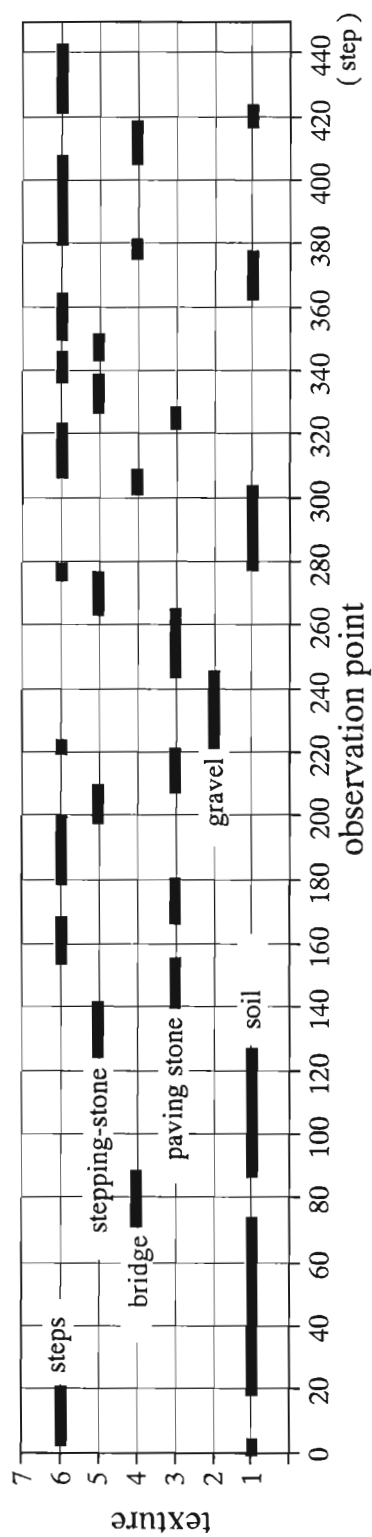


FIGURE 12.12. Changes of ground texture along the path.

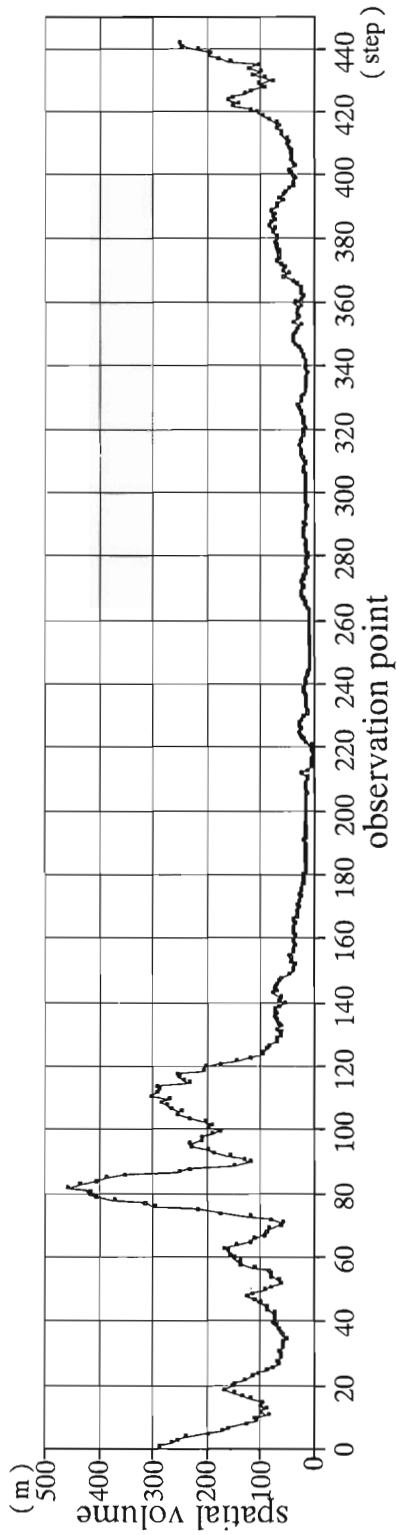


FIGURE 12.13. Changes in spatial volume along the path.

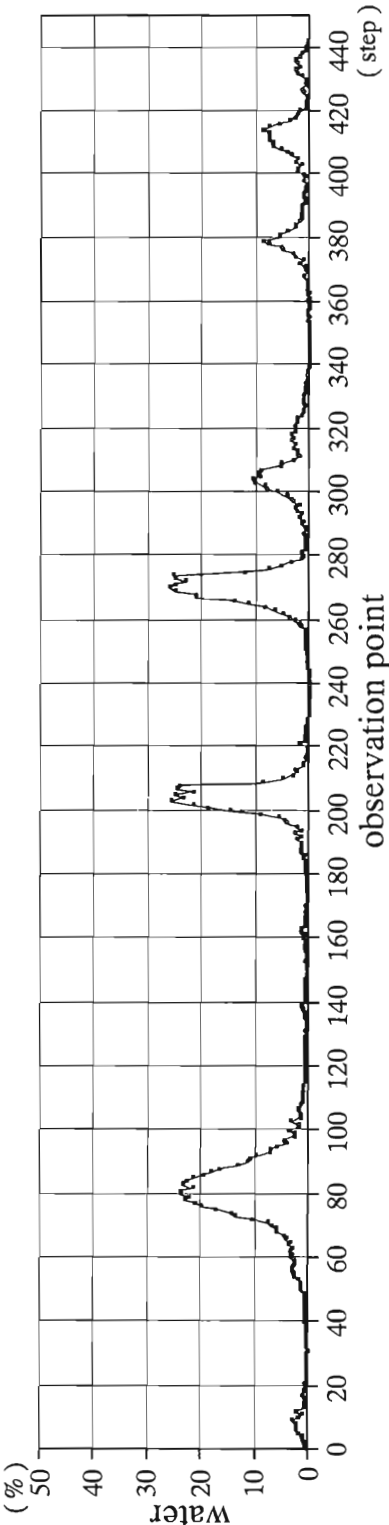


FIGURE 12.14. Changes in visible area of the water along the path.

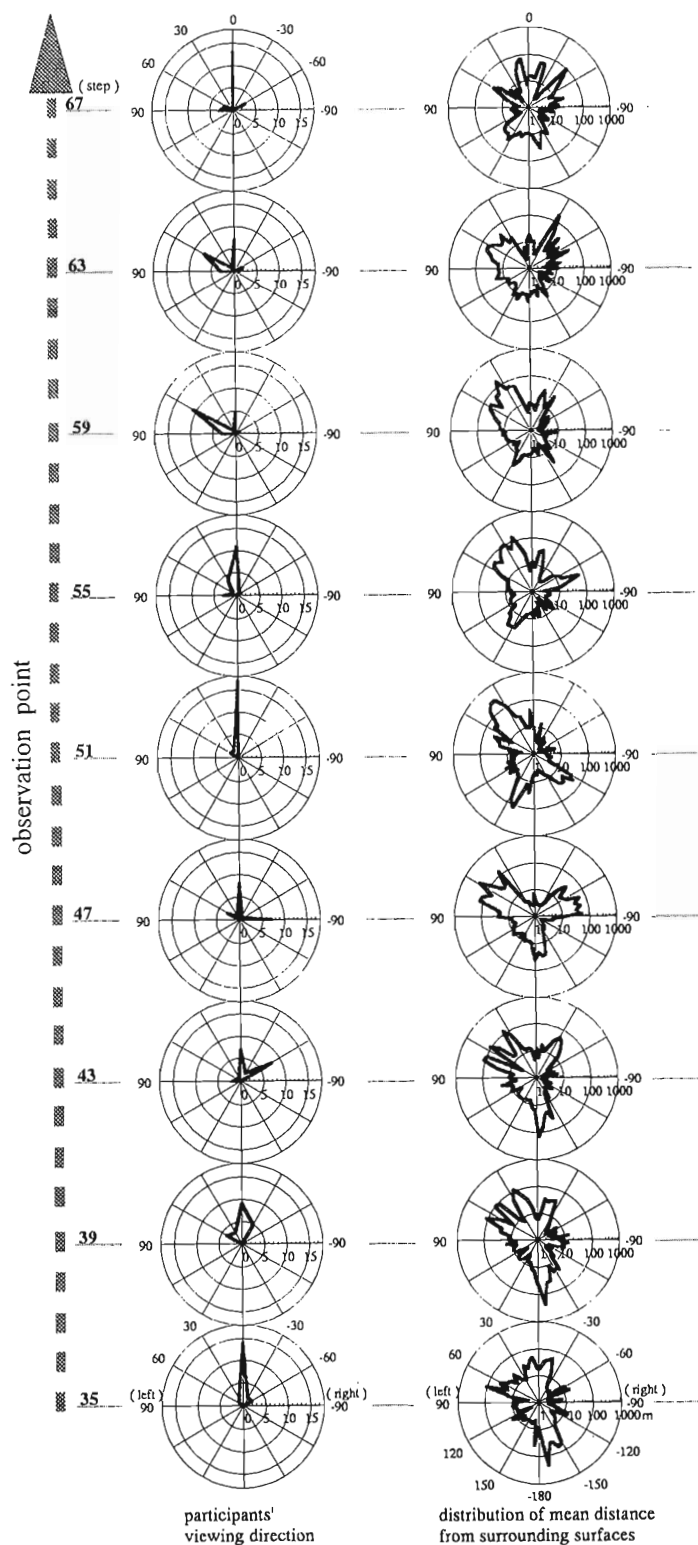


FIGURE 12.15. The participants' viewing directions and the mean distance from the surrounding surfaces (shown only every 4 observation points from 35 to 67).

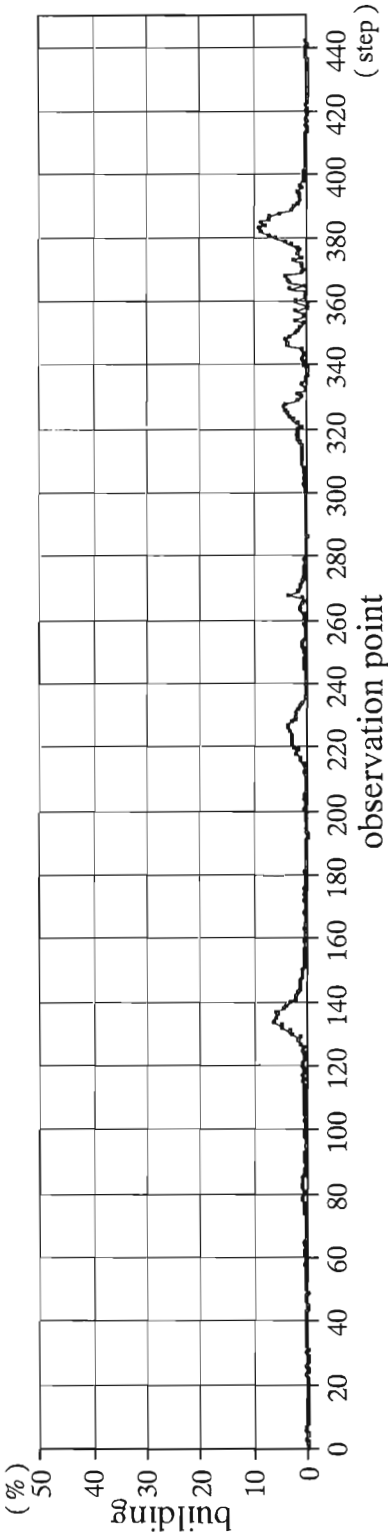


FIGURE 12.16. Changes in visible area of buildings along the path.

CONCLUSION

The data from the present empirical study generally support the hypotheses that people's behavior commonly changes at certain places in the garden path and can be explained by the sensory information in the environment. Although more comprehensive analysis including other senses such as hearing is necessary to construct an explanatory system, the measurement of sensory information in the environment has been found to be useful for the prediction of human behavior.

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