Studies about Architectural Space and Human Behavior

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Outline of today's lecture

Part 1: What are the Environment-Behavior Studies?
Part 2: Characteristics of Environment Perception
Part 3: Concept of ambient vision and its research application

Part 1:

What are the Environment-Behavior Studies ?

A discipline aimed at understanding
the relationship between the environment and human behavior
in order to design and manage a good built environment

Purpose of design of built environment (city / architecture)

⇒ Building an environment that fits the basic needs of users

Three principles of architecture shown in Vitruvius's "The Ten Books on Architecture"

用
Utilitas
(commodity)

Functional fitness → Convenience, ease of use

強
Firmitas
(firmness)

Physical/ structural fitness → Robustness, stability, shielding

美
Venustas
(delight)

Psychological/ Behavioral fitness → Environment-Behavior Studies

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Psychological/ Behavioral fitness

Environment-Behavior Studies
(EBS)

- Perceptual, cognitive aspects
- Emotional aspects
- Social, cultural aspects

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  Providing information to guide appropriate behavior in a given situation
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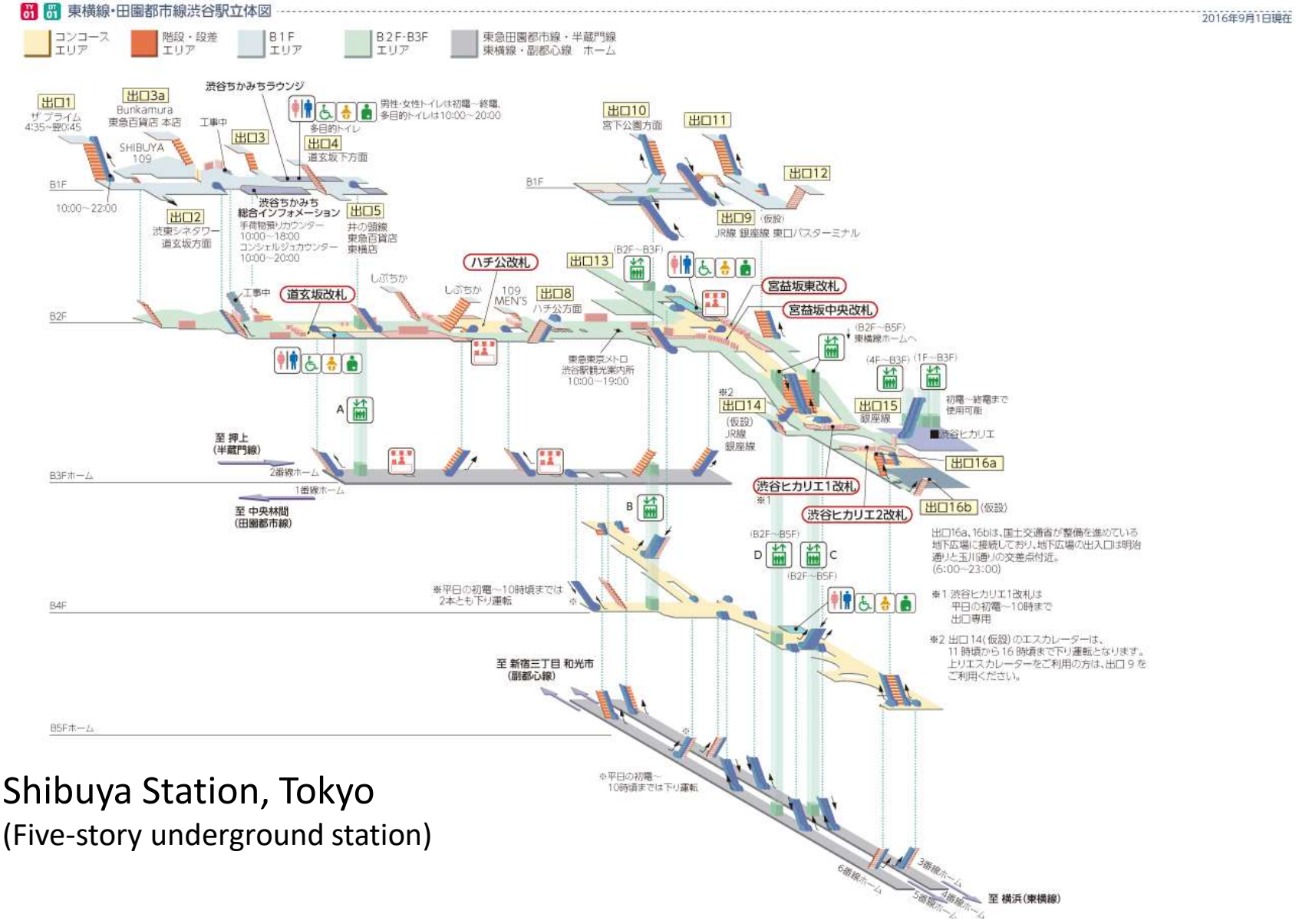
Way-finding issues

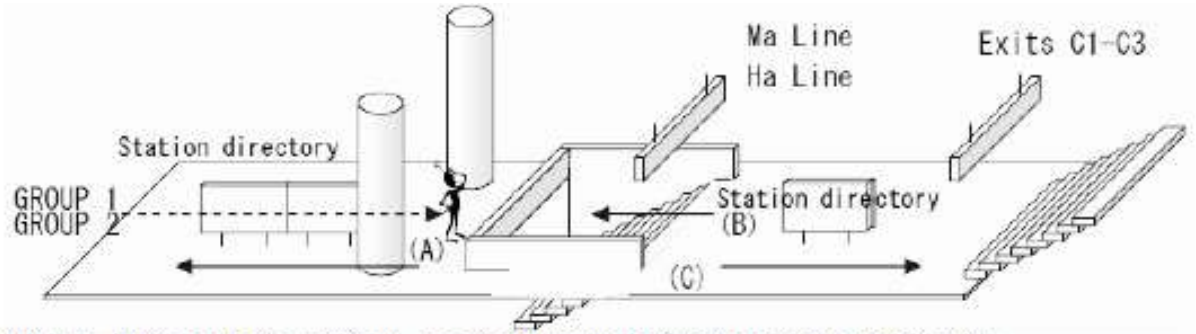
A large-scale underground station where it is easy to get lost



Shibuya Station, Tokyo
(Five-story underground station)

Evacuation behavior in an emergency

This study* experimentally examines how the wording of warning announcements and instructions combines with nearby spatial features and signs to influence evacuation behavior at subway stations.



Setting 2: At the end of a platform, near both downward (B) and upward (C) stairs

(A)

(B)

(C)

From this platform of a underground station has no stairs upward. Passengers have to go down once to get to the above ground.

⇒ Design that goes against the inherent psychological tendency of human behavior

* Effect of Wording of Fire Warning Announcements on Evacuation Behavior in Subway Stations <Proceedings of the EDRAMOVE intensive: Movement and Orientation in Built Environments, pp. 59-65, May. 2008.>

Subway station designed in harmony with human behavior

Canary Wharf Station, London : Designed by Norman Foster, 1999

Minatomirai Station, Yokohama Subway, 2004

You-Are-Here map

The readability of the “You-Are-Here map” depends on its location and orientation.

Old You-Are-Here map at the entrance of the Tokyo Institute of Technology Campus

Before

A new campus map that correspond to the actual location.

After

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- Perceptual, cognitive aspects
  Providing information to guide appropriate behavior in a given situation
- Emotional aspects
  Creates atmosphere, beauty, and place attachment
- Social, cultural aspects

Place Attachment

The psychological bond between a person and the environment in which the person lives is called "**place attachment**".

- The nostalgia for the hometown where one was born and raised is a typical example.
- It leads to an action to strengthen one's interest in one's living environment, deepen one's awareness, protect it, and improve it.

- Lack of place attachment in newly developed cities.
- The inhabitants become indifferent to the environment, neglect to maintain it, and have poor relationships with their neighbors.

Importance of place attachment (why is it necessary?)

<Normal >
⇒ Beautiful and safe community

The degree of maintenance of the environment around the dwelling unit and natural surveillance over the residents, which are important points of crime prevention, are promoted by the place attachment.

<Emergency>
⇒ Disaster-resistant community

For example, immediately after a major disaster occurs, public institutions such as fire departments and police will not function, and we will have no choice but to protect the town ourselves. In such case, the collaboration of those who have place attachment to where they live is indispensable.

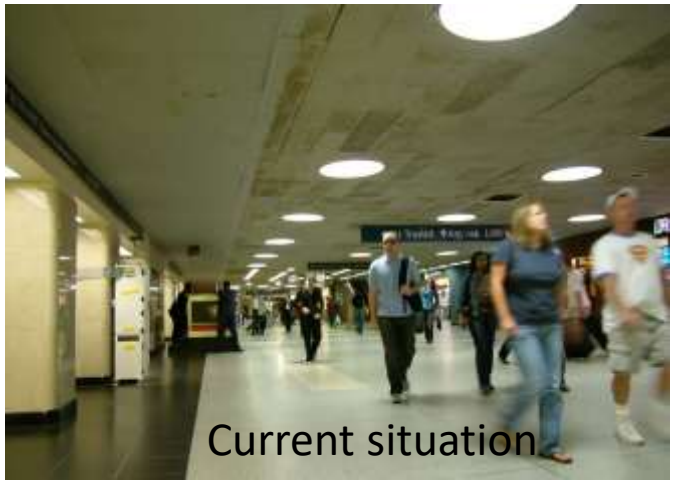
Attachment to lost places

The Pennsylvania Station in New York, was originally a building with colonnades like a Greek temple. However, the station building was demolished by selling air rights and became a mundane skyscraper.

Pennsylvania Station

Completed in 1910

Dismantled in 1962


Current situation

The famous quote about “New Penn Station” by Architectural Historian Vincent Scully: “One entered the city like a god. one scuttles in now like a rat.”

Recent global issues and place attachment

- The **place attachment** of people, who displaced caused by conflicts makes them feel great suffering as well as provides a source of action.
- The COVID-l9 pandemic reaffirmed the importance of **place attachment**.

ELSEVIER

Journal of Environmental Psychology
Volume 72, December 2020, 101516

Distant from others, but close to home: The relationship between home attachment and mental health during COVID-19

Benjamin R. Meagher [a, b] ✉, Alyssa D. Cheadle [b]

Abstract

The COVID-19 pandemic has had significant consequences for Americans' daily lives. Many people are spending more time in their homes due to work from home arrangements, stay at home orders, and closures of businesses and public gathering spaces. In this study, we explored how one's attachment to their home may help to buffer their mental health during this stressful time. Data were collected from a three-wave, longitudinal sampling (n=289) surveyed at baseline, two, and four weeks after. We found **a clear relationship between an individual's attachment to home and positive mental health.** Across all three waves, home attachment was negatively associated with symptoms of depression, anxiety, and stress. Furthermore, participants' home attachment at baseline was predictive of subsequent mental health two weeks after, which suggests that one's relationship to their home was particularly important during the initial onset of the national response to the outbreak. Predictors of home attachment included conscientiousness, agreeableness, and restorative ambience. Over the course of the study, kinship ambience also emerged as a predictor of home attachment. In the midst of increased mental health concerns and limited resources due to COVID-19, the home may buffer some individuals from depressive and anxiety-related symptoms by functioning as a source of refuge, security, and stability.

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  Creates atmosphere, beauty and place attachment
- Social, cultural aspects
  Control of person-to-person interaction, Crime prevention, Consideration of regional cultural characteristics

Social interaction and spatial layout

Humphrey Osmond: Function as the Basis of Psychiatric Ward Design , 1957

Canadian psychiatrist Osmond finds that person-to-person interaction is facilitated or suppressed by chair layout.

- Arrangements that encourage interaction are called "sociopetal".
- Arrangements that suppress interaction are called "sociofugal ".

Design to promote interaction（sociopetal）

Design to suppress interaction（sociofugal）

Concepts of human-space ecology

Proxemics

The study of spatial distances between individuals in different cultures and situations.

Edward T. Hall :The Hidden Dimension, 1966

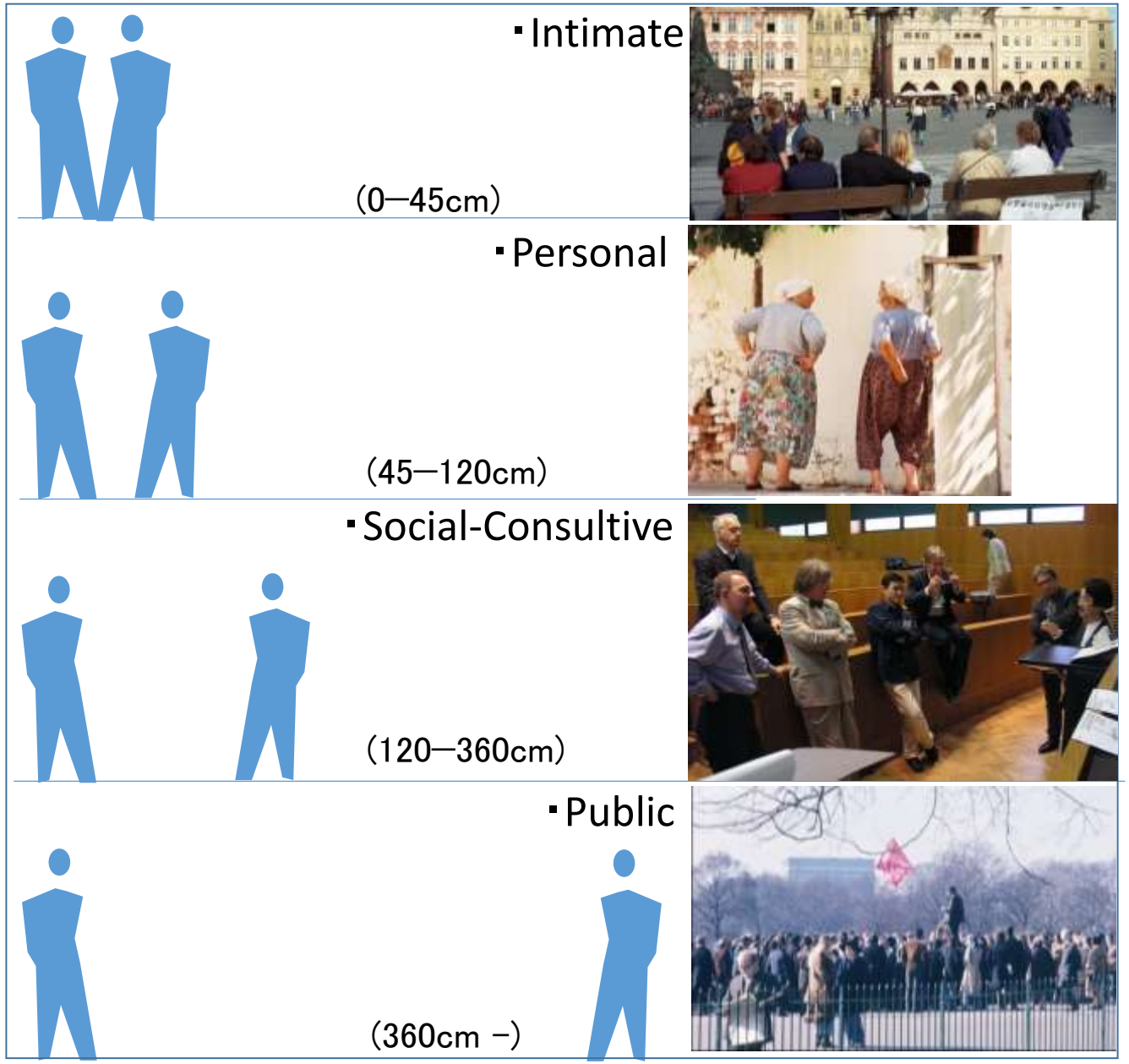
Personal Space

An area with invisible boundaries surrounding a person's body into which intruders may not come.

Robert Sommer: Personal Space : The behavioral basis of design,1969.

After the 2016 Australian Open tennis match, an interviewer replied, "Why do you step back when I point the microphone? Do I smell?" "Because you've stepped into my territory."

Classification of interpersonal distance



Temporary housing project considering social interaction

Temporary housing with conventional north entrance

Temporary housing at the entrance facing each other to encourage interaction among residents

- The conventional parallel rows with north-facing entrances make people less likely to encounter.
- After the 1995 Hanshin-Awaji earthquake, more than 260 elderly people were found dead alone in temporary housing.
- These solitary deaths were attributed to the typical temporary-housing design, and could have been prevented through improvements in temporary-housing.
- Architectural research group of University of Tokyo proposed face-to-face entrance to be able to feel a sense of community.
- As the result, the wood deck was used as common space to activate community building by inhabitants*.

*Dr. Kazuhiko Nishide, & Mr. Ryosuke Tomiyasu: The effects of community-care housing design on inhabitants' community building: Examination of temporary-housing project in Iwate prefecture after the 2011 East Japan earthquake, EDRA44, 2013

Misfit of reconstruction housing with foreign aid to the traditional lifestyle

Disaster reconstruction housing built with overseas assistance after the 2006 Central Java Earthquake in Indonesia.

Traditional Javanese dwelling with porch , which provided a place for daily interaction with neighboring residents

Reconstruction housing with traditional spatial characteristics by a local architect

Disaster reconstruction housing designed by a local architect has become established as a house that suits the lives of residents and the surrounding environment in just a few years.

Changes in reconstruction housing over time


2006年(平成18年)12月12日　火曜日　亮月

被災地の建設現場で、作業員たちに声をかけるエコ・プラウォトさん（右）。復興住宅の鋭くとがった屋根は、ジャワの伝統的な形だ＝バントゥル県で、武田剛撮影

The role of E-B S in environmental design

Why should we study EBS?

To minimize loss due to failure in building practices:

- Failure due to ignorance and hypothetical error about the behavior of users of architectural space

Example: Failure of the Pruitt-Igoe housing complex in St. Louis

Failure of **t**he Pruitt-Igoe housing complex

Built in 1955 (11 stories, 2,764 units)
1972 Bombing dismantling
http://www.defensiblespace.com/book/illustrations.htm

The architect's vision of how the 3rd floor communal corridor in Pruitt-Igoe would be used

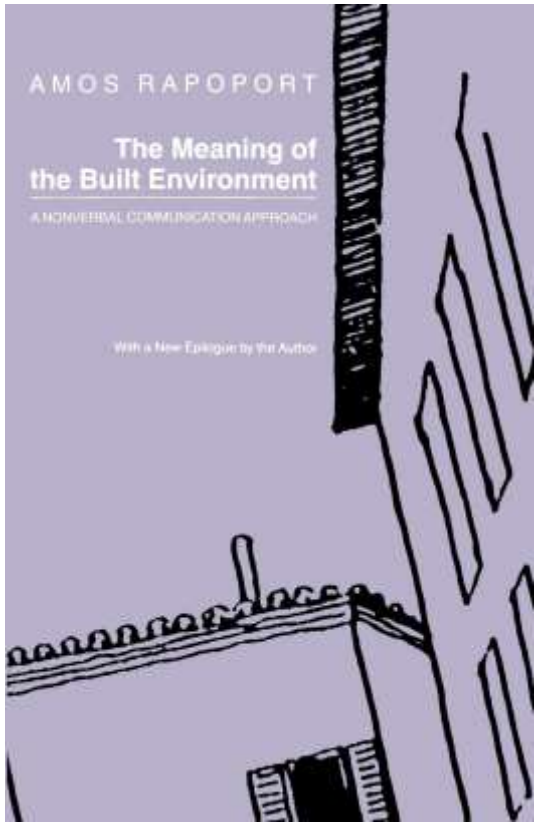
The 3rd floor communal corridor as it actually turned out, and the vandalism that ensued.

Users' meanings and designers' meanings

Rapoport noted, "One of the hallmarks of man-environment research is the realization that designers and users are very different in their reactions to environments, their preferences, and so on, partly because their **schemata** vary."

Amos Rapoport

Amos Rapoport: The meaning of the built environment, 1982



Meaning of "schema" (psychology):

1. Mental structure of preconceived ideas
2. Framework representing some aspect of the world
3. System of organizing and perceiving new information

1. Mental structure of preconceived ideas

⇒ a framework for extracting information from the environment that the perceiver has in advance.

Schema of the driver's license examination site

Japan

日本

US

アメリカ

2. Framework representing some aspect of the world

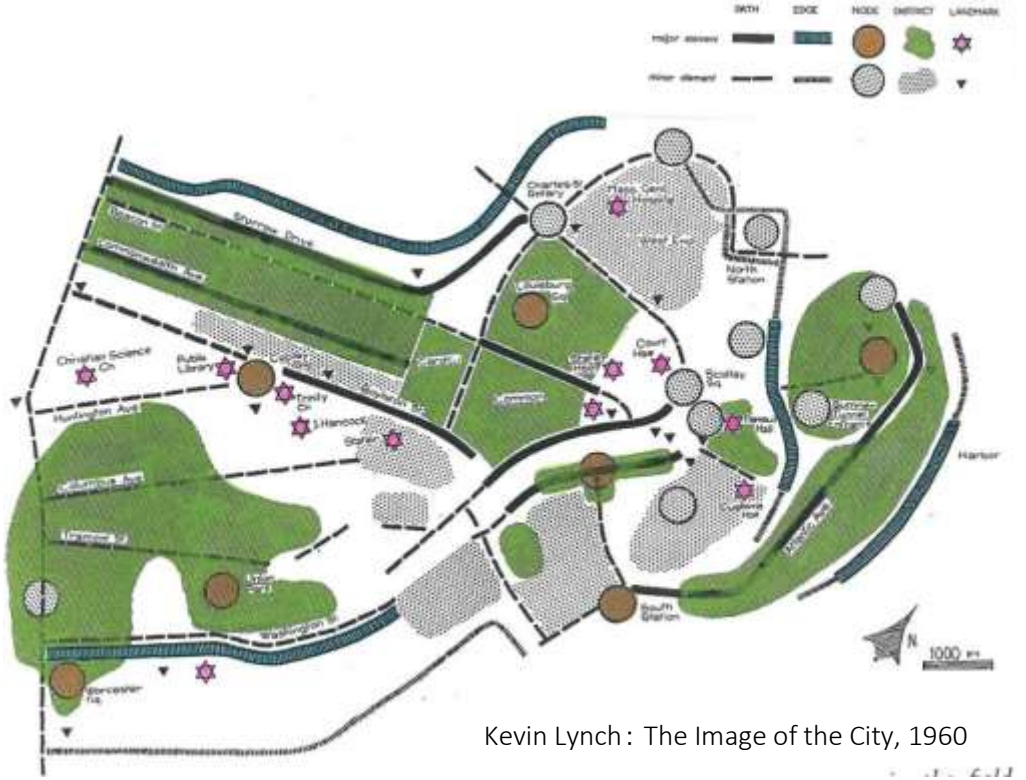
⇒ The cognitive map, or image map, of a city

Boston map and its cognitive map

Description and analysis of the image of the city shared by the residents

Five elements that make up the image of Boston

Path, edge, node, district, land mark



Kevin Lynch : The Image of the City, 1960

3. System of organizing and perceiving new information.

The schema of the third meaning was used by Psychologist Urich Neiser when he described "perceptual cycle model“.

Cognition by perceptual cycle

The process of perceptual cycle

①The observer hypothesizes that "that is probably XXX" based on the cognitive framework (i.e. **Schema)**.

②To confirm this, he/she will “direct the activity”

③ Such exploratory activities as approaching or touching the target

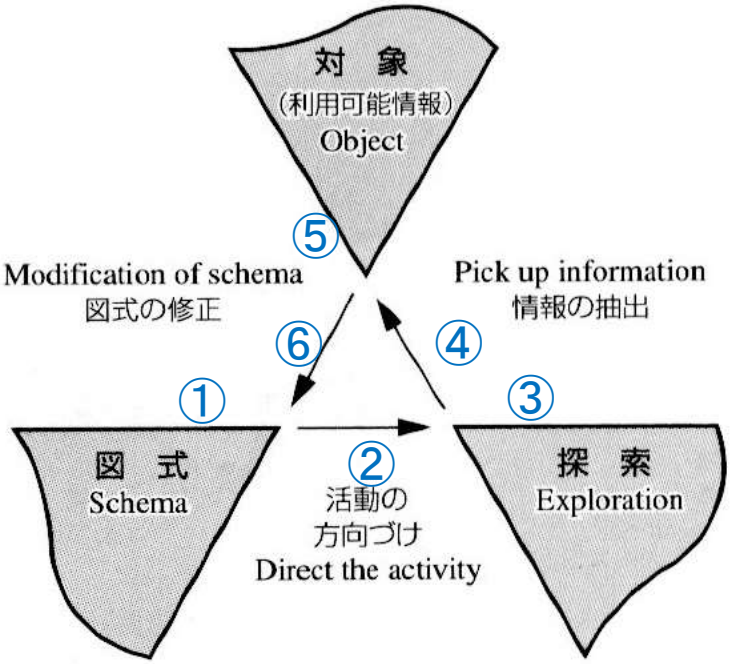
④To “pick up information”.

⑤ If the hypothesis is wrong by collating with the information obtained from the target.

⑥The observer performs "modification of schema".

Then, "direct the activity" again using the modified schema・・・・

by repeating such a cycle, it leads to correct recognition.



Neisser’s perceptual cycle model

Why should we study E-B S?

Minimize loss due to failure in building practice:

- Failure due to ignorance and hypothetical error about the behavior of users of architectural space

Example: Failure of the Pruitt-Igoe housing complex in St. Louis, USA.

The gap between the environmental designer (architect) and the user

⇒Need for user research

Why should we study E-B S?

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  Example: Failure of the Pruitt-Igoe housing complex in St. Louis, USA.
  The gap between the environmental designer (architect) and the user
  ⇒Need for user research

- Failure due to incomprehension of human behavior in a huge, dense, and complex built environment

  Example: Lost in underground space (the case of Shibuya station shown earlier)
  ⇒Need to understand environmental perception ⇒ will be discussed next part

How can E-B S be put to practical use?

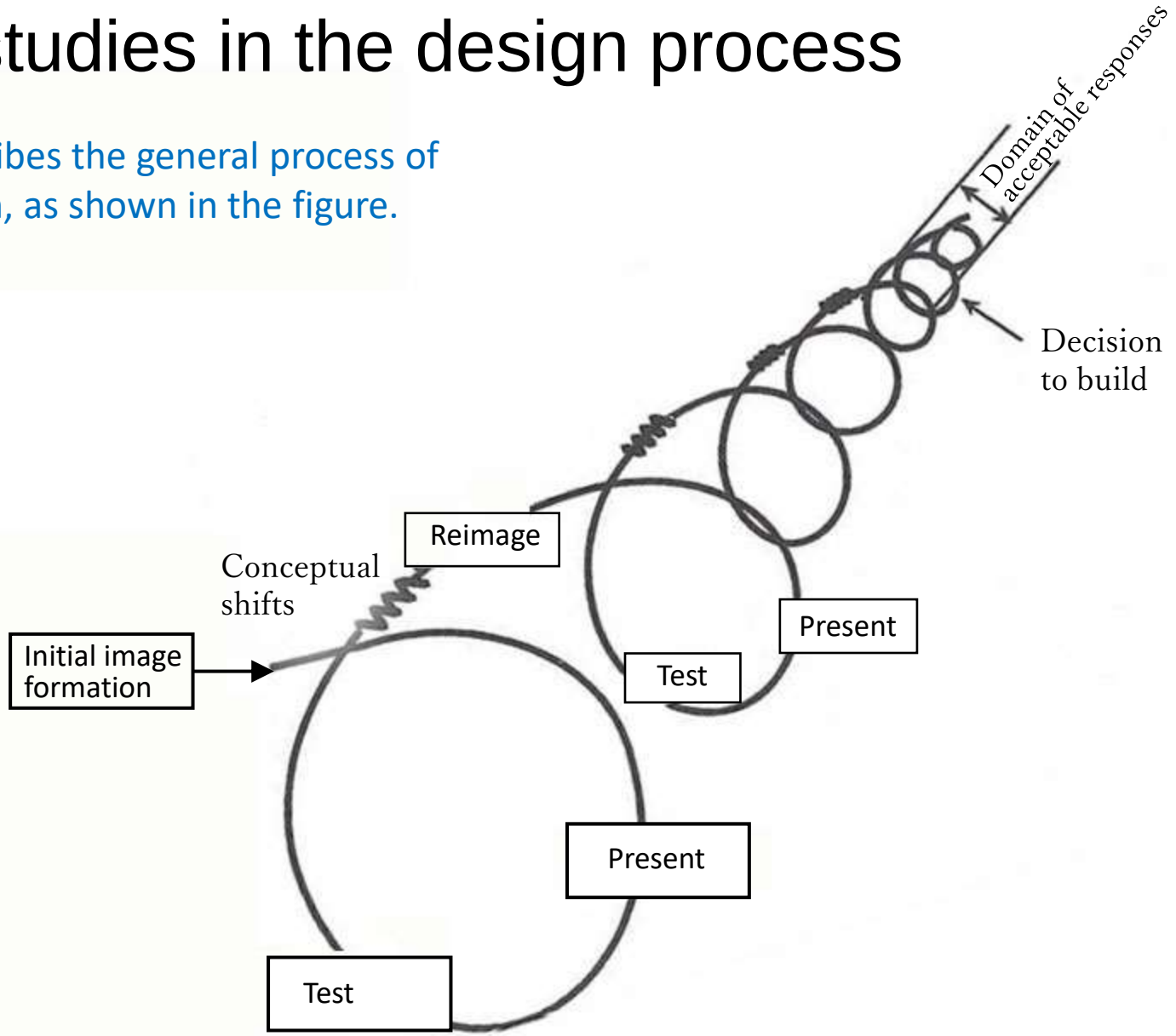
Environment-behavior studies in the design process

Architectural Sociologist John Zeisel describes the general process of environmental design as a spiral evolution, as shown in the figure.

The design is refined and gradually converges as the following activities are repeated.

- Create an initial image based on various requirements and conditions.
- Present it as a concrete form.
- Test it
- If there are any inconveniences, change concept and re-image.

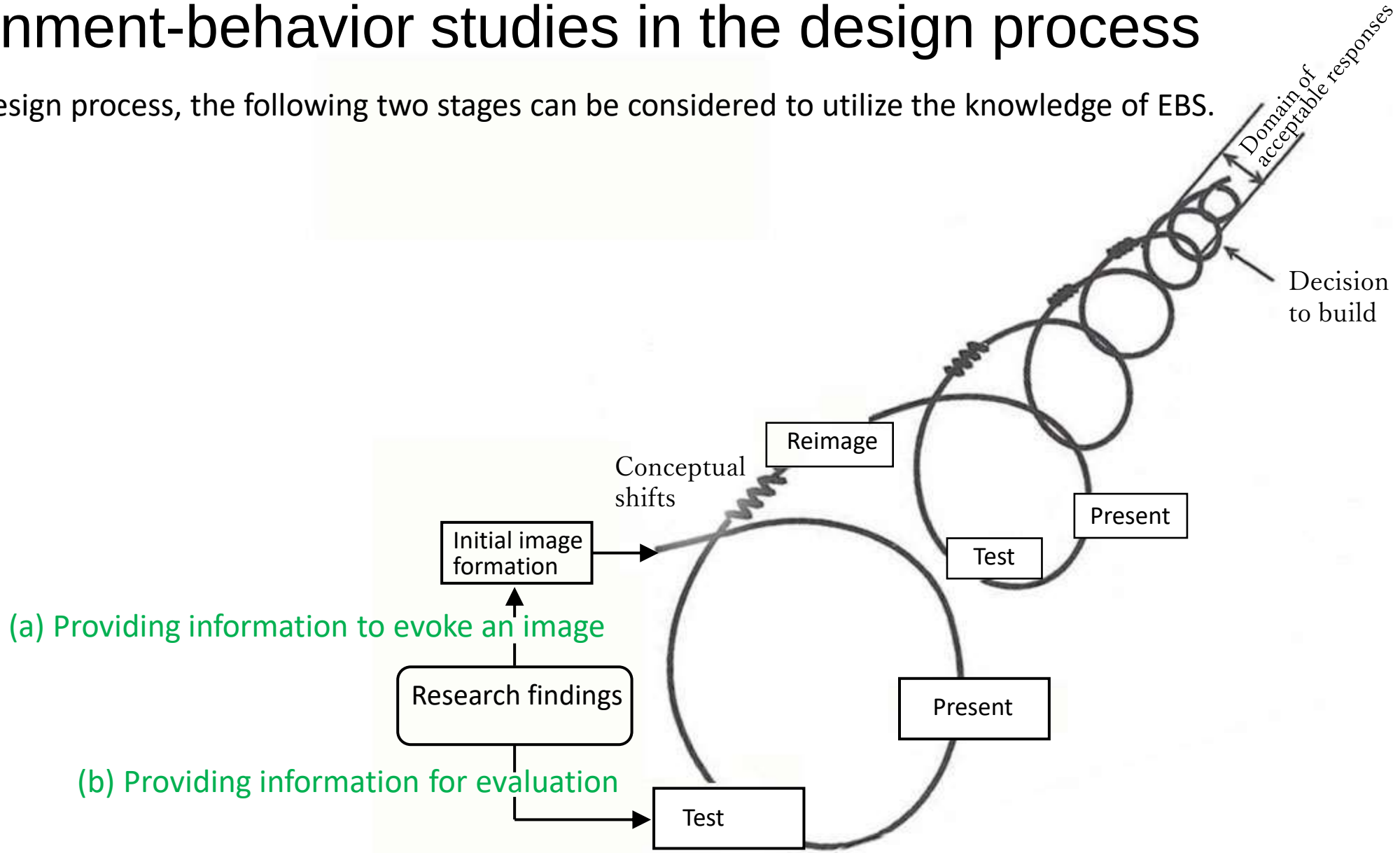
This cycle continues until a proposal is accepted that construction can be undertaken.



Based on Zeisel,J.:Inquiry by Design : Tools for Environment-Behavior Research,Cambridge University Press,（1981）

Environment-behavior studies in the design process

In this design process, the following two stages can be considered to utilize the knowledge of EBS.

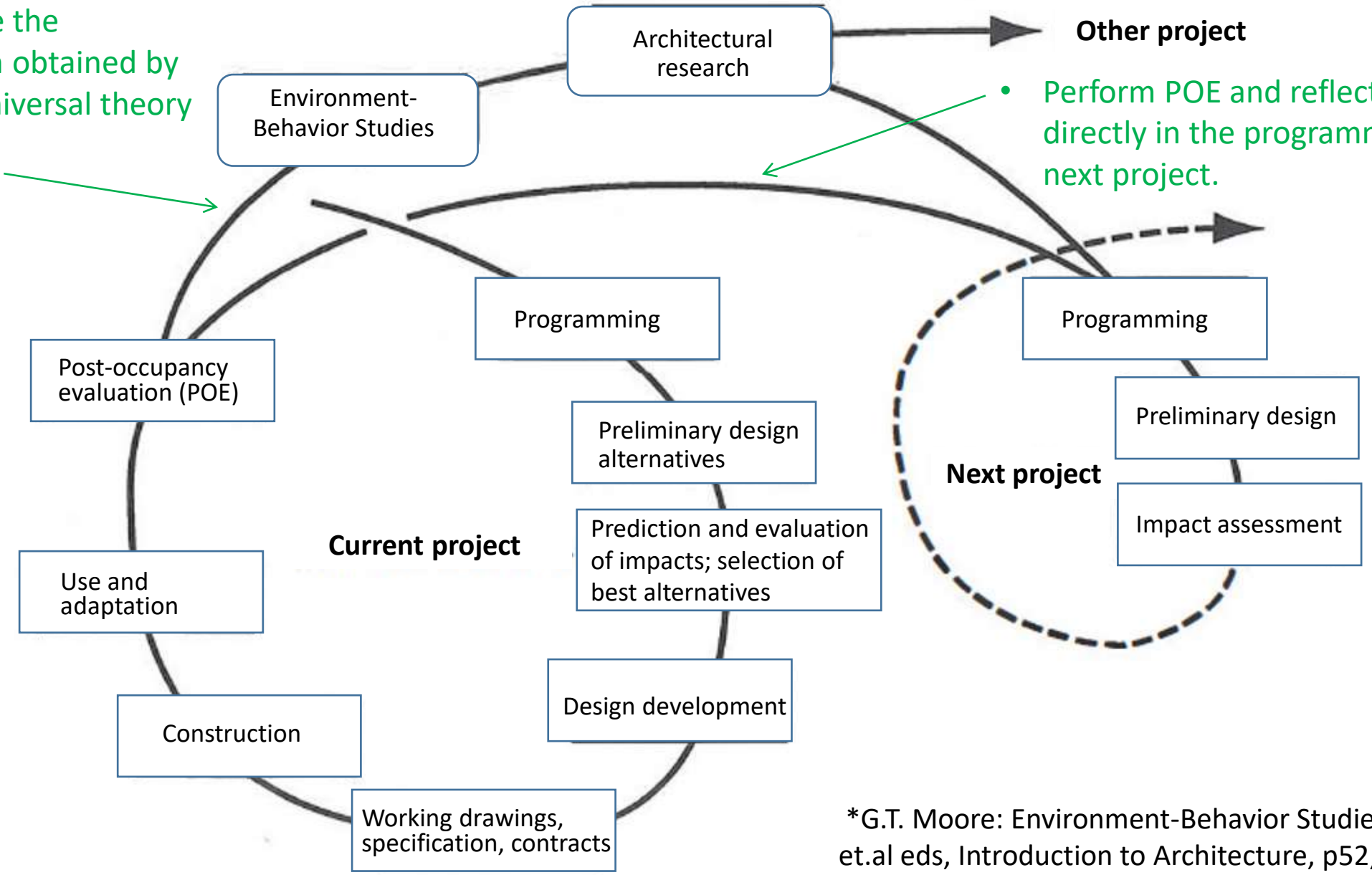


Based on Zeisel,J.:Inquiry by Design : Tools for Environment-Behavior Research,Cambridge University Press,（1981）

Environment-behavior studies in the whole construction process*

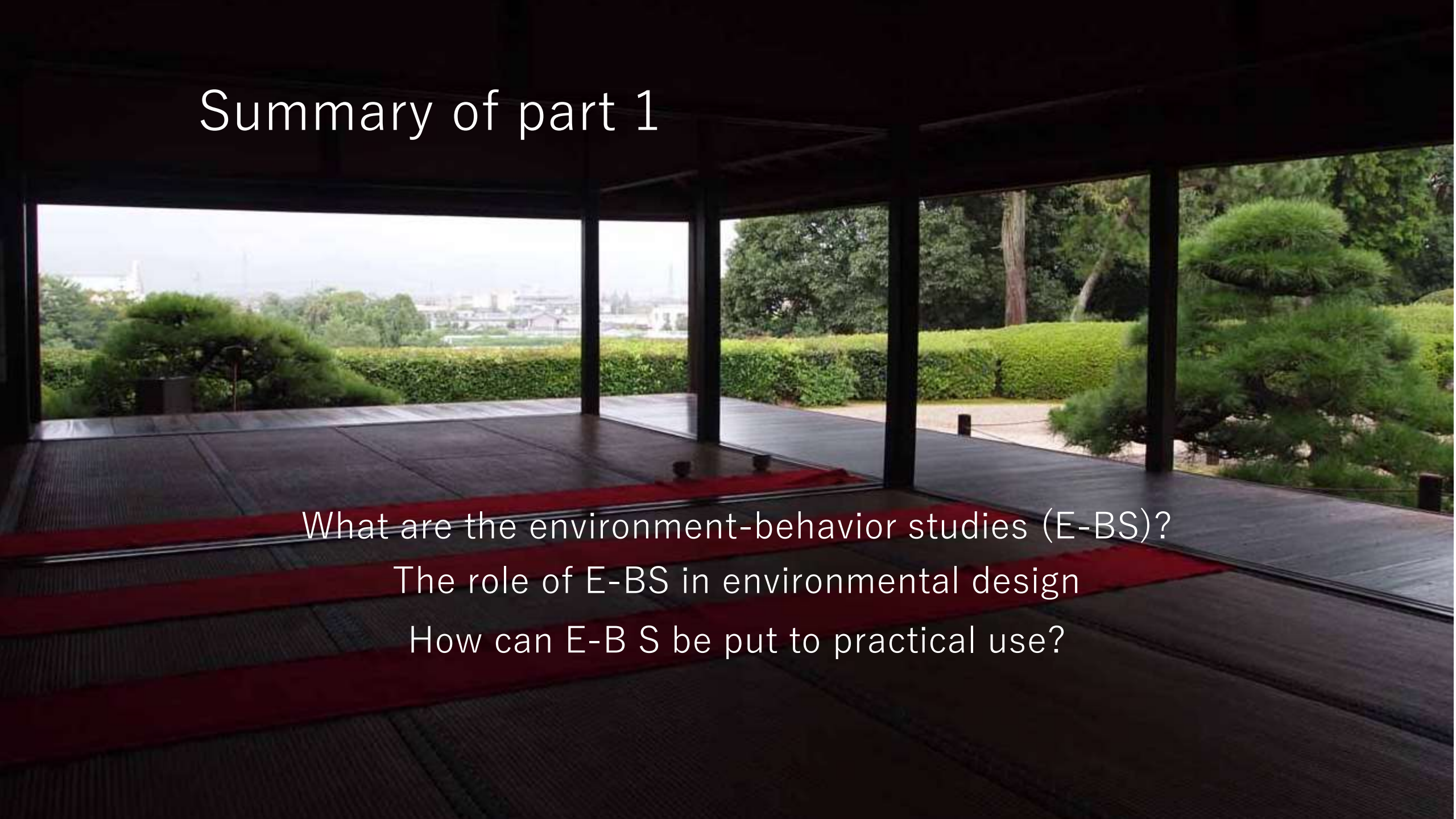
- Systematize the information obtained by POE as a universal theory or model

- Perform POE and reflect the result directly in the programming of the next project.



*G.T. Moore: Environment-Behavior Studies, in J.C. Snyder et.al eds, Introduction to Architecture, p52, Mc-Graw-Hill, 1979 (Based on the work of J. Ziesel, 1975)

Summary of part 1



What are the environment-behavior studies (E-BS)?

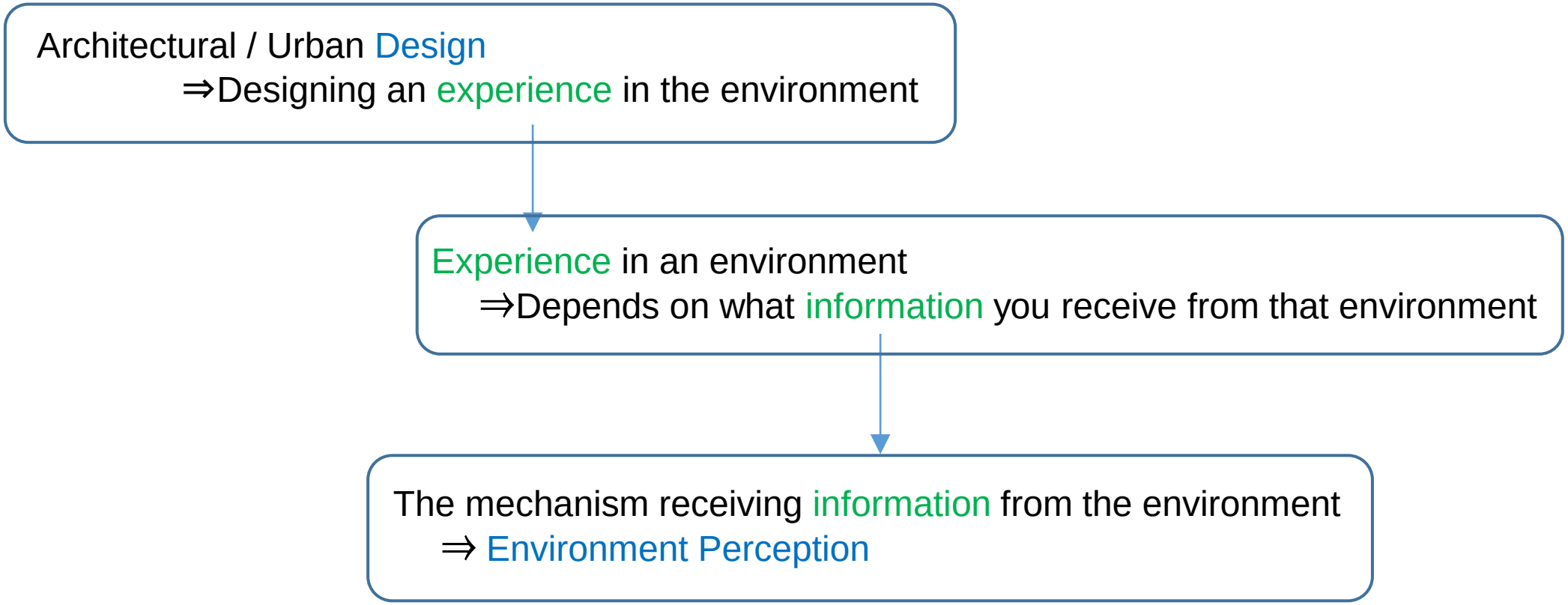
The role of E-BS in environmental design

How can E-B S be put to practical use?

Part 2:

Characteristics of Environment Perception

Why do environment designers need to learn about environmental perception?



Characteristics of Environment Perception as contrasted with Object Perception

W. Ittelson

Psychologist William Ittelson noted that the results of laboratory studies on the perception of "objects" could not be applied to the perception of "environment".

Three major characteristics of environmental perception pointed out by Ittelson

(1) The environmental information is obtained through all senses.

(2) The environment itself has no boundary in space or time.

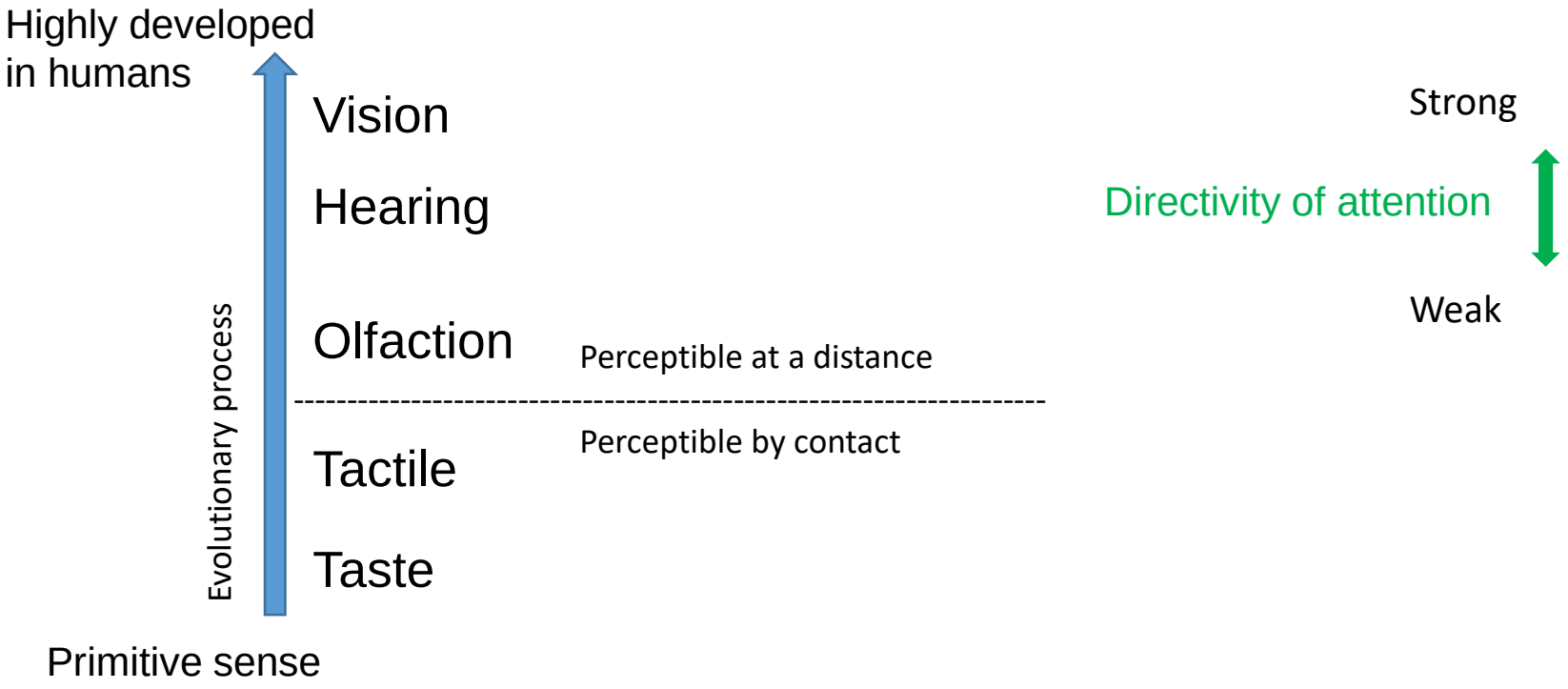
(3) The environmental information lies not only in central but also in peripheral area of the sight.

（Ittelson, W.: Environment perception, in W. Ittelson et al (eds.) An Introduction to Environmental Psychology, pp. 102-109, 1977）

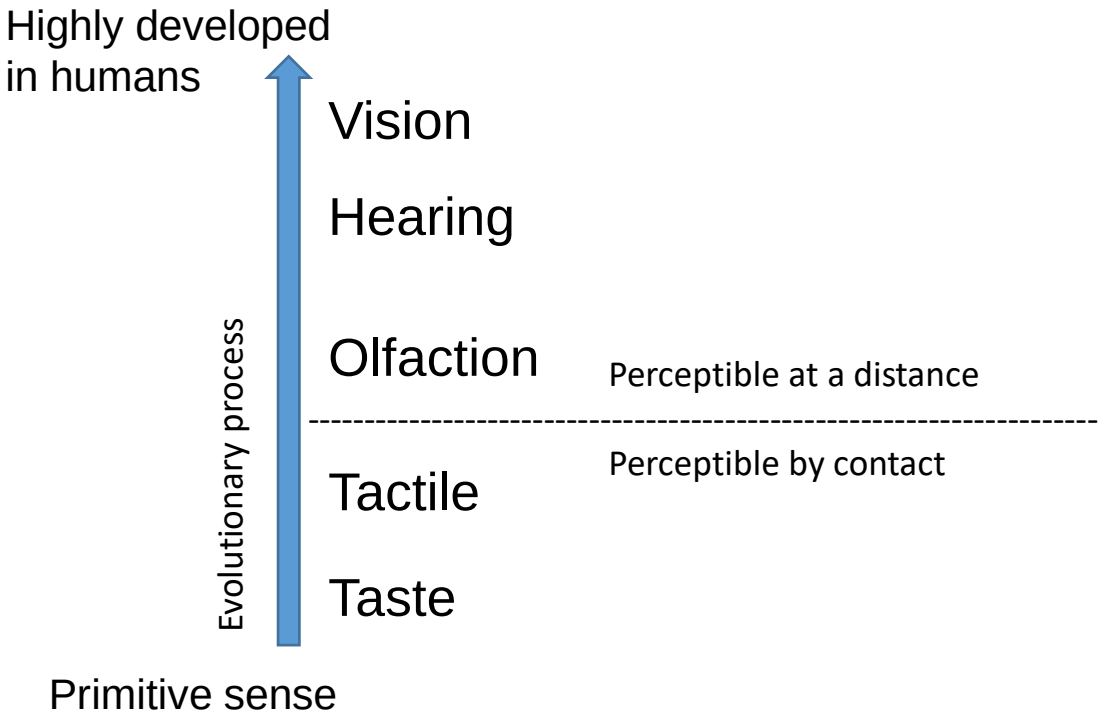
Characteristics of Environment Perception as contrasted with Object Perception

(1) The environmental information is obtained through all senses.

- Characteristics and roles of the five senses in environmental perception



■ Characteristics and roles of the five senses in environmental perception



Strong

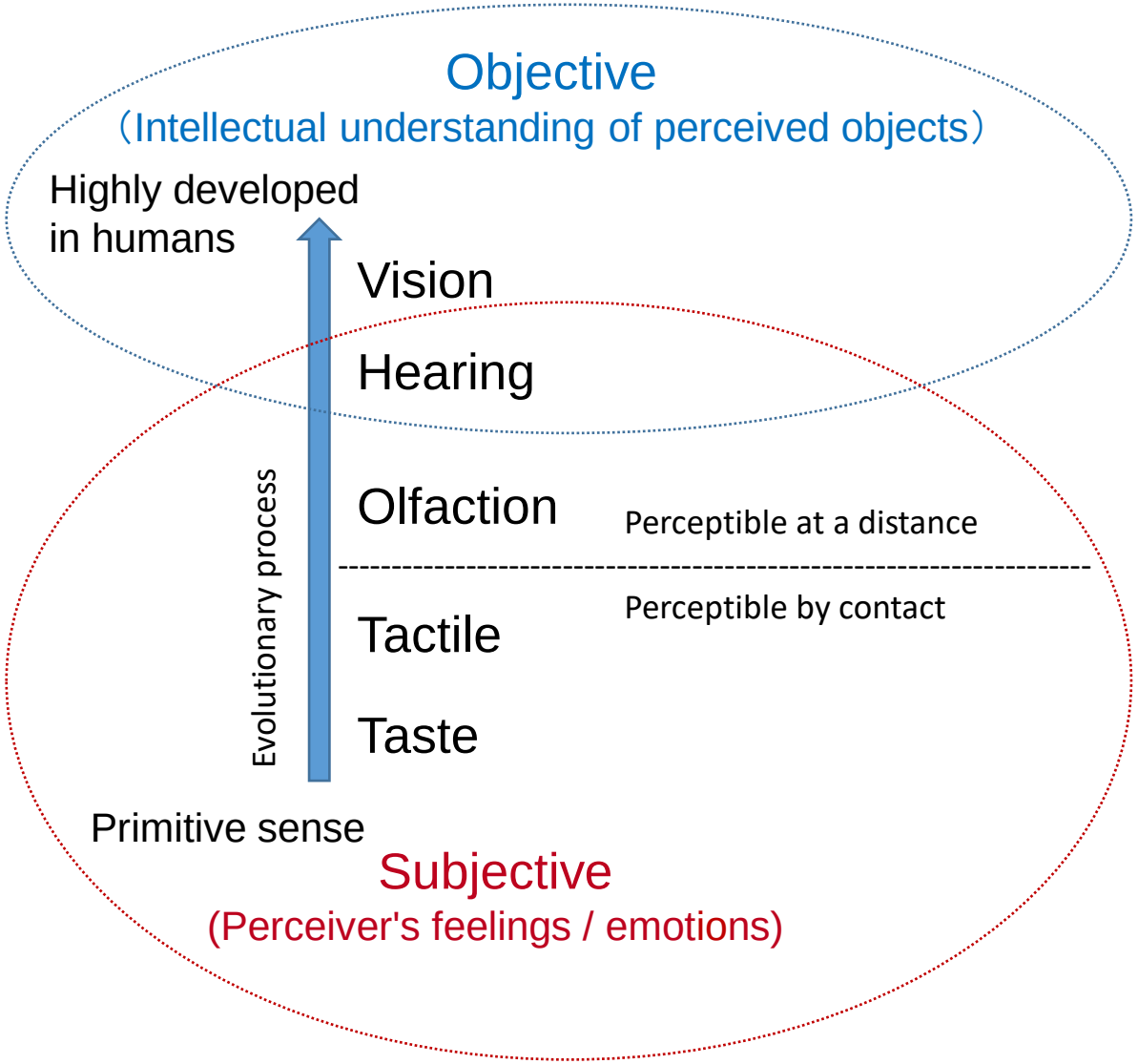
Directivity of attention

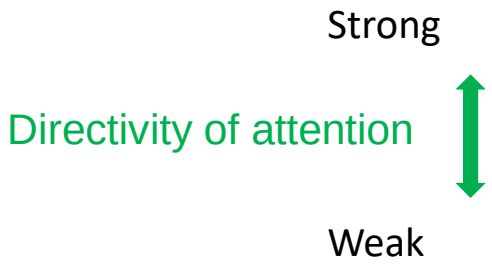
Weak

Cocktail party effect

(selective listening to speech)

■ Characteristics and roles of the five senses in environmental perception





The five senses with different roles work together to smoothly receive information from the environment.

Characteristics of Environment Perception as contrasted with Object Perception

(1) The environmental information is obtained through all senses.

- Environmental design considering multi-sensory perception

Vision — Landscape

Canadian composer and acoustic researcher **R. Murray Schafer** showed the ideology of "Reflection on vision centered modern Western civilization and an attempt to restore auditory culture."

Hearing — Soundscape (R. M. Schafer*1)

As with soundscape, phenomenological geographer **J.D. Porteous** aimed to restore the rich non-visual experience that is being lost from the urban environment.

Olfaction — Smellscape (J.D. Porteous*2)

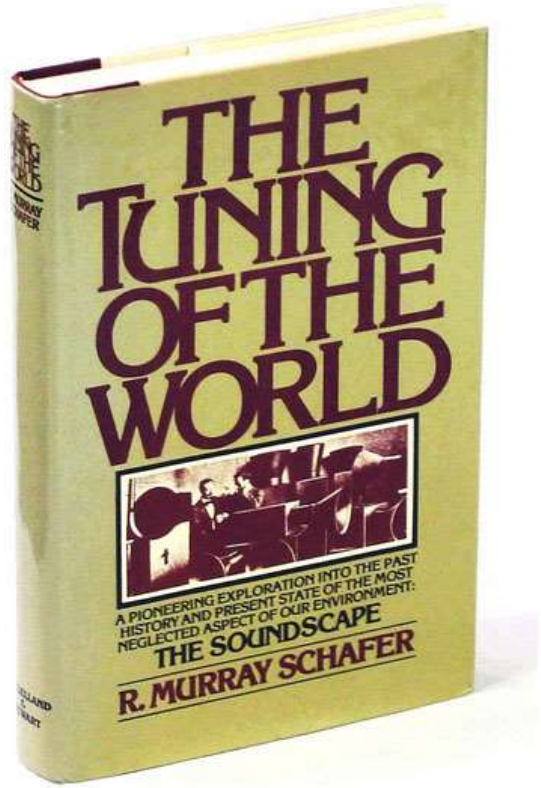
*1 Schafer R. M.(1977). *The Tuning of the World*. New York: A. A. Knopf.

*2 Porteous, J. D. (1985). Smellscape. *Prog. Phys. Geogr*. 9, 356–378.

Soundscape

The Tuning of the World, by Schafer, is a pioneering exploration of the sonic environment—an attempt to discover what it was like in the past, to analyze and criticize what it is today, and to imagine what may happen to it in the future.

Examining history, geography, anthropology, and sociology from a sonic point of view, the book makes an important contribution to acoustic ecology, which is the study of the relationship between man and the sounds of his environment.



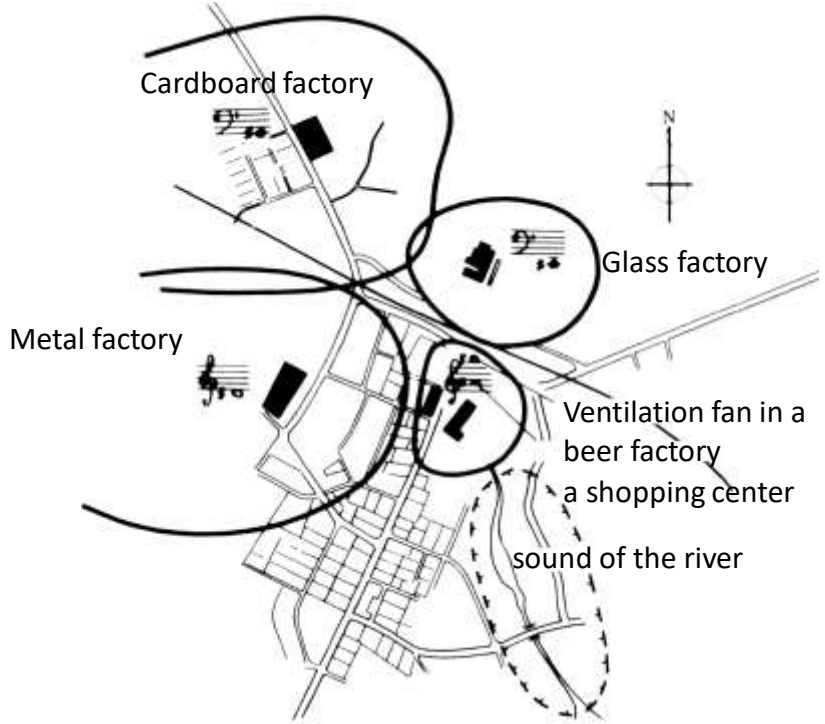
R. Murray Schafer: *The Tuning of the World*. New York: A. A. Knopf, 1977

Soundscape survey and design

The soundscape survey examines the spatial and temporal distribution of sounds, and evaluates the totality of various sound environments that exist in the region, such natural sounds as wind and water, including artificial sounds.

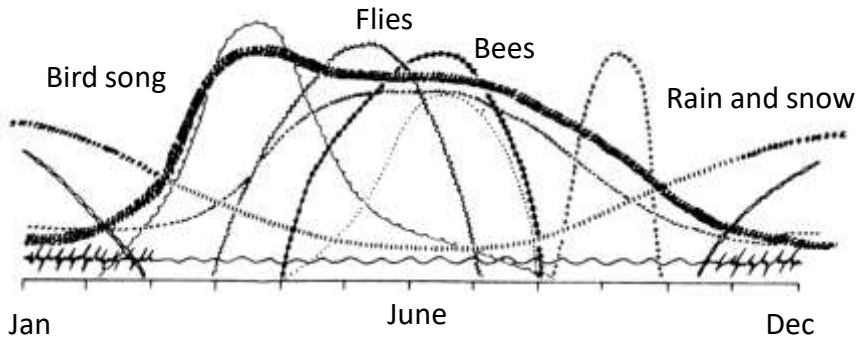
Soundscape survey is ultimately an attempt to connect to soundscape design.

Villa d'Este garden (Tivoli, Italy), known as “The Soniferous Garden”



Spatial distribution of sound

Each factory in a Swedish village plays a sound with a different pitch



Temporal distribution of sound

The annual cycle of the natural soundscape of the West Coast of British Columbia. Shows the relative amount of various sounds

The bustle of AMEYOKO (shopping street in Tokyo)

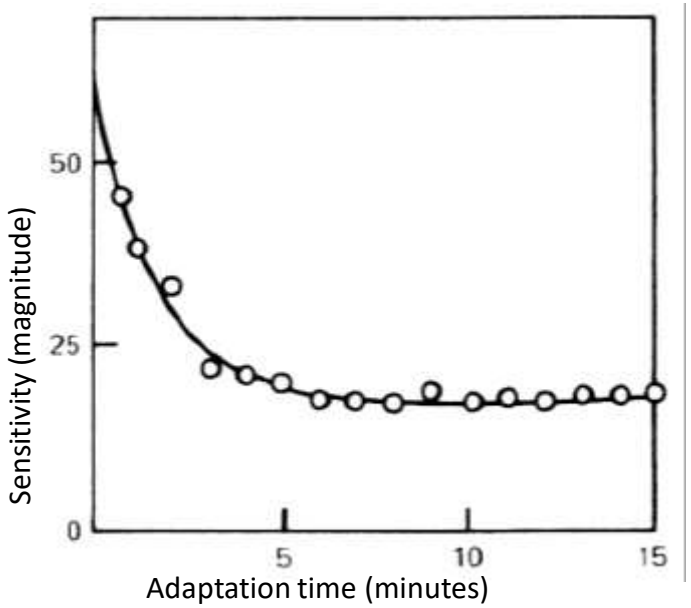
Smellscape

Shinbashi, Tokyo

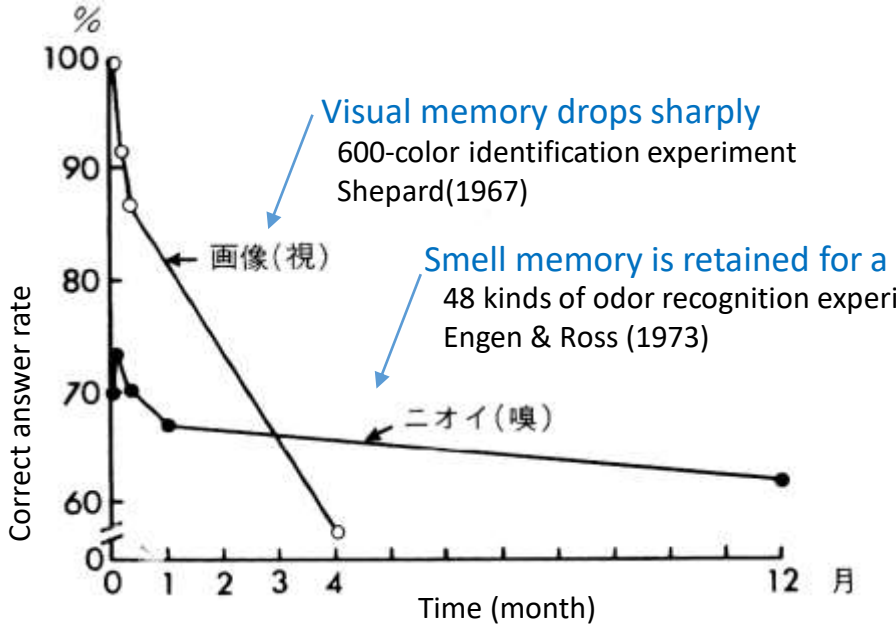
Characteristics of olfactory sense: from Engen's "The Perception of Odors" *

*T. Engen: *The Perception of Odors*, Academic Press, 1982

- **Smell likes and dislikes**: Depend on experience ⟸ Pleasant / unpleasant depending on familiarity (cultural differences, differences in development process)
- **Smell adaptation**: Sensitivity declines over time ⟸ Function to call attention / alarm to change of state
- **Smell memory**: Easy to retain for a long time ⟸ Retaining the experience of harmful foods



Decrease in sensitivity over time



Relationship between recognition rate and holding time in sight and smell

Application of Smellscape Concept

<Application example 1>

The Viking Museum (York, England) is trying to recreate the scent of the Norse-dominated land (fish, leather, earth) in the 10th century.

<Application example 2>

In 2001, the Ministry of the Environment of Japan selected "100 excellent odor places" in order to support the efforts of the region to conserve and create good scents as well as the nature and culture that is the source of them.

https://www.env.go.jp/air/kaori/index.htm

Smellscapes selected in the Kanto Koshin region (near Tokyo)

Grape field and wine

Used book district

Smell of rice cracker soy sauce

Tree storage

Kinesthetic experience

A study on the memory of places by the kinesthetic experience

- When memorizing a place, it may depend not only on visual information, but also on kinesthetic memory, that is, a sequence of movements to reach the place.
- The grid-like streets seem easy to understand from their simple structure, but the similar spaces are repeated, so it is possible to mistake the location.
- On the other hand, in the streets created according to the natural terrain, the change in the kinesthetic sense that are experienced by following the path may guide to the destination.

Flat and monotonous grid road

Complex road with bends and undulations

An experimental study:

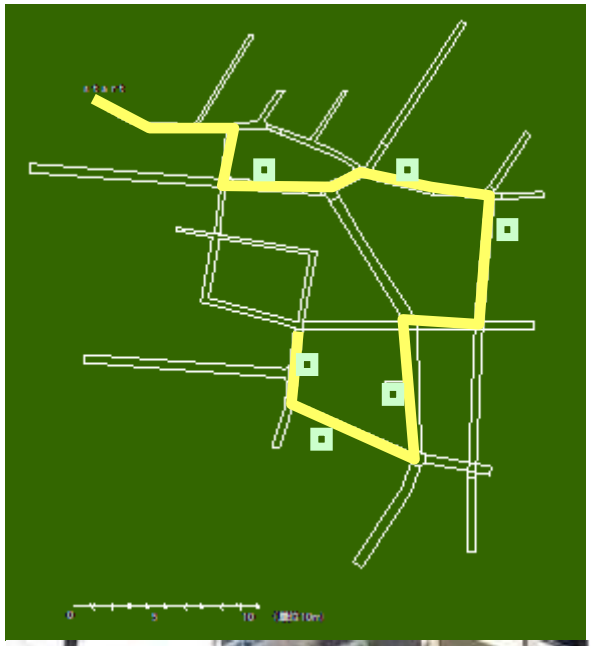
Kinesthetic sequential memory as a factor of place identification*

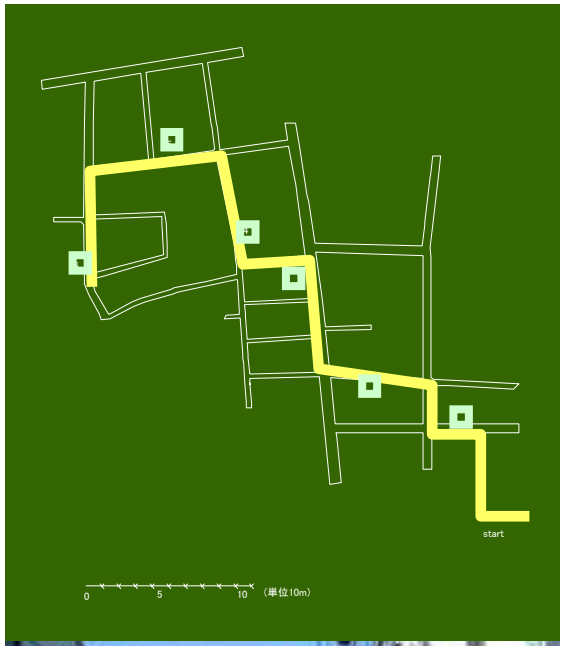
This study examind how the kinesthetic experience of walking a route affects the memory of places along the route.

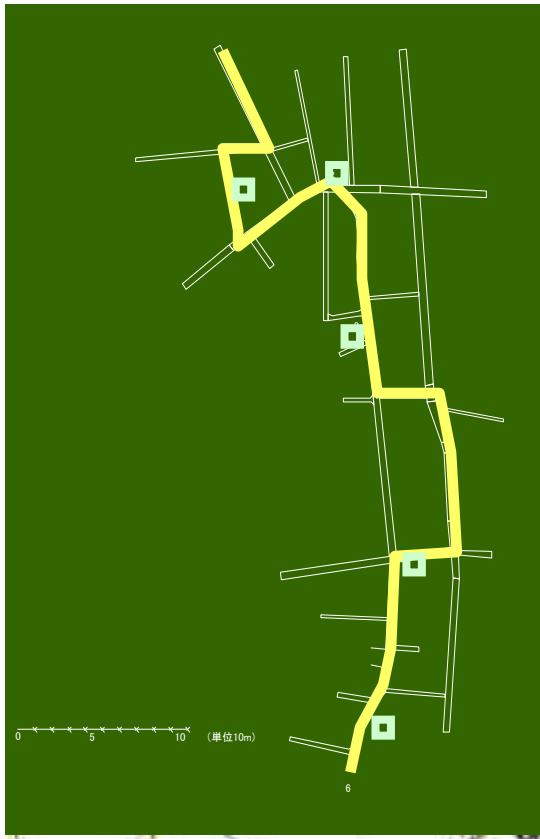
Each of the 31 participants was asked to walk on three routes with different road configurations shown on the right, and to remember the six places on each route.

After this experience, the participants were asked to identify the places by two types of memory recall experiments.

Three experimental routes







Route I: Non-grid and sloped

Route II: Grid-like and flat

Route III: Non-grid and flat

*Ohno, R., Nakayasu, M., Soeda, M.: Kinesthetic sequential memory as a factor of place identification, J. Archit. Plann. Eng., AIJ, No. 569, 173-178, Oct., 2002.

Two types of memory recall experiments

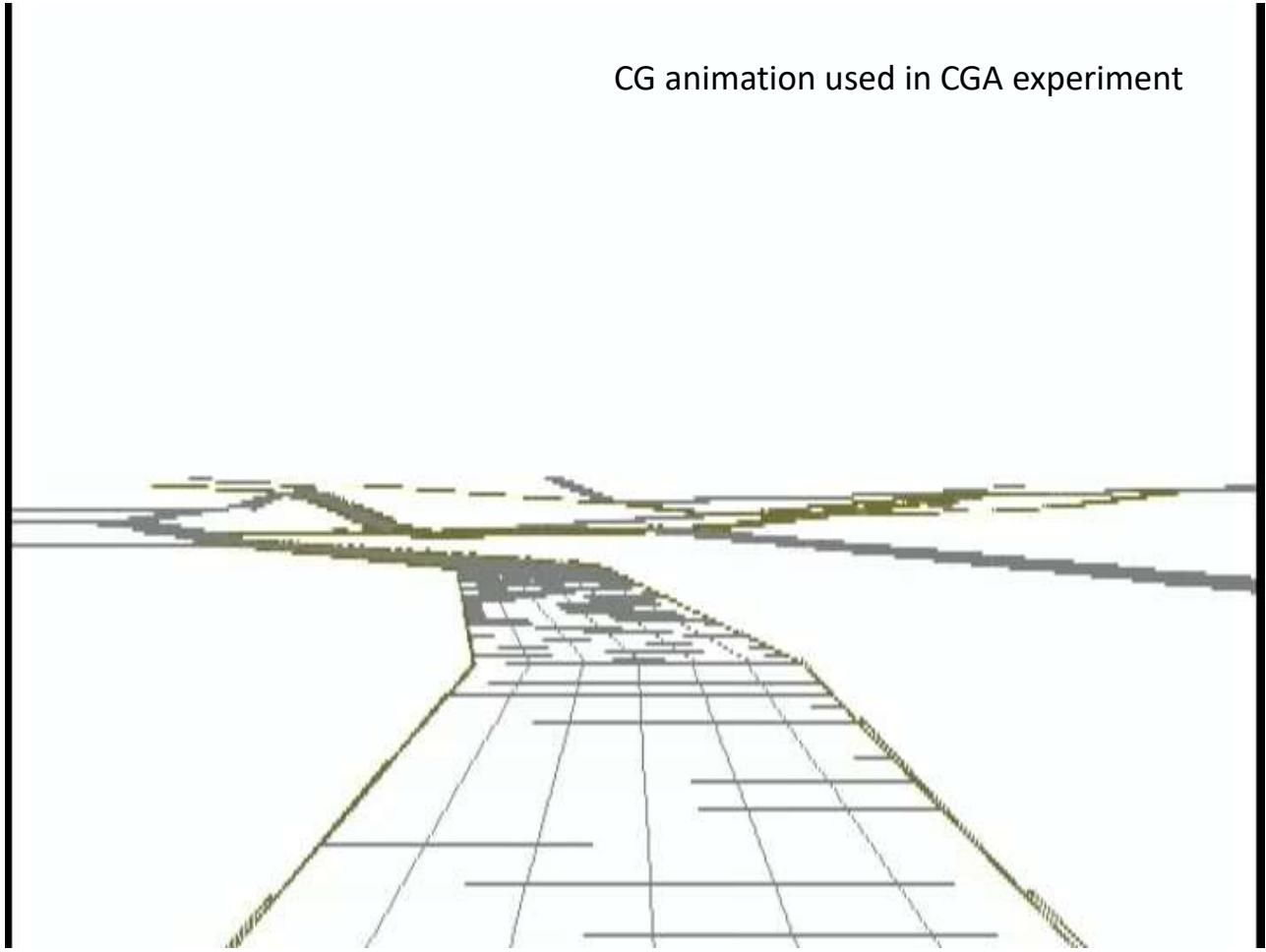
1) RP experiment

Participants were presented 12 photographs including the 6 points instructed to memorize and 6 points other than that in a random order.

2) CGA experiment

Participants were presented with a CG animation in which only the road surface shape of the experimental route was drawn on the computer screen.

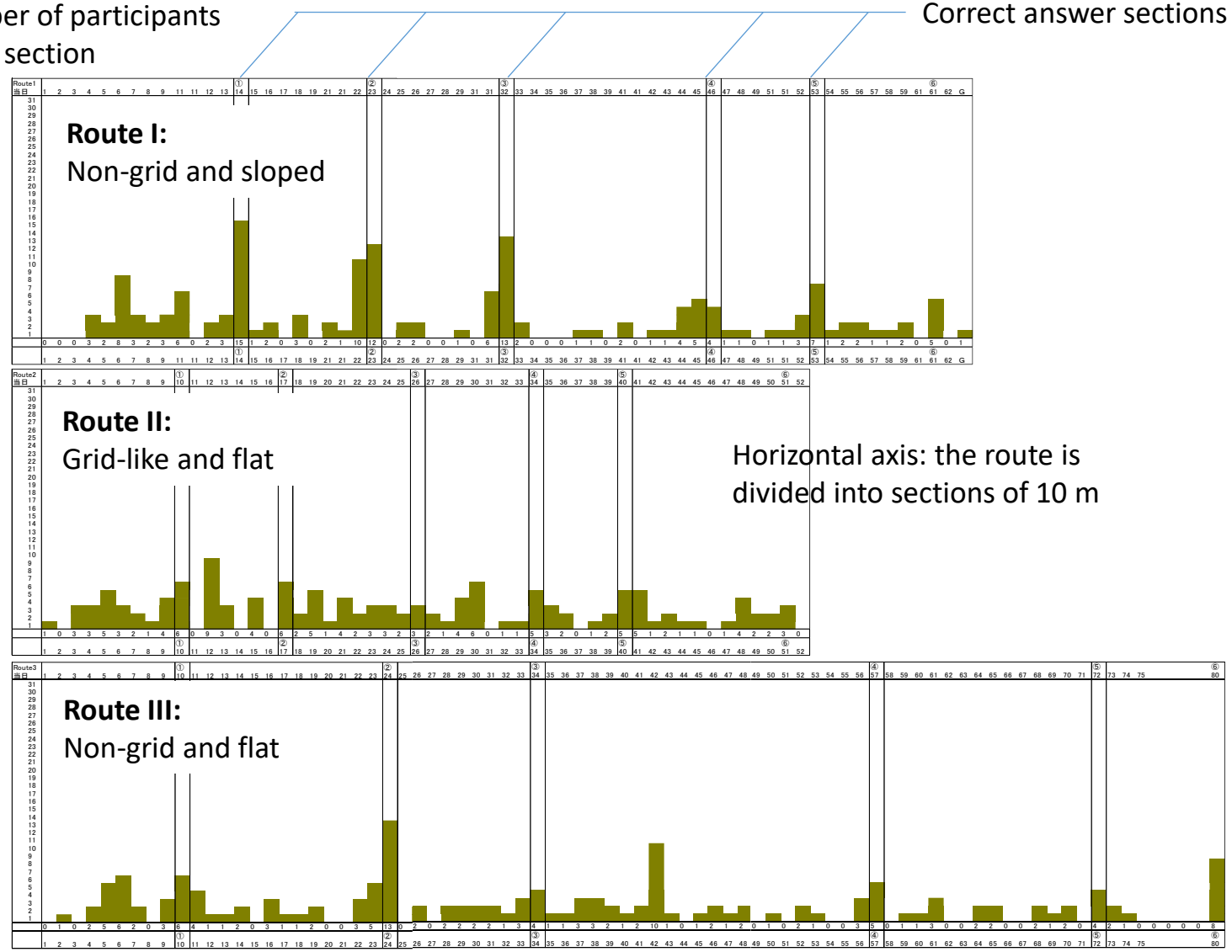
CG animation used in CGA experiment



Results of CGA experiment

Vertical axis: the number of participants who answered in each section

Correct answer sections



Horizontal axis: the route is divided into sections of 10 m

Distance from the start divided into sections of 10 m

In Route I (non-grid and sloped), the participants' answers were concentrated in and near the correct answer section.

In Route II (grid and flat), the participants' answers were dispersed.

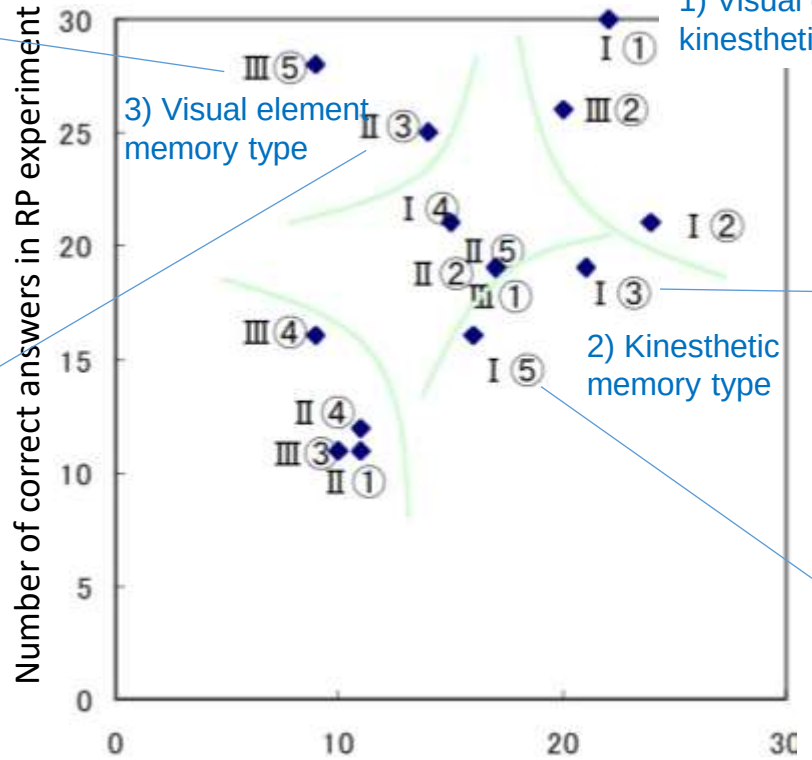
From this result, it was found that the location can be identified by the experience of moving along a certain path reproduced by CG animation.

Type classification by memory clues

Each point instructed to memorize was classified according to the number of correct answers in the RP experiment and CGA experiments

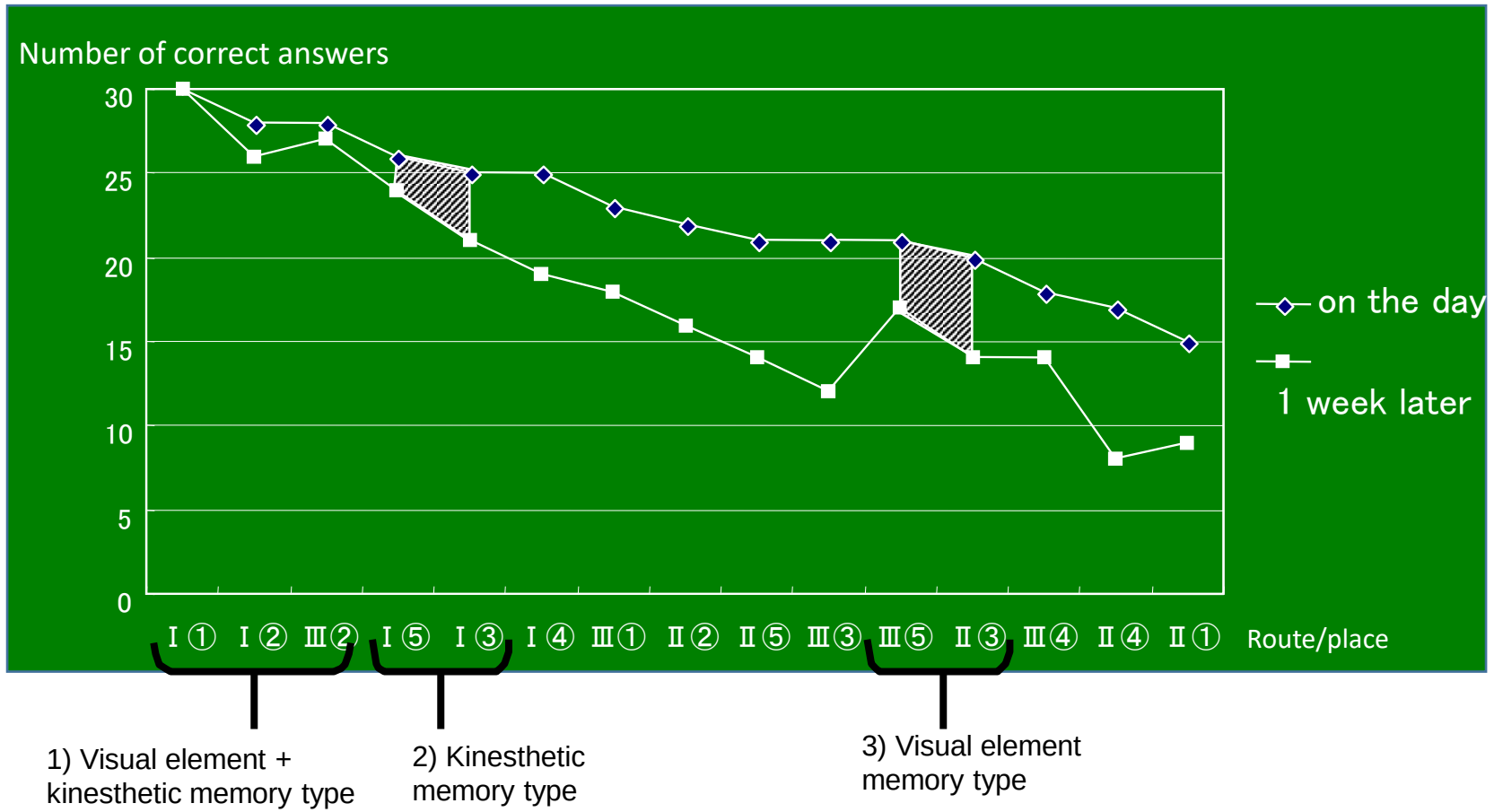
1) **Visual element + kinesthetic memory type**: At the point where both visual and kinesthetic clues were present, the correct answer rate was high in the two experiments.
2) **Kinesthetic memory type**: At the point where kinesthetic clues exist, the correct answer rate was high in the CGA experiment.
3) **Visual element memory type**: At the point where visual clues exist, the correct answer rate was high in the RP experiment.

Flat route



Non-grid and sloped route

Ease of recalling memory by type of clue



The results of the recall experiment on the day and one week after the memory experiment

Percentage of correct answers: "visual element + kinesthetic memory type" has the highest, followed by "kinesthetic memory type" and "visual element memory type".

The decline in the number of recalls after one week is greater in the "visual element memory type" than in the "kinesthetic memory type".

This indicates that memories of places with kinesthetic experience are more easily recalled and retained longer than places without it.

an episode about

Memory of the environment by the sense of movement of the body

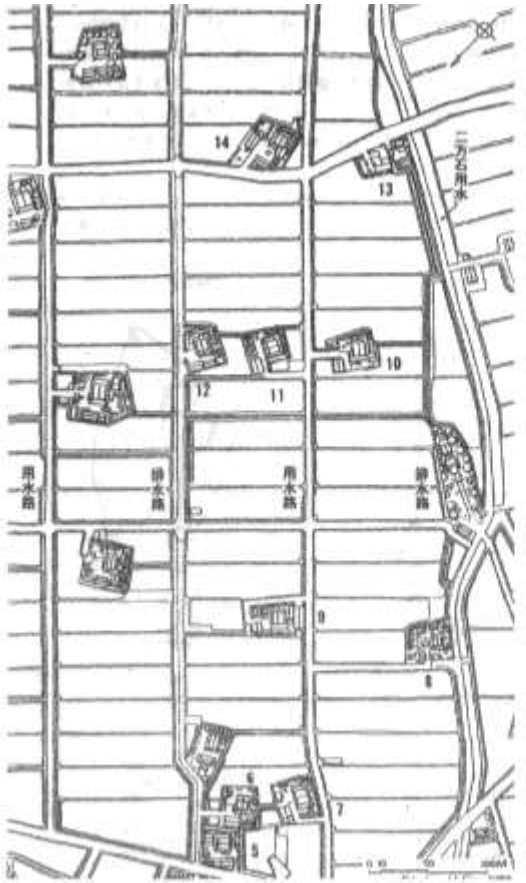
The dispersed settlements in the Tonami Plain, Toyama Prefecture, Japan have undergone enormous changes under the name of "agricultural modernization.“

The spatial composition that once followed the natural water system and the hierarchy of roads has been replaced by a mechanical, monotonous grid.

After this modification, I heard that an old woman may have difficulty returning to her home, where she lived for many years.

This is probably because the potential environmental information that has been embodied by decades of living here and has unconsciously led her to her destination has ceased to work.

*Kurono, H., Kikuchi, S.,: The Spatial Composition of a Dispersed Village from Relationship between the Village and the configuration of Buildings in the Premises: A special analysis of dwelling system in Tonami plain Part 2, J. Archit. Plann. Eng., AIJ, No. 507, 151-155, May, 1998.



After Before

The dispersed settlements in the Tonami Plain*

Three major characteristics of environmental perception pointed out by Ittelson

- ✔ (1) The environmental information is obtained through all senses.
  - Characteristics and roles of the five senses
  - Soundscape
  - Smellscape
  - Kinesthetic memory

(2) The environment itself has no boundary in space or time.

(3) The environmental information lies not only in central but also in peripheral area of the sight.

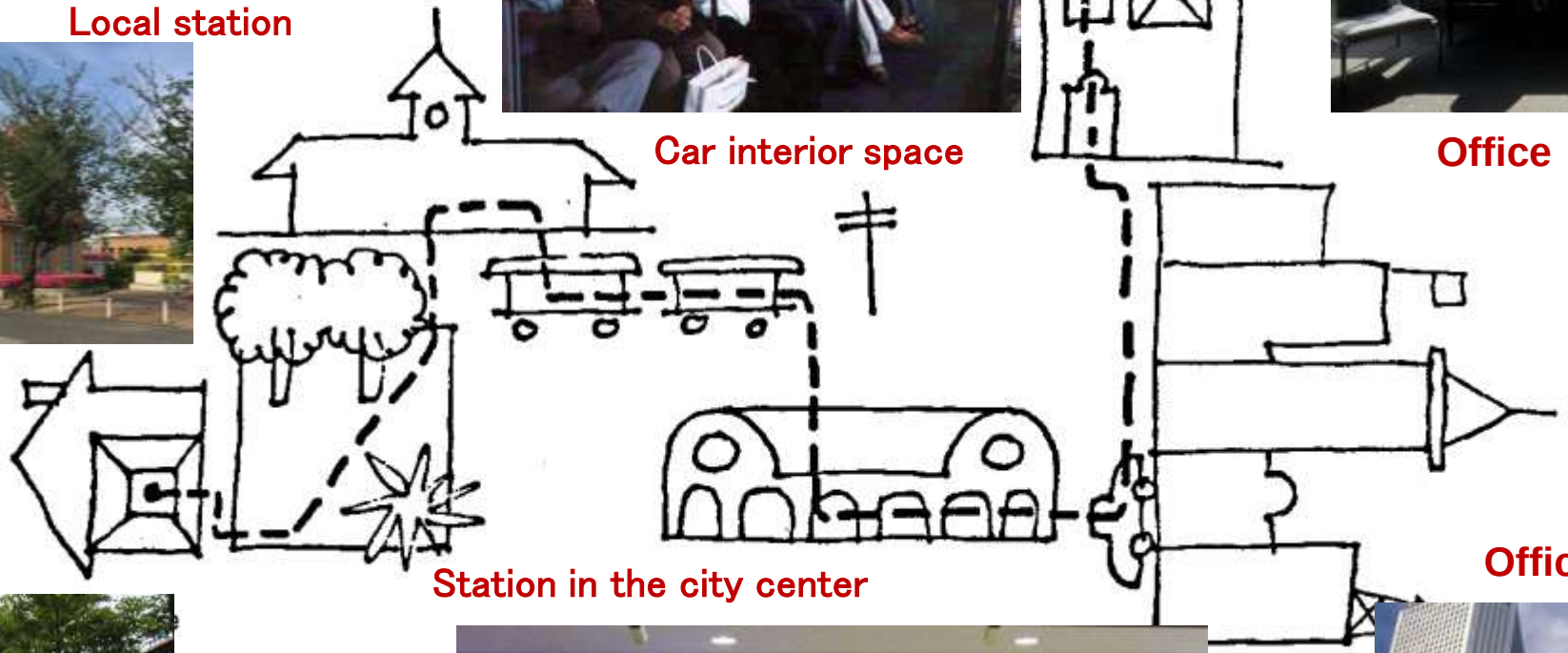
No boundary in space and time

Daily travel experience (commuting) in the city

Car interior space

Office

Local station

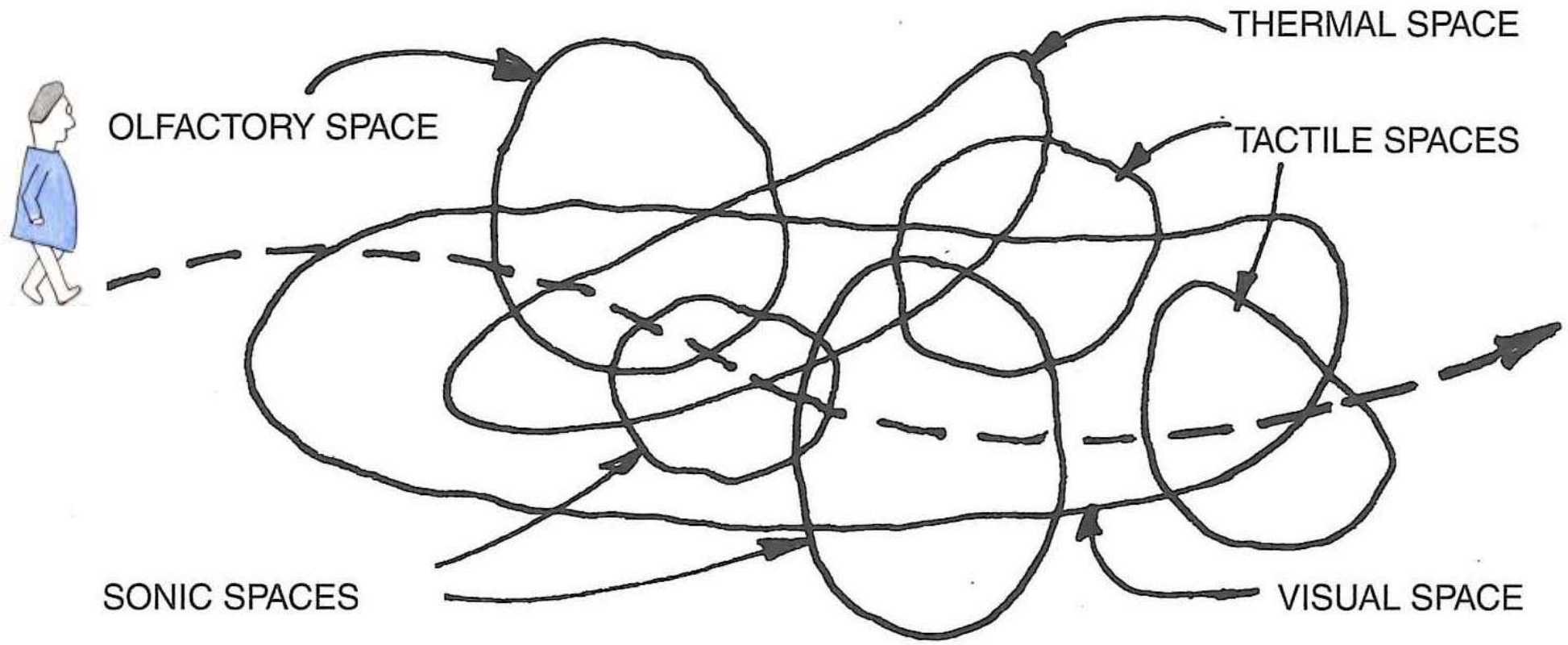


Suburban housing

Station in the city center

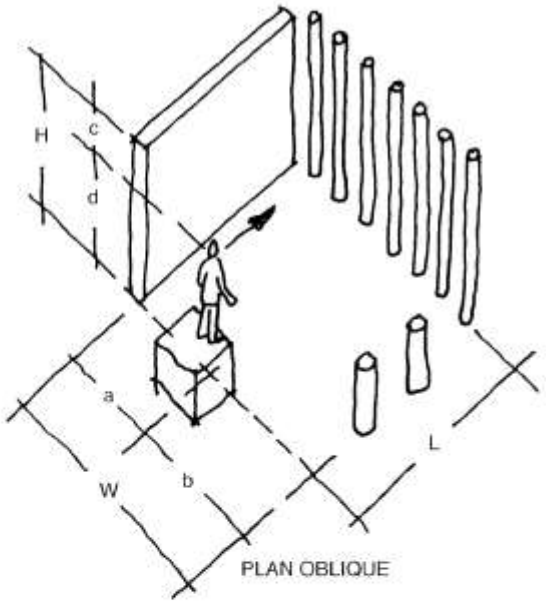
Office district

Multi-sensory sequential experience along with human movement*



*Thiel, P. :People, Paths, and Purposes: Notations for a participatory envirotecture, University of Washington Press, 1979

Notation for understanding and designing the spatial experience in motion



PLAN OBLIQUE

H = height of *space*

= c + d

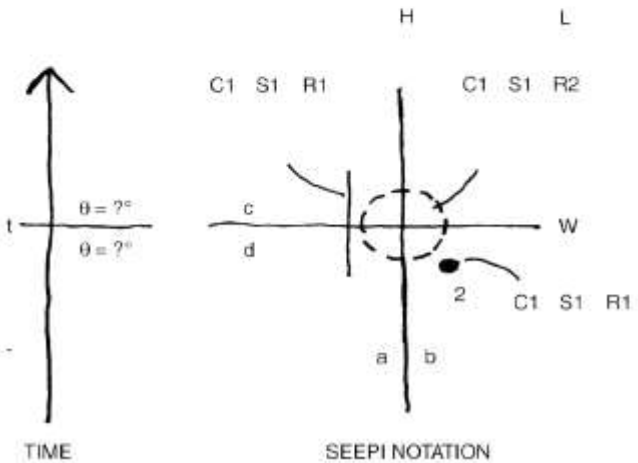
d denotes the height of the UP's eye level above the under surface of the space. If d = UP's standing eye height, do not indicate.

W = width of *space*

= a + b

a and b denote the lateral position of the UP in the space. If a = b, do not indicate.

L = length of *space*



TIME

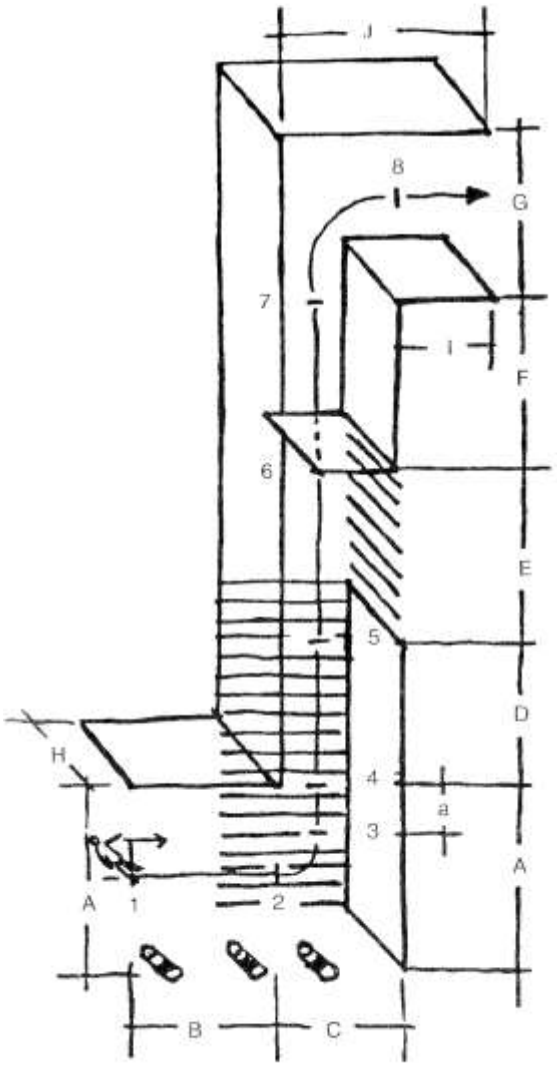
SEEPI NOTATION

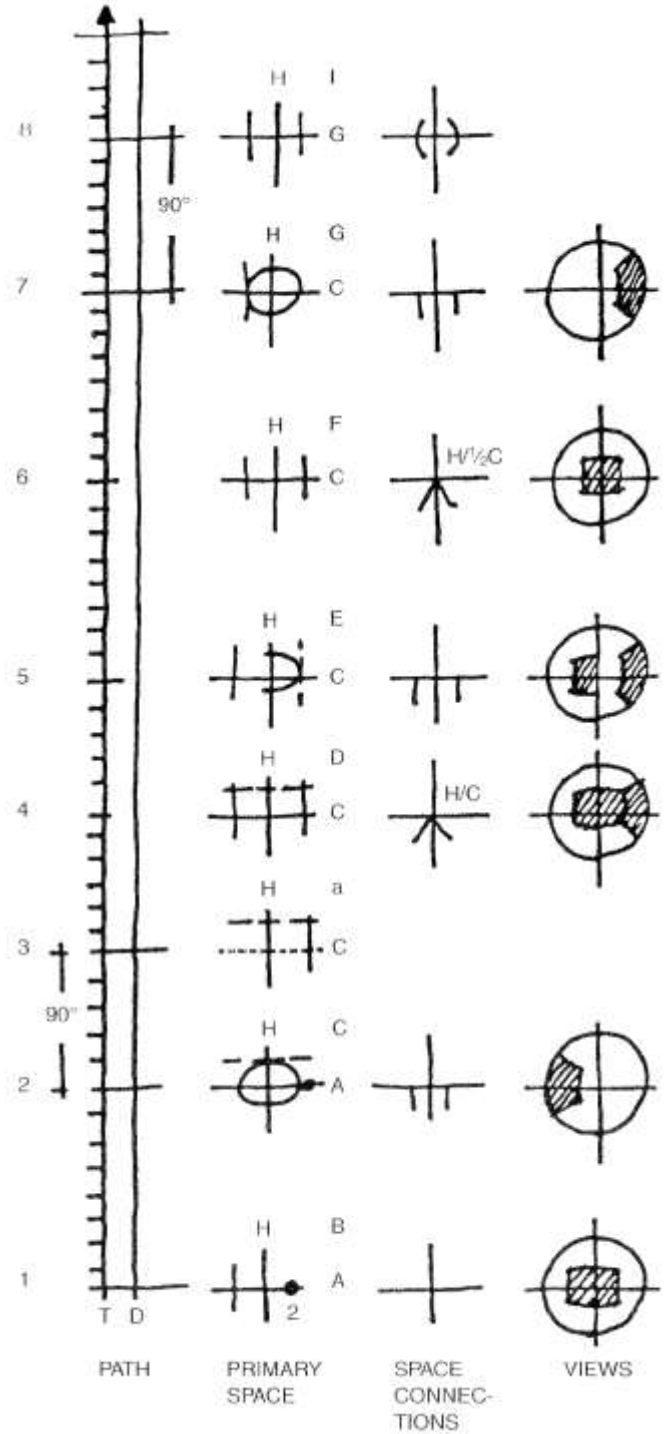
surface SEE

screen SEE

object SEE

Note that $\theta = \phi = 0°$ unless otherwise indicated. If $\theta = \phi = 0°$, do not indicate.

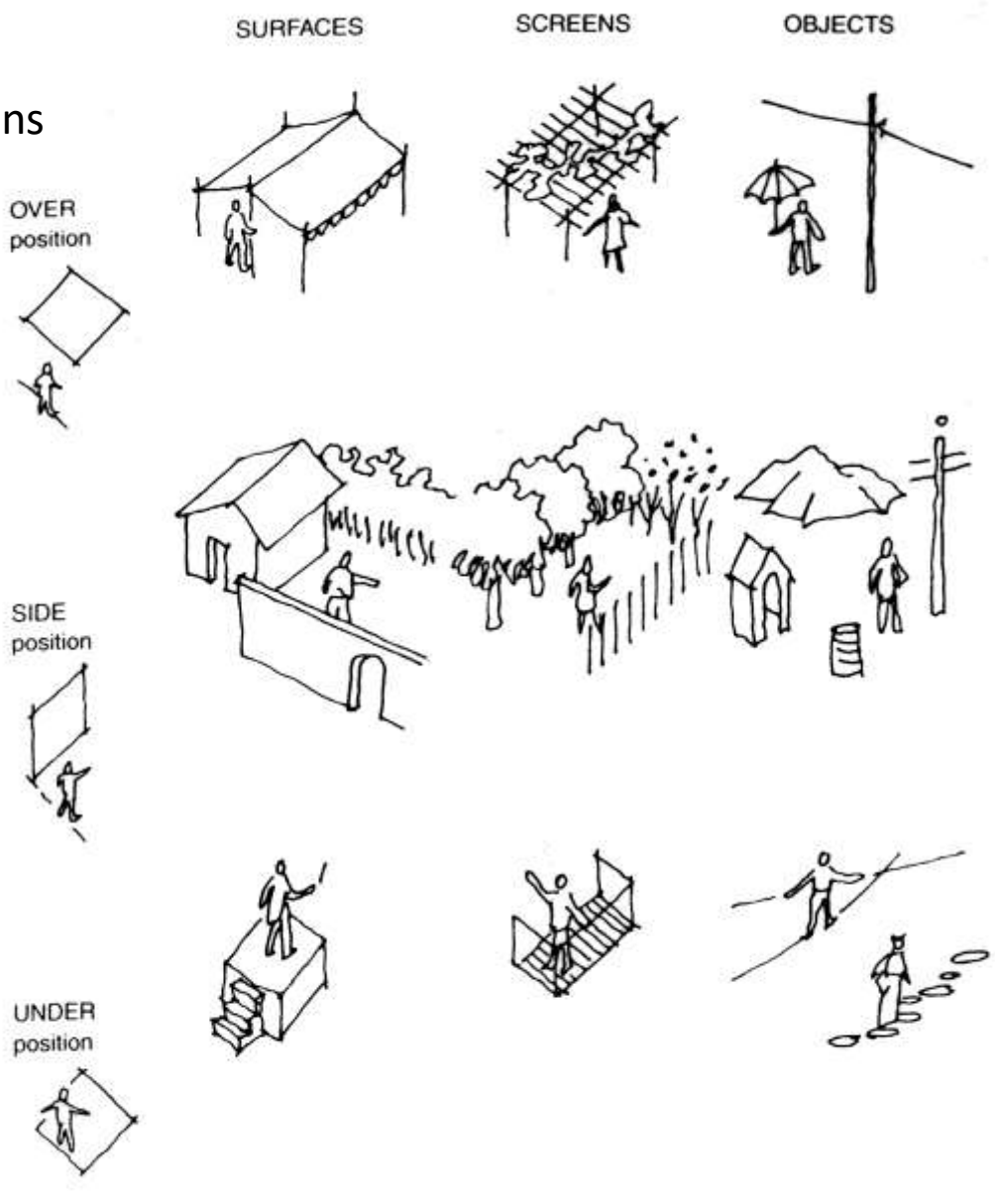




Space-Establishing Elements

Types

Positions



Create a space by covering

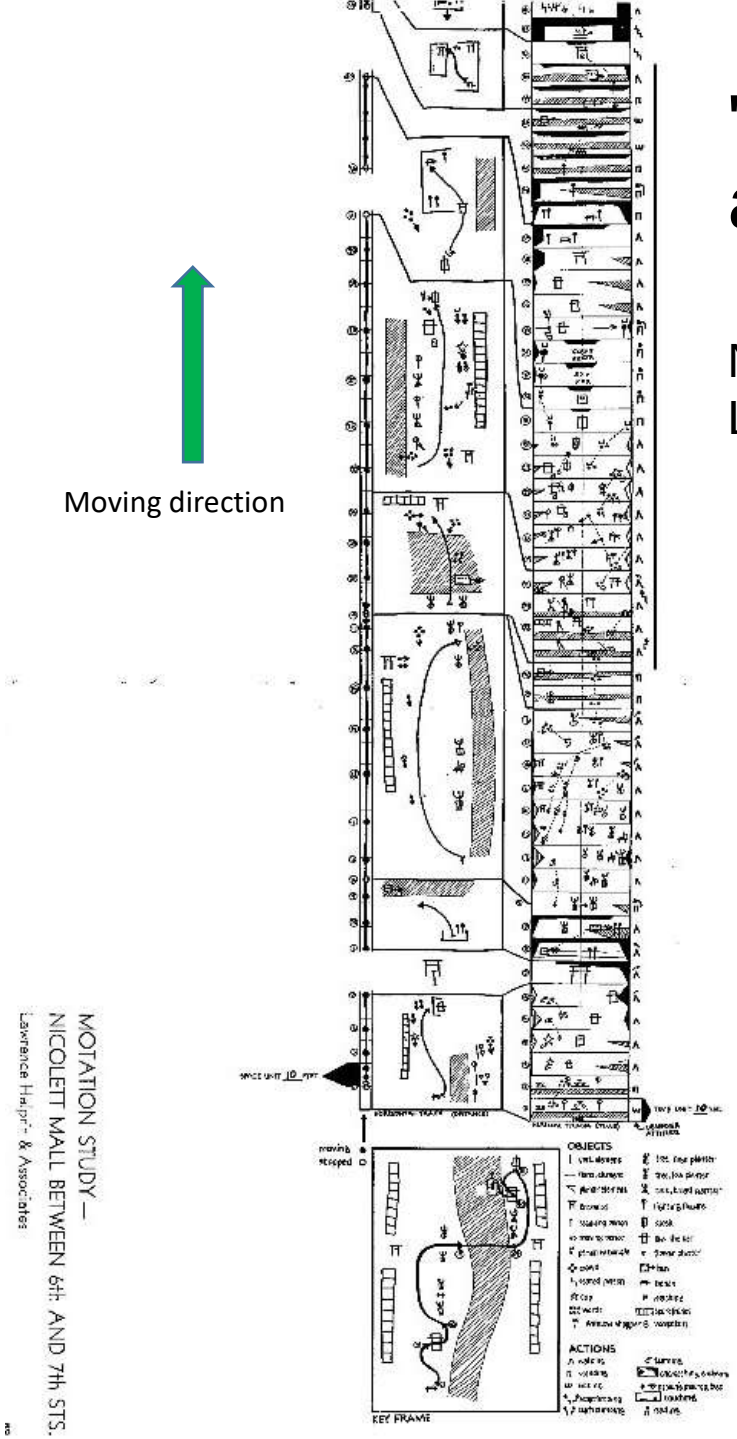
Create a space next to it

Create a space underneath

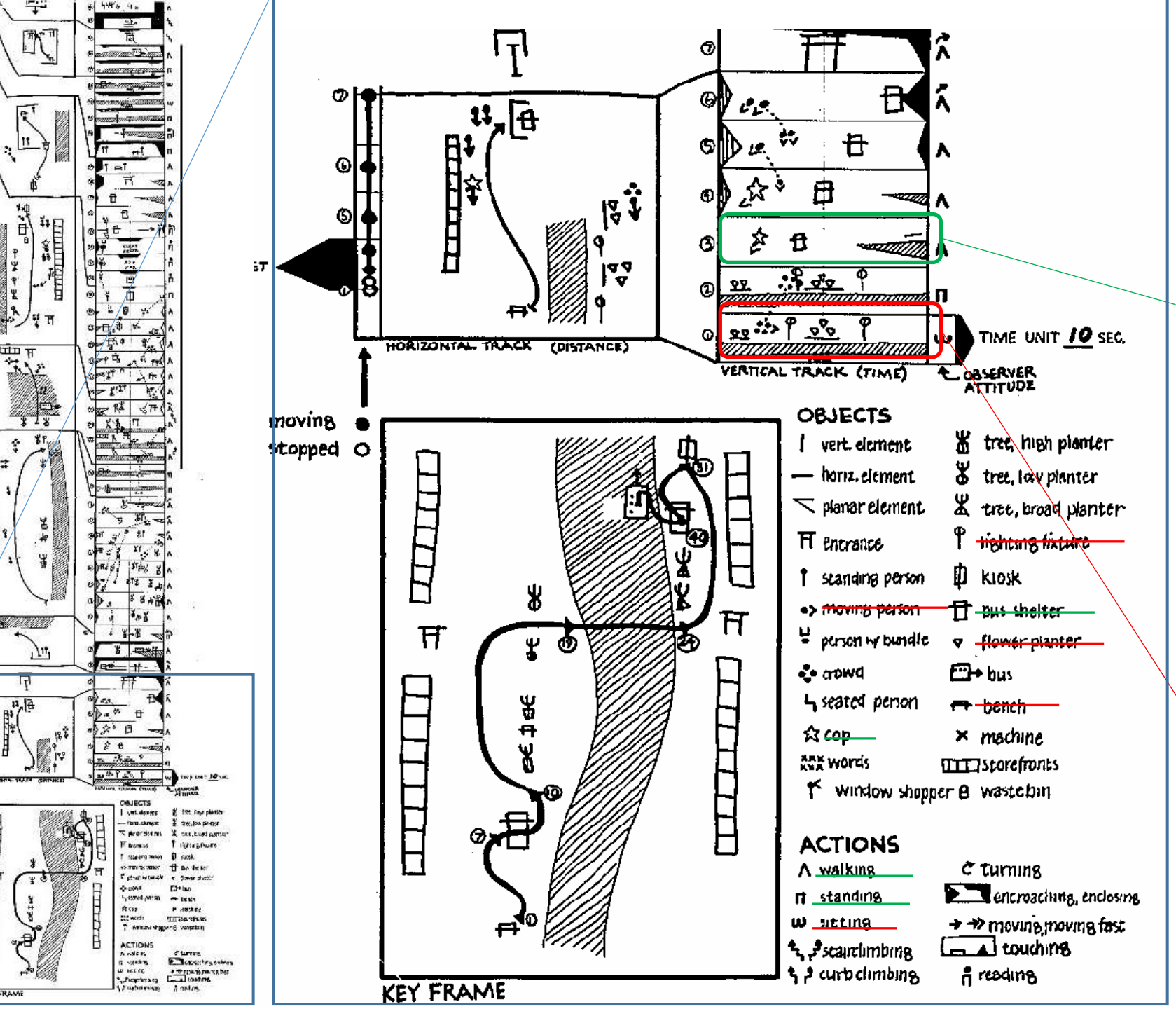
"Motaion" that describes things and the actions of people on a time axis.

Nicollet Mall in Minneapolis is a transit mall designed in 1967 by Lawrence Halprin.

Moving direction



Enlarged partial view



③When you get up and start walking, you can see the road on your right, the bus stop on your left, and the police officers are patrolling here.

①When you sit on the bench, you can see the road in front of you, the streetlights on the other side, the flowers of the planters, and the people walking down the street.

Three major characteristics of environmental perception pointed out by Ittelson

(1) The environmental information is obtained through all senses.

✔ (2) The environment itself has no boundary in space or time.

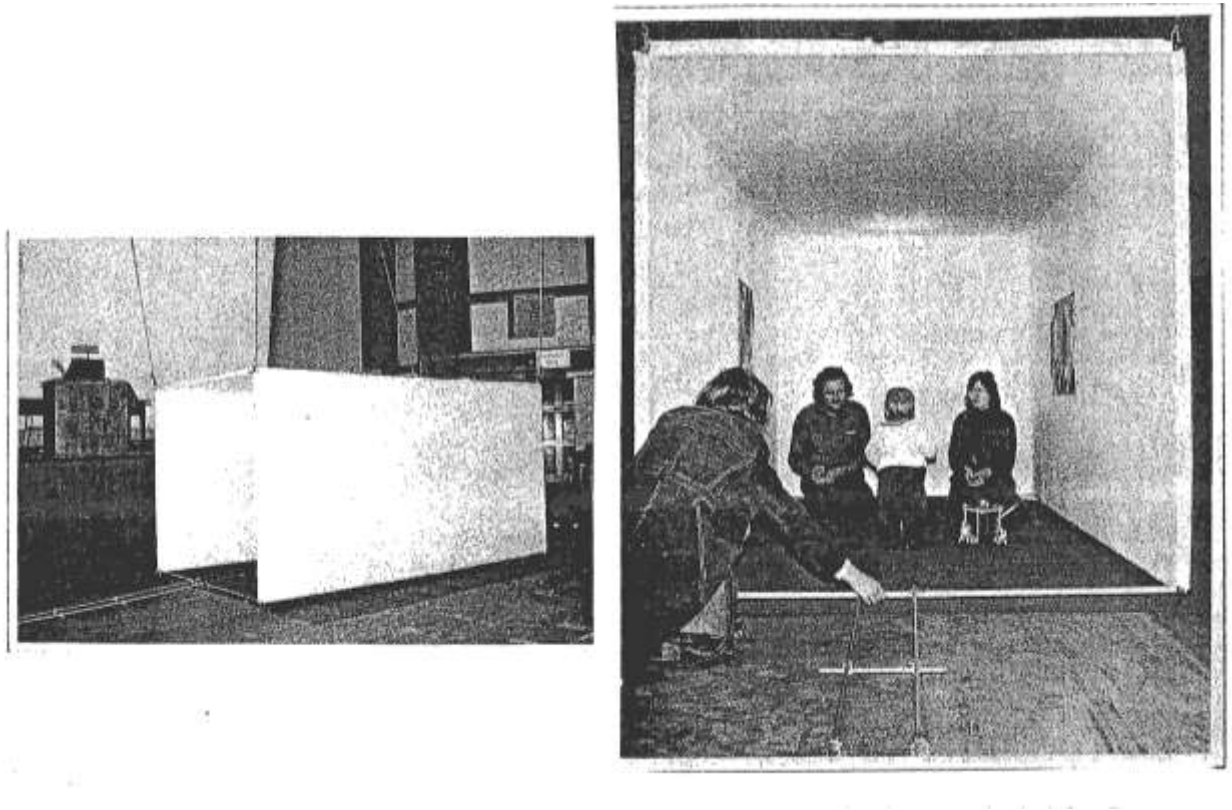
(3) The environmental information lies not only in central but also in peripheral area of the sight.

（Ittelson, W.: Environment perception, in W. Ittelson et al (eds.) An Introduction to Environmental Psychology, pp. 102-109, 1977）

(3) The environmental information lies not only in central but also in peripheral area of the sight.

Experiment in a moving room*

This experiment clearly showed that we maintain an upright posture based on peripheral visual information.

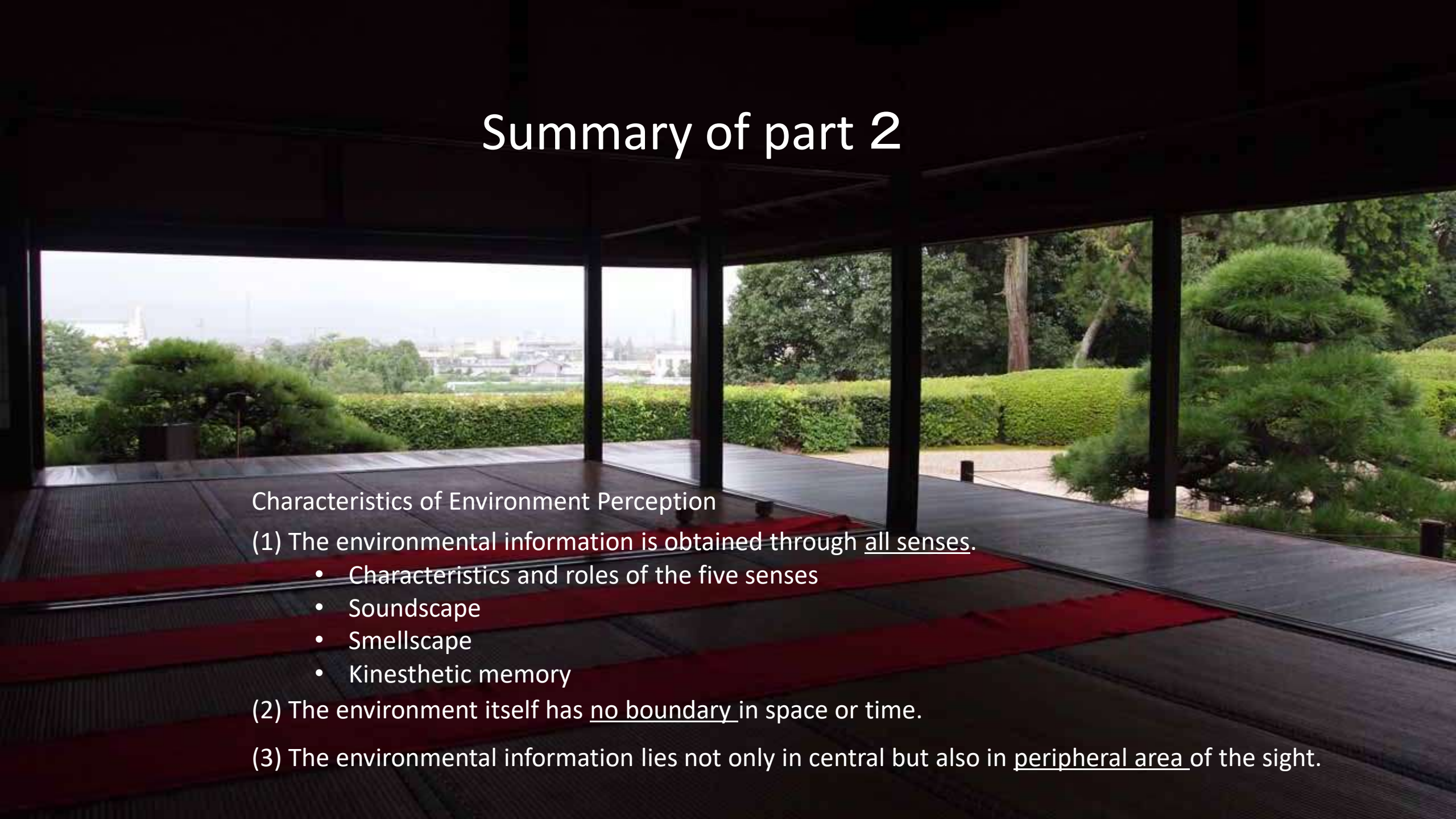


Infant subject standing backwards. His mother is in the same room.

*Lee, D.N. & Aronson, E.: Visual proprioceptive control of standing in human infants, Attention Perception & Psychophysics 15(3):529-532, May 1974

More about the importance of information from other than central vision in the next Part 3.

Summary of part 2



Characteristics of Environment Perception

(1) The environmental information is obtained through all senses.

- Characteristics and roles of the five senses
- Soundscape
- Smellscape
- Kinesthetic memory

(2) The environment itself has no boundary in space or time.

(3) The environmental information lies not only in central but also in peripheral area of the sight.

Part 3:

Concept of ambient vision and its research application

Visual systems with different spatiotemporal ranges in information acquisition

Directivity of attention

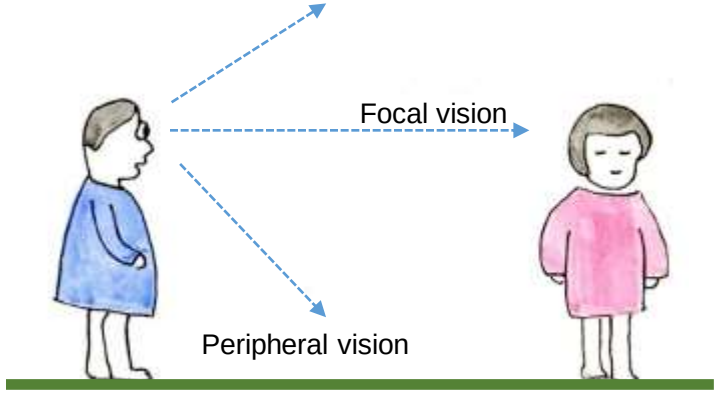
Focal vision

Peripheral vision

Within fixed field of view

strong

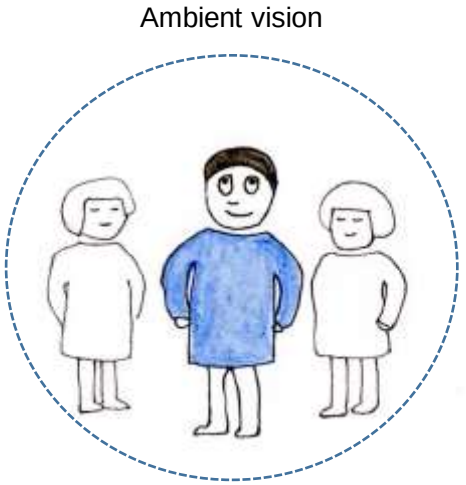
weak



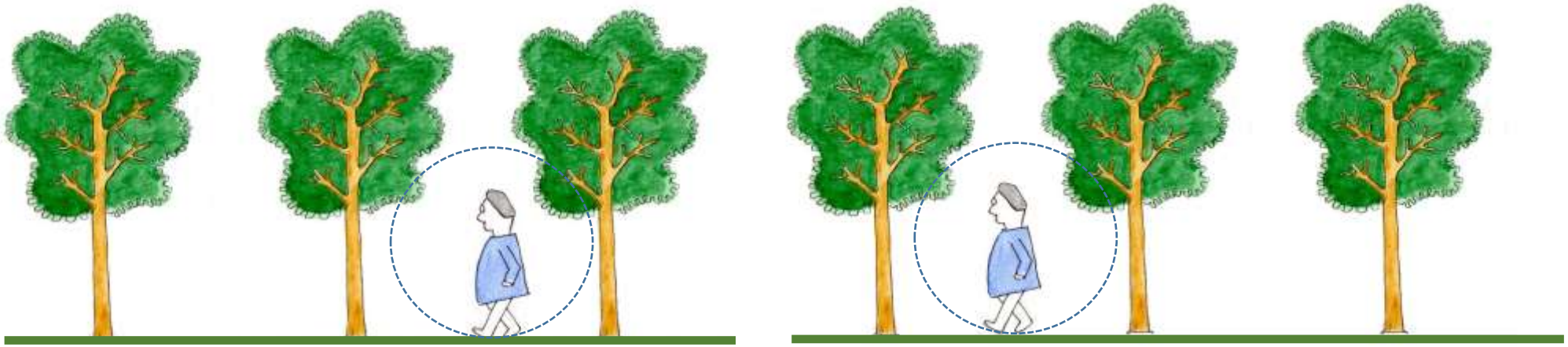
No directivity

Ambient vision

All directions around the perceiver



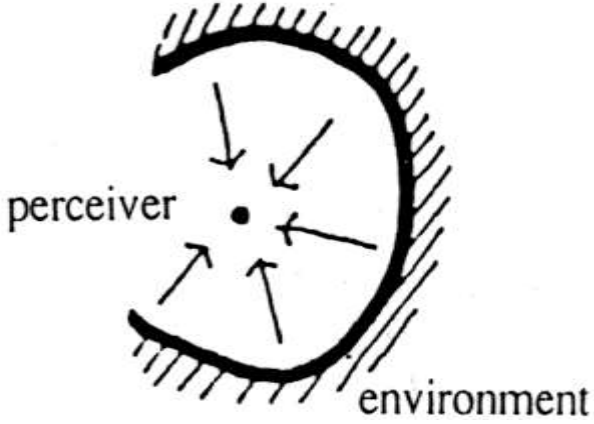
Impression of a place received by Ambient vision

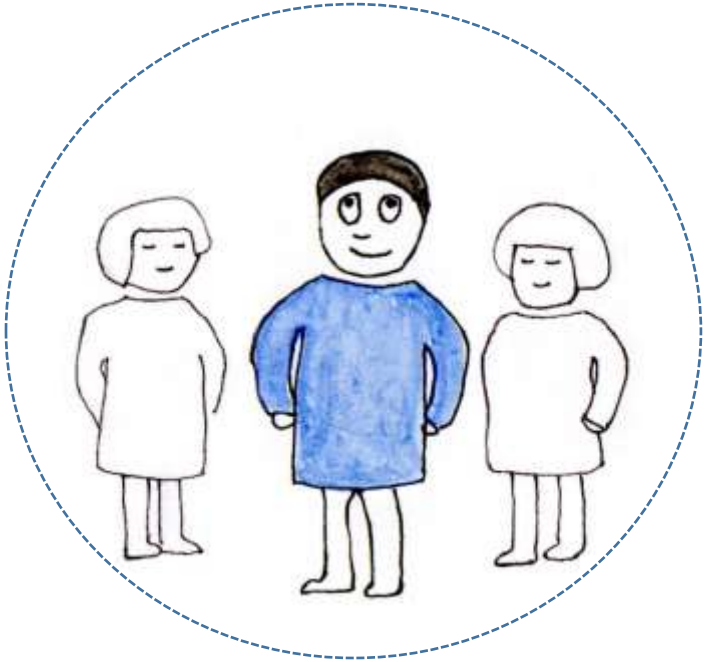


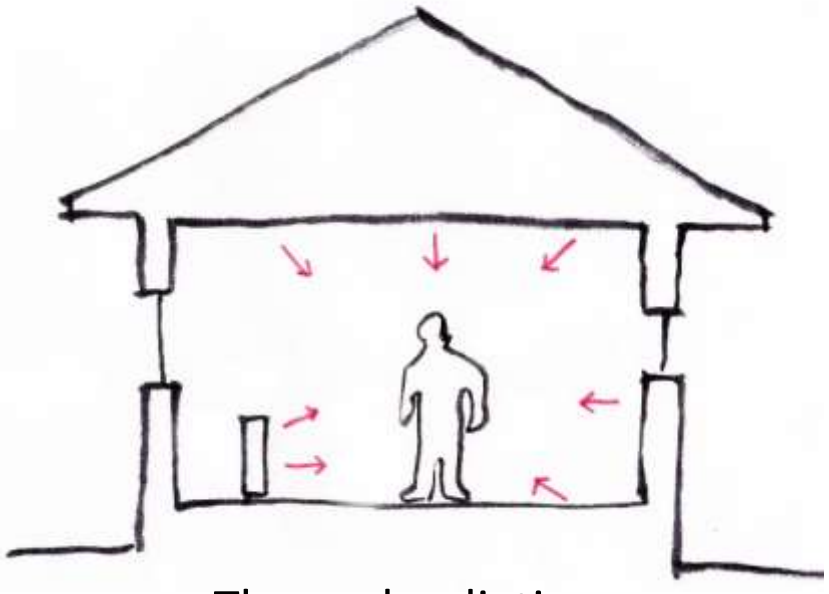
The impression of a place by ambient vision depends not only on the scene you are seeing at a certain moment, but also on the scenes you have experienced before and cannot see it at the present.

"visual radiation" by ambient vision

Ambient vision receives visual information emitted from the surrounding environment just as it would receive thermal radiation.







Thermal radiation

Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Visual pathways		
Perceiver's attitude		
Nature of information processing		
Behavioral function		
Outcome		

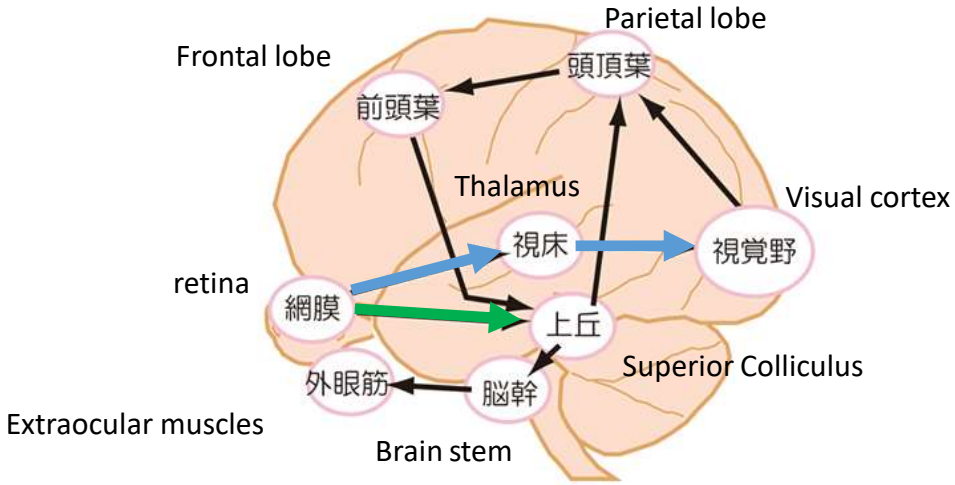
Points regarding the differences in the characteristics of the two visual systems that have been discussed in various fields

Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Visual pathways	Via thalamus / visual cortex (cerebrum)	Via the superior colliculus (midbrain)

Parallel processing model

The visual system has been found to have two parallel major neural pathways, each of which works differently in the processing of visual information.



Visual information that is perceived as visible

Visual information that is not noticed as visible

Source : National Institute for Physiological Sciences, Japan

Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Perceiver's attitude	Conscious / attentional	Unconscious / subliminal
Behavioral function	Detection / recognition of objects	Attention evocation / orientation Body locomotion

Focal vision is a serial attentive process, which is restricted to a small area of the visual field.
And it detects and recognize objects.

Ambient vision unconsicously extends over a wide area of the visual world.
It is involved in orienting the human in space and guiding its larger movements.

Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Nature of information processing	Perceptual selection Scrutiny process.	Perceptual integration Intuitive process

Focal vision perform perceptual selection through scrutiny process.
Ambient vision perform perceptual integration through intuitive process.

Outcome	Understanding	Global impression/ feeling

Focal vision identifies a specific object in the environment and provides an intellectual understanding of what it is.

Ambient vision instantly captures the state of the environment and evokes an intuitive grasp and emotional response to the environment.

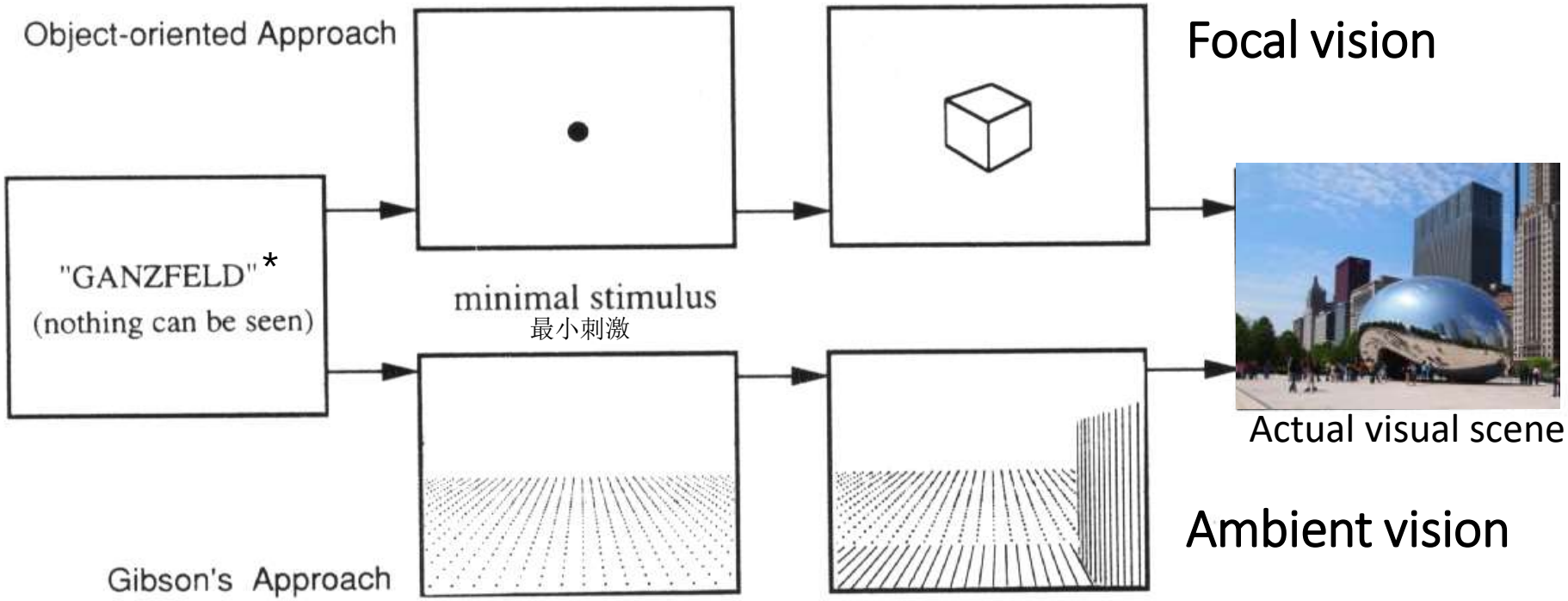
Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Visual pathways	Via thalamus / visual cortex (cerebrum)	Via the superior colliculus (midbrain)
Perceiver's attitude	Conscious / attentional	Unconscious / subliminal
Behavioral function	Detection / recognition of objects	Attention evocation / orientation Body locomotion
Nature of information processing	Perceptual selection Contemplative process	Perceptual integration Intuitive process
Outcome	Understanding	Global impression/ feeling
Source of information	What are the environmental elements that are the sources of information for each of the two visual systems?	

Two ways of thinking about the composition of the visual space

Two approaches for filling up visual field

The visual field is composed by
discrete elemental features (objects)



The visual field is composed by
continuous environmental features (surfaces)

*The whole field where you can feel the brightness but cannot see anything

Based on Landwehr, K.: On the minimal stimulus information for something to be seen. Paper presented at XXIII International Congress of Psychology, Acapulco, Mexico, 1984

Comparison of characteristics of two visual systems

Characteristics	Focal vision	Ambient vision
Visual pathways	Via thalamus / visual cortex (cerebrum)	Via the superior colliculus (midbrain)
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Nature of information processing	Perceptual selection Contemplative process	Perceptual integration Intuitive process
Outcome	Understanding	Global impression/ feeling
Source of information	Discrete elemental features (objects)	Continuous environmental features (surfaces)

Description of the impression of a place by measurement of ambient visual information

From the above discussion:

- The impression of the place depends on ambient vision.
- The source of ambient visual information is continuous environmental features (surfaces).

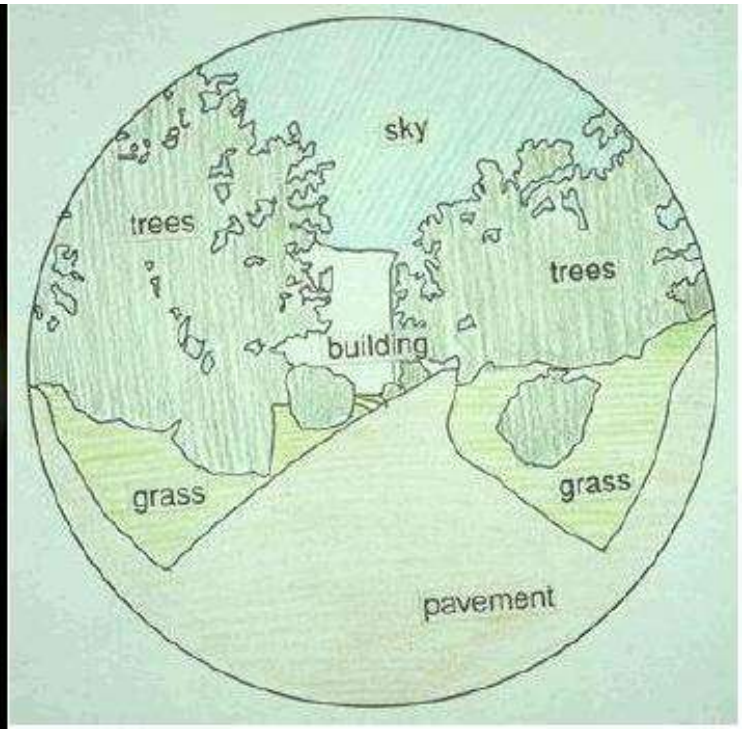
Therefore

- The impression of the place can be described by the environmental surfaces.

Method for measuring ambient visual information*

Hemispherical projection of a scene

A photo taken with a fisheye lens



Manually divided into basic components based on the photo

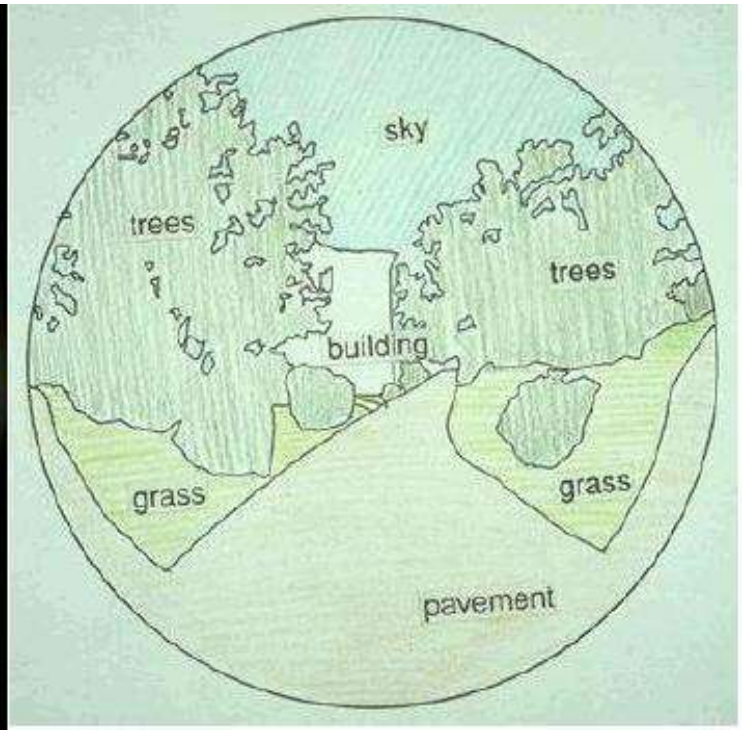
Hypotheses:

- The basic units of the environmental surfaces that convey ambient visual information were postulated to be areas of visible surfaces divided according to differences in their “affordance”, or meaning for basic human behavior.
- The impression of the place can be described by the ratio of the area of components.

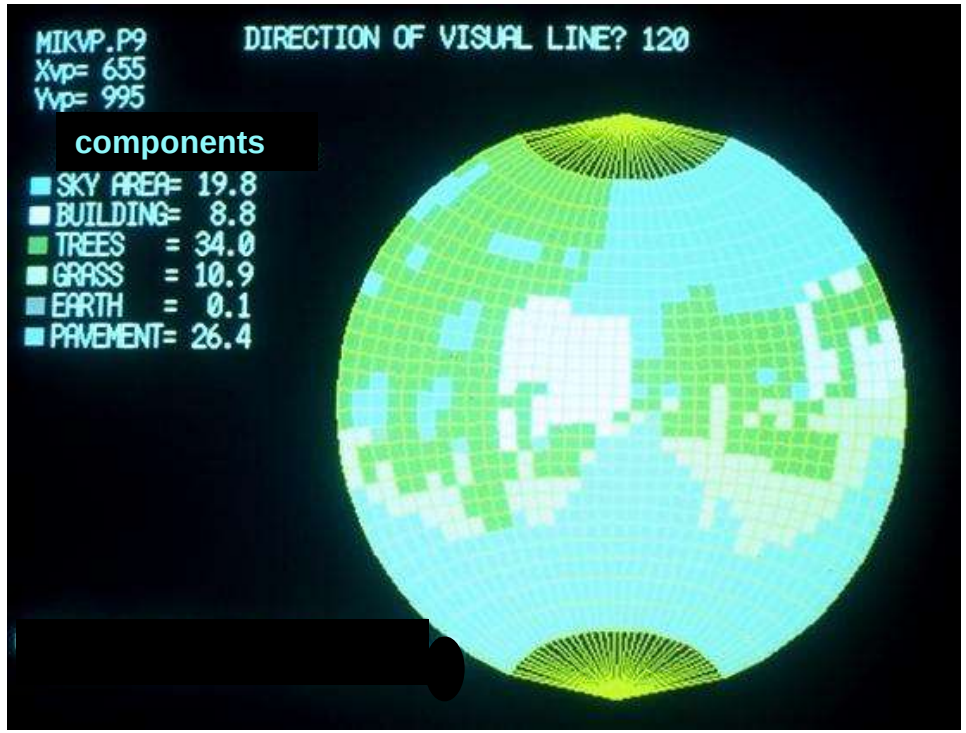
*Ohno, R. Ambient vision of the environmental perception : Describing ambient visual information. Proceedings of the 22nd Annual Conference of the Environmental Design Research Association, 1991

Development of a computer program for measurement of ambient visual information

Hemispherical projection of a scene

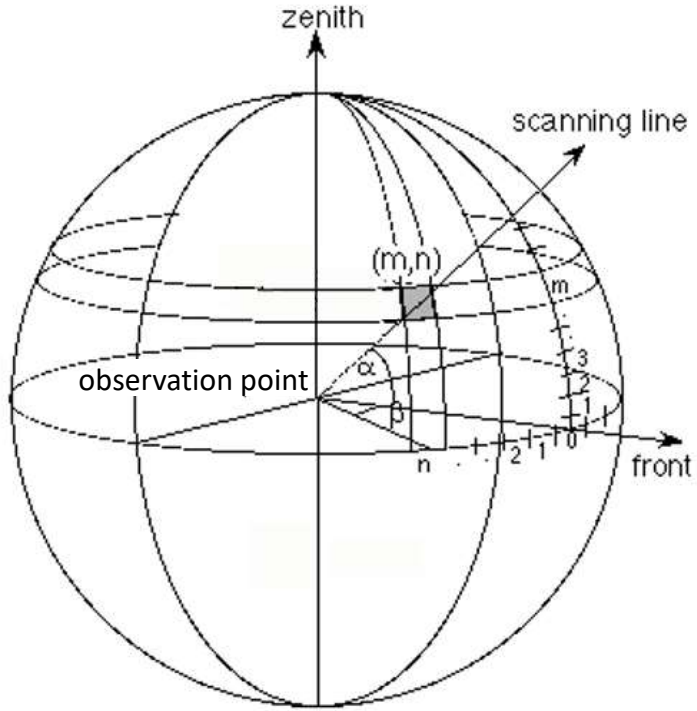


An example of the result of measurement for the scene by the computer program

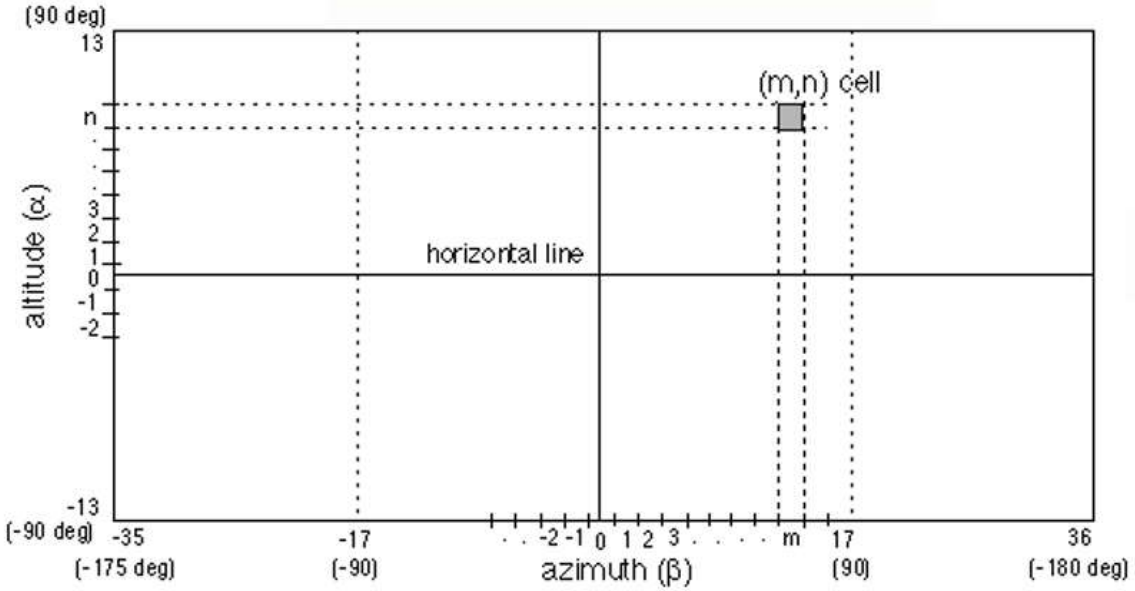


Visible area of basic components of environmental surfaces are measured

Principles and processes of measurement



Projection sphere



Projection spherical surface developed on a plane

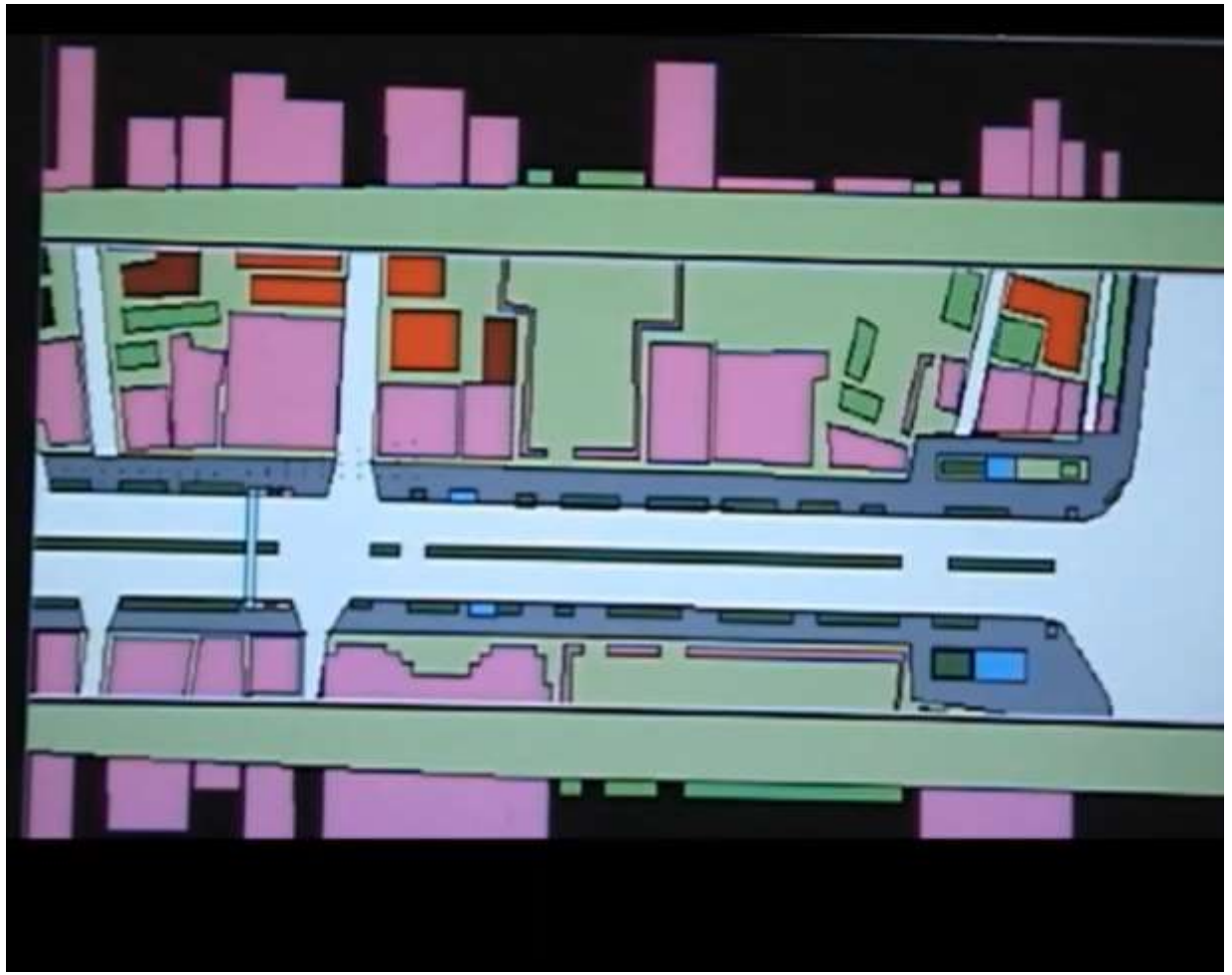
- The program identifies the array of visible surfaces of various components by numerous scanning lines radiating from an observation point in all directions with equal density.
- At the same time, it measures the distance between the surfaces and the observation point.
- The result is recorded in a cell on the projection sphere, which is unfolded on the plane shown on the right.

Environmental Data

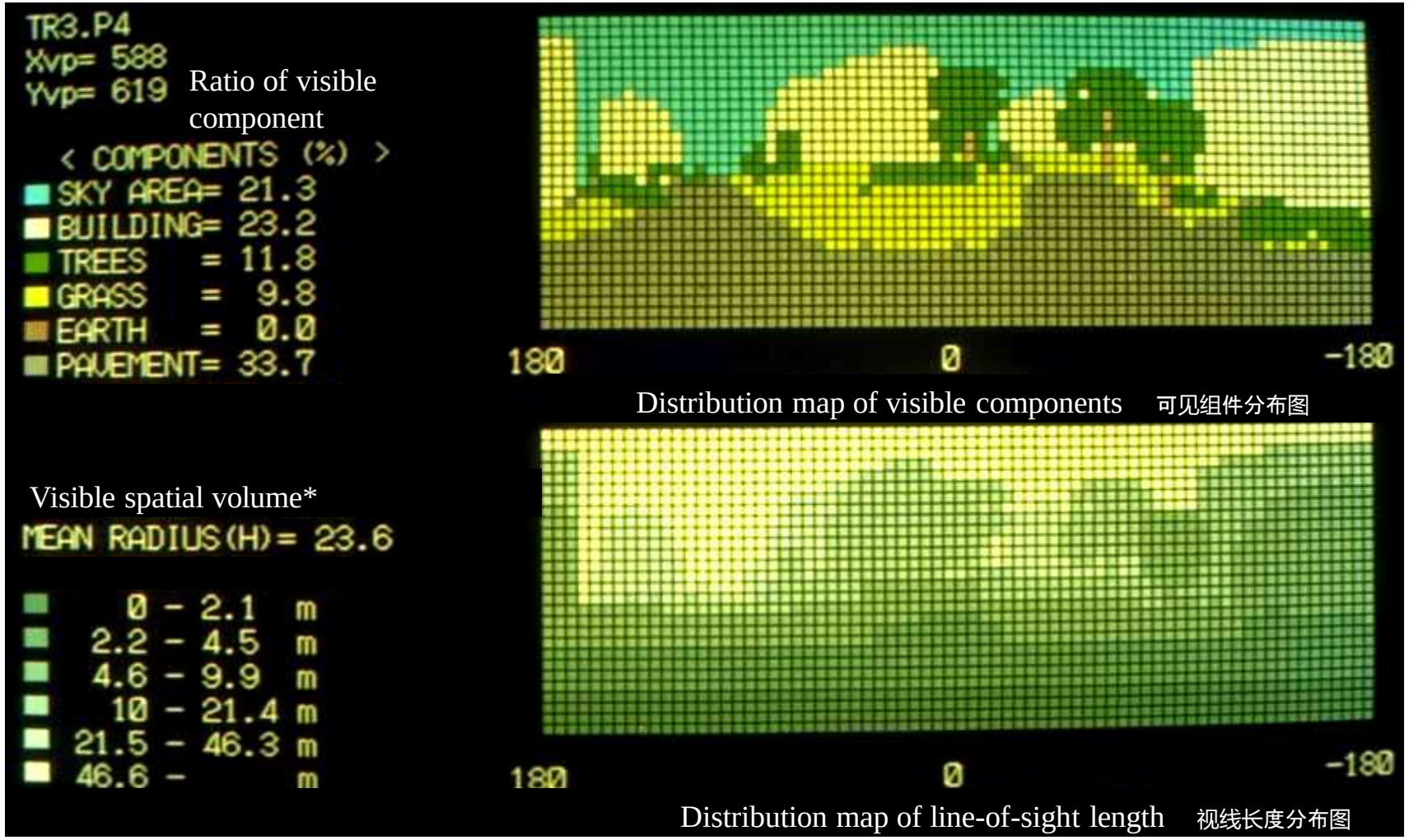
(a) Terrain data

(b) Site plan data

Measurement process of the program



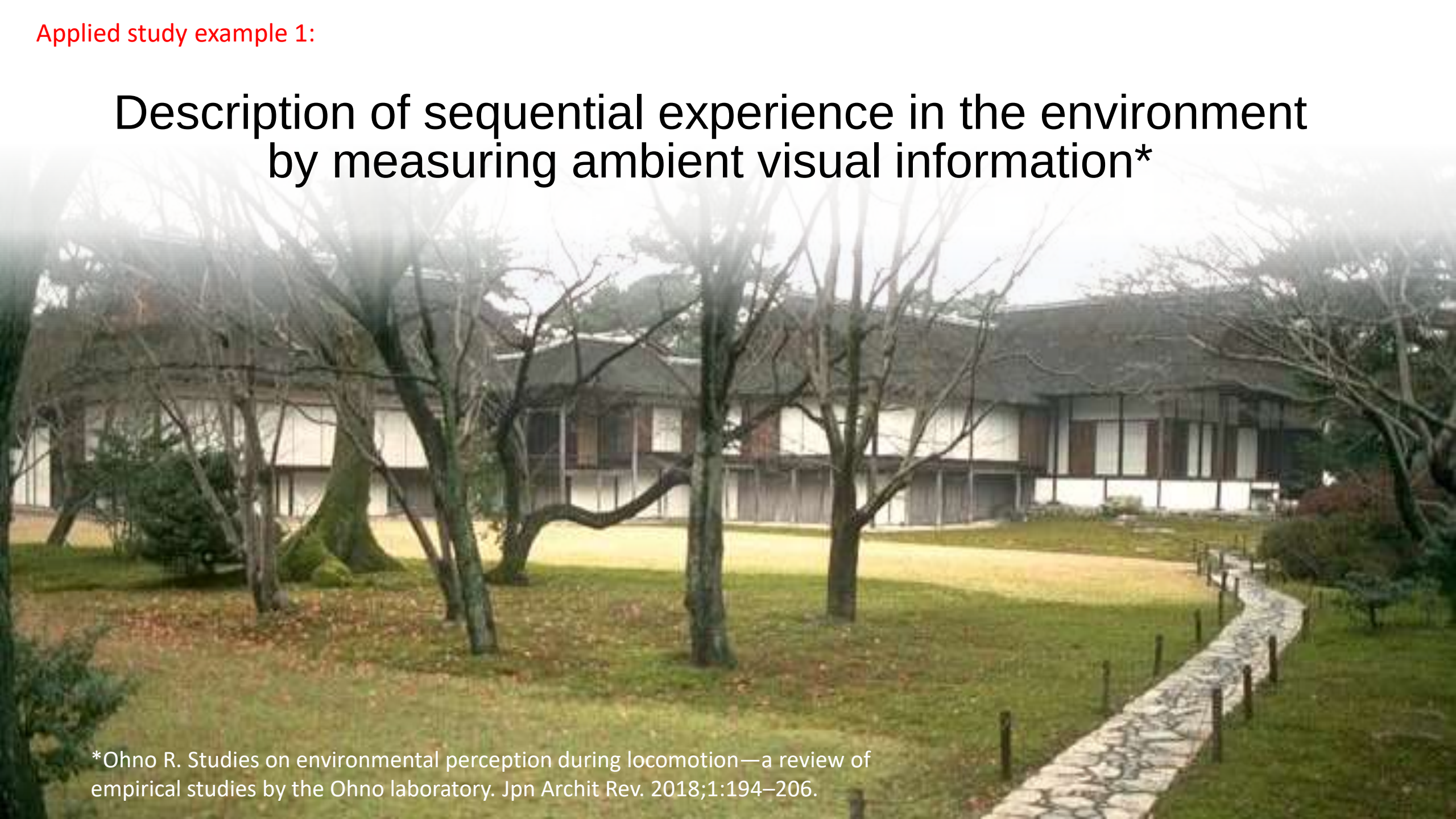
An example of measurement result



* The visible spatial volume is the average value of all scanning lines (1944 lines), and corresponds to the radius when replaced with a sphere.

Applied study example 1:

Description of sequential experience in the environment by measuring ambient visual information*



*Ohno R. Studies on environmental perception during locomotion—a review of empirical studies by the Ohno laboratory. Jpn Archit Rev. 2018;1:194–206.

Japanese circuit-style garden (Katsura Rikyu, Kyoto)

The Japanese circuit-style garden is designed for visitors to enjoy the shifting scenery while walking on a winding path around a central pond.

Garden type classification from the observer's viewpoint

Japan ⇔ Western

Fixed viewpoint

Garden to sit and watch

French garden

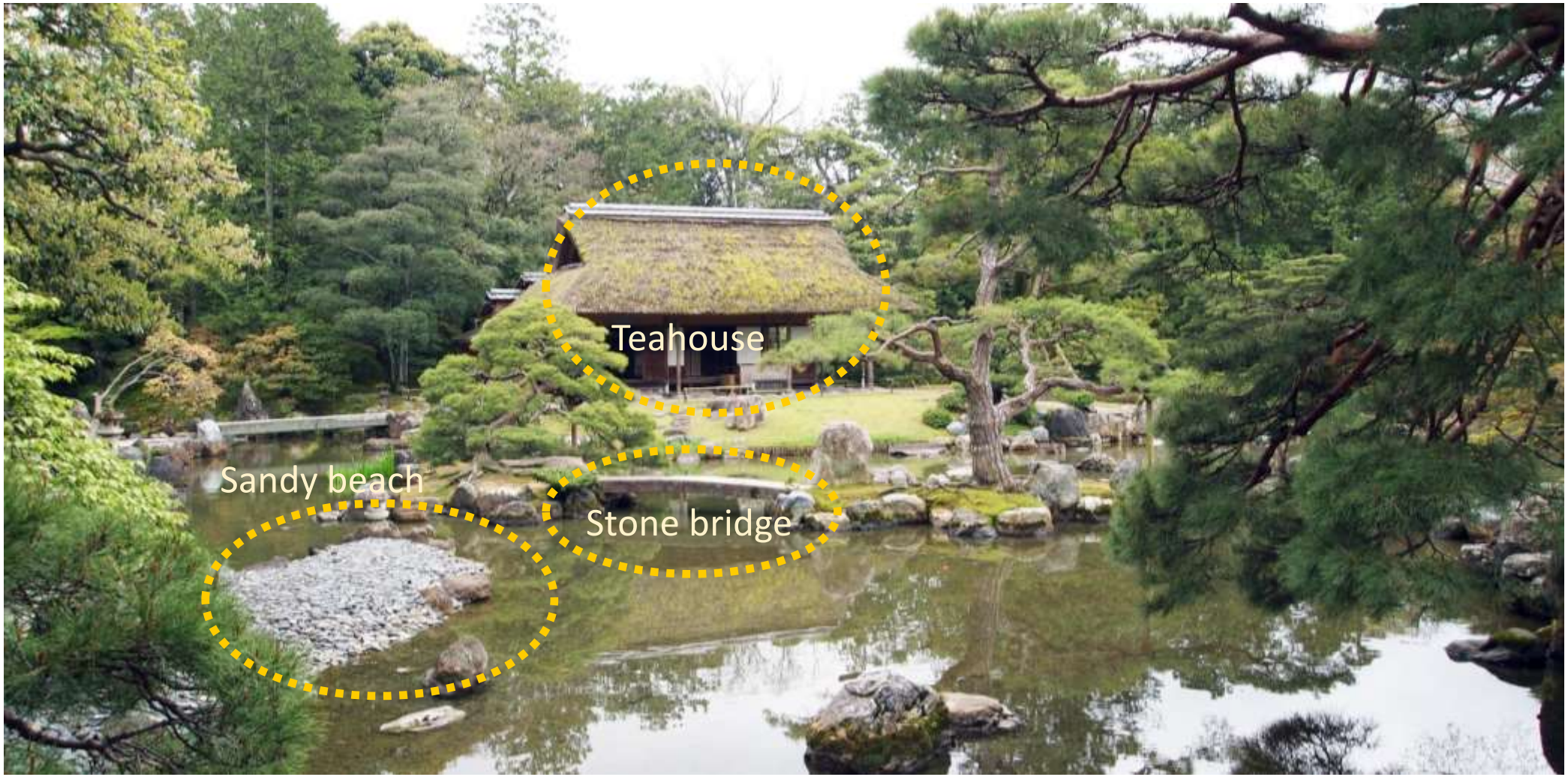
Moving viewpoint

Circuit-style garden

English landscape garden

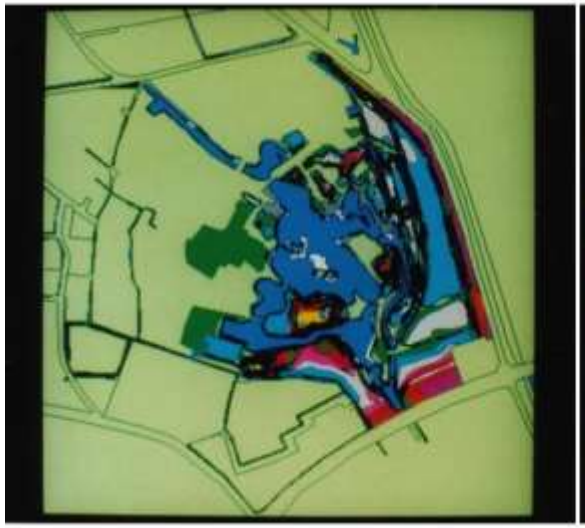
English landscape garden (Stourhead, England)

Appreciation of the garden by the focal vs. ambient information



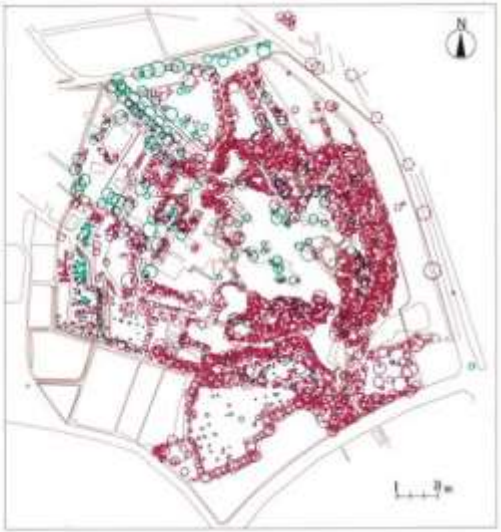

聚松

Procedure of computer analysis of a Japanese circuit-style garden



(a) Terrain data

(b) Site plan data

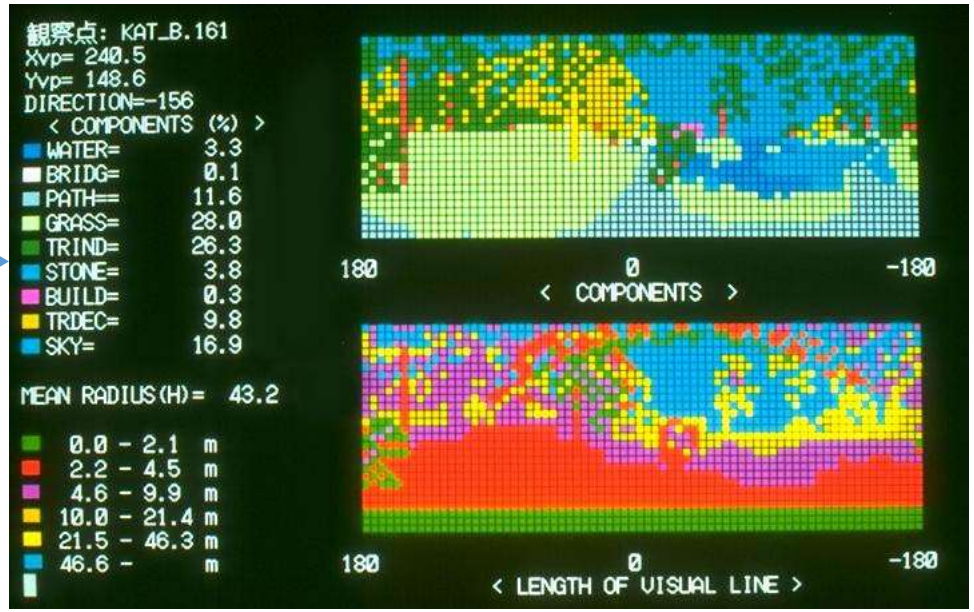


(c) Tree data

(d) Observation point data

Measurement of ambient visual information around an observer

An example of the analysis results



Changes in ambient visual information (visible amount) in the Japanese garden

This figure shows the ratio of each visible component of the garden at a series of observation points along the path.

We are trying to explain the change in atmosphere as we walk through the garden by this method of describing ambient visual information.

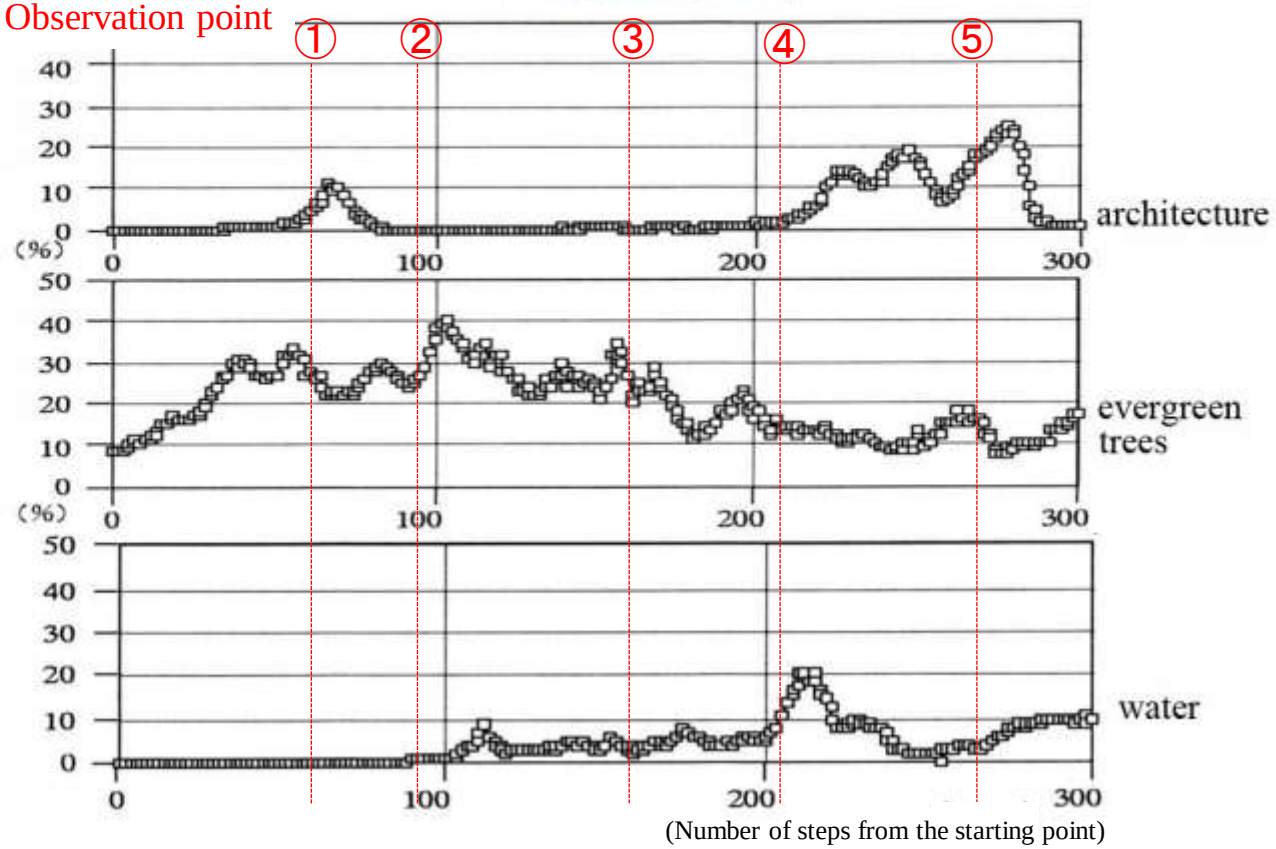
②

Observation point ①

③

④

⑤



Observation points along the garden path

Profiles of measured visible components

（Only a part of the measurement result is shown）

Applied study example 2:

Influence of ambient visual information on people's behavior in the circuit-style garden

In this study*, we attempted to reveal how ambient visual information affects behavior in a Japanese garden.

Experiment

- The 21 participants were asked to walk freely on the garden path one by one.
- The points where the behaviors such as stopping, changing the walking speed, and looking around were recorded by a video camera.

Measurement of Sensory Information

The computer program explained above was applied to measure ambient visual information along the path.

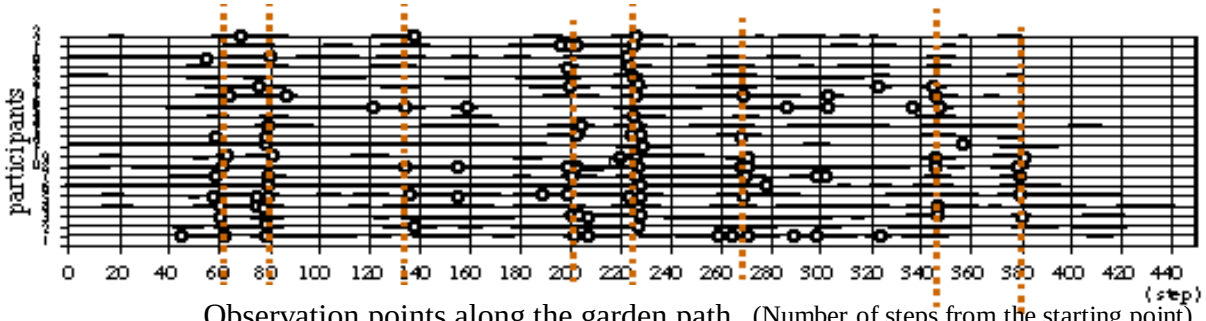
Sorakuen garden, Kobe

*Ryuzo Ohno, Tomohiro Hata, Miki Kondo: Experiencing Japanese Gardens: Sensory information and behavior, in J. Demick, et al. (Eds.), *Handbook of Japan-United States Environment-Behavior Research*, Plenum Press, pp. 163-182, 1997.

The results of the experiment

- In the **figure above**, each horizontal line shows each participant's behavior along the garden path (440steps =220m).
- The thick line indicates the zones where participant slowed down, and the small circle indicates the points where they made a stop.
- From this figure, we noticed the circles form several vertical lines or clusters.
- This indicates that the places where these actions tended to occur are fairly common among the participants.

- **The figure below** shows the viewing directions of participants by arrows on the map.
- The length of the arrows indicates the number of participants who viewed the same direction from an observation point.
- From this figure, it is also noted the tendency to choose similar places to stop and look in a certain direction.

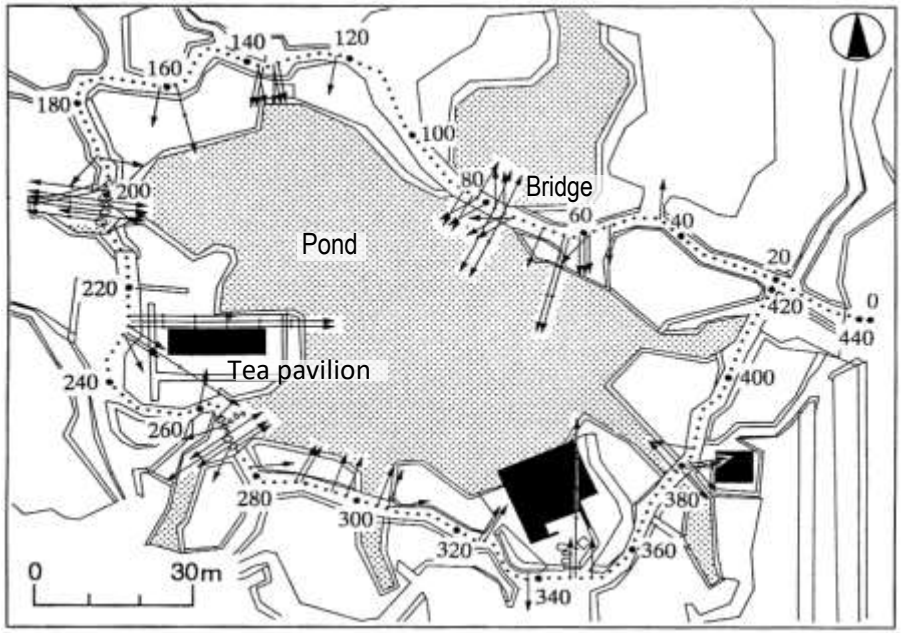


Observation points along the garden path (Number of steps from the starting point)

--: slow walk zone

o: stopped point

Each participant's behavior concerning where they slowed down and made a stop.



The stopped points and viewing directions

The result of measurement

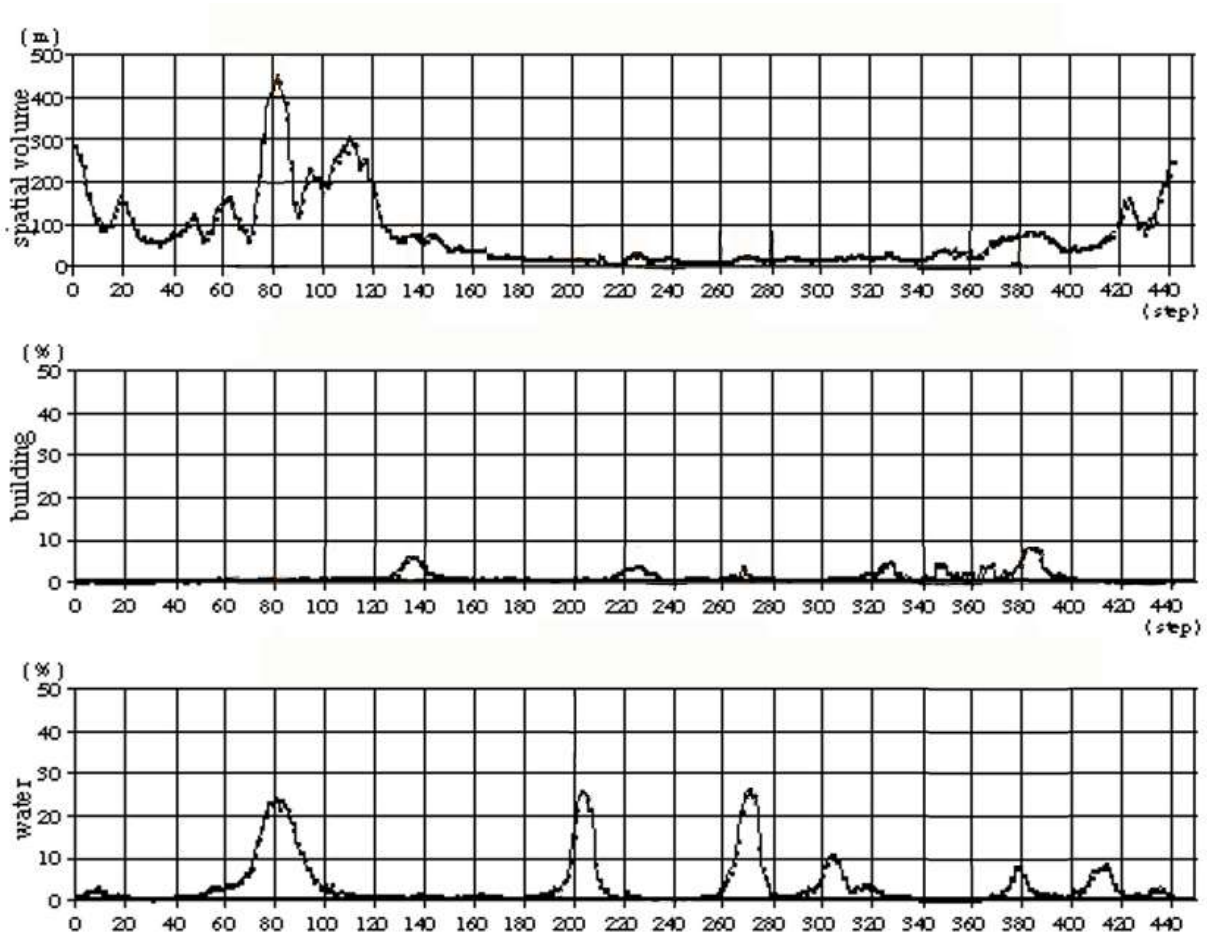
Measured profiles of the ambient visual information

Spatial volume

visible components

Buildings

Water surface



Observation points along the garden path (Number of steps from the starting point)

Correspondence between measured ambient visual information and behavior

It was found that the point where the participants stopped on the garden path was the point where the spatial volume increased sharply, and also the point where the visibility (solid angle) of the building and the water surface increased.

Behaviors:

Stopping, changing the walking speed

--: slow walk zone

o: stopped point

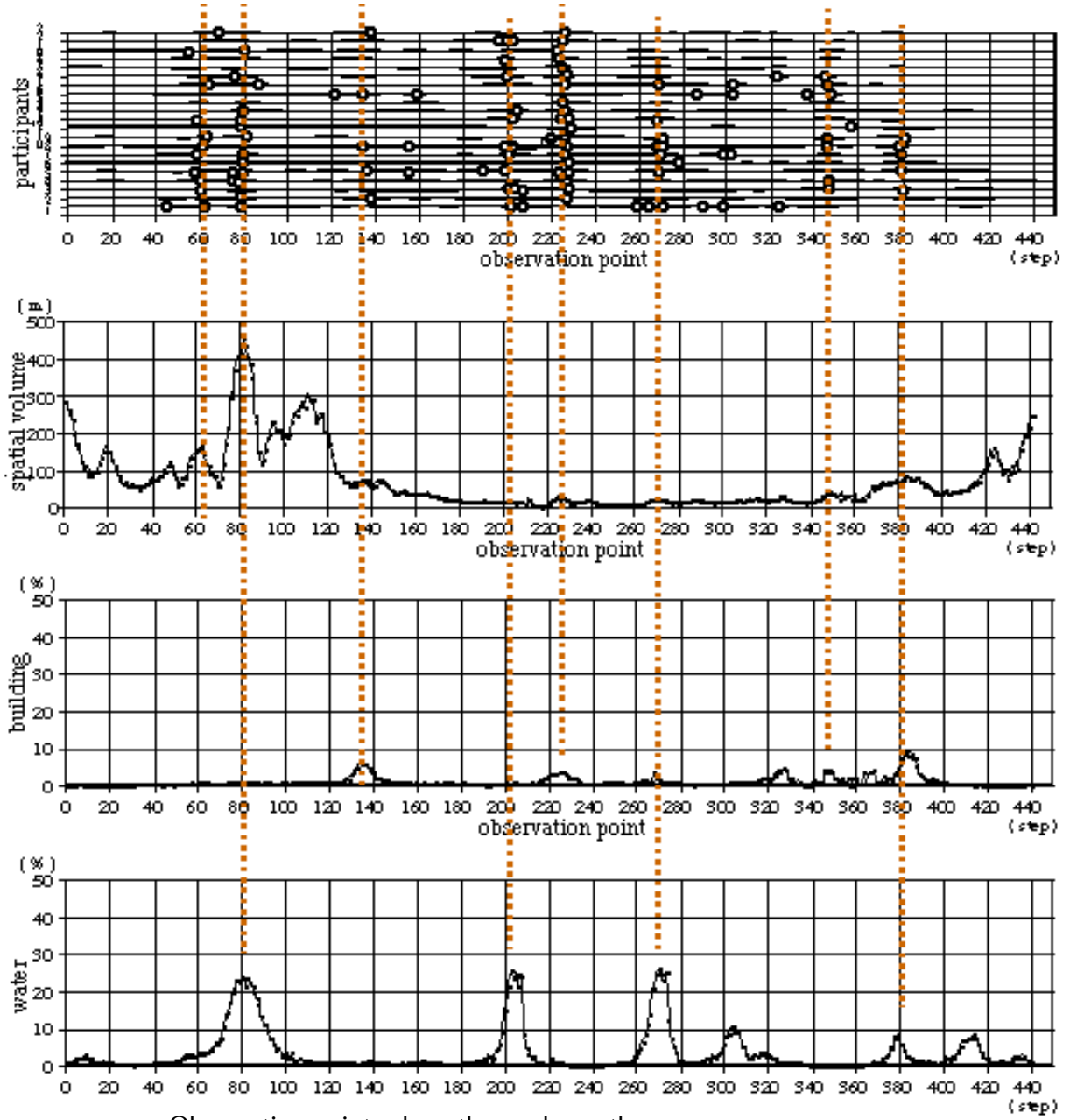
Measured profiles of the ambient visual information

Spatial volume

visible components

Buildings

Water surface



Observation points along the garden path (Number of steps from the starting point)

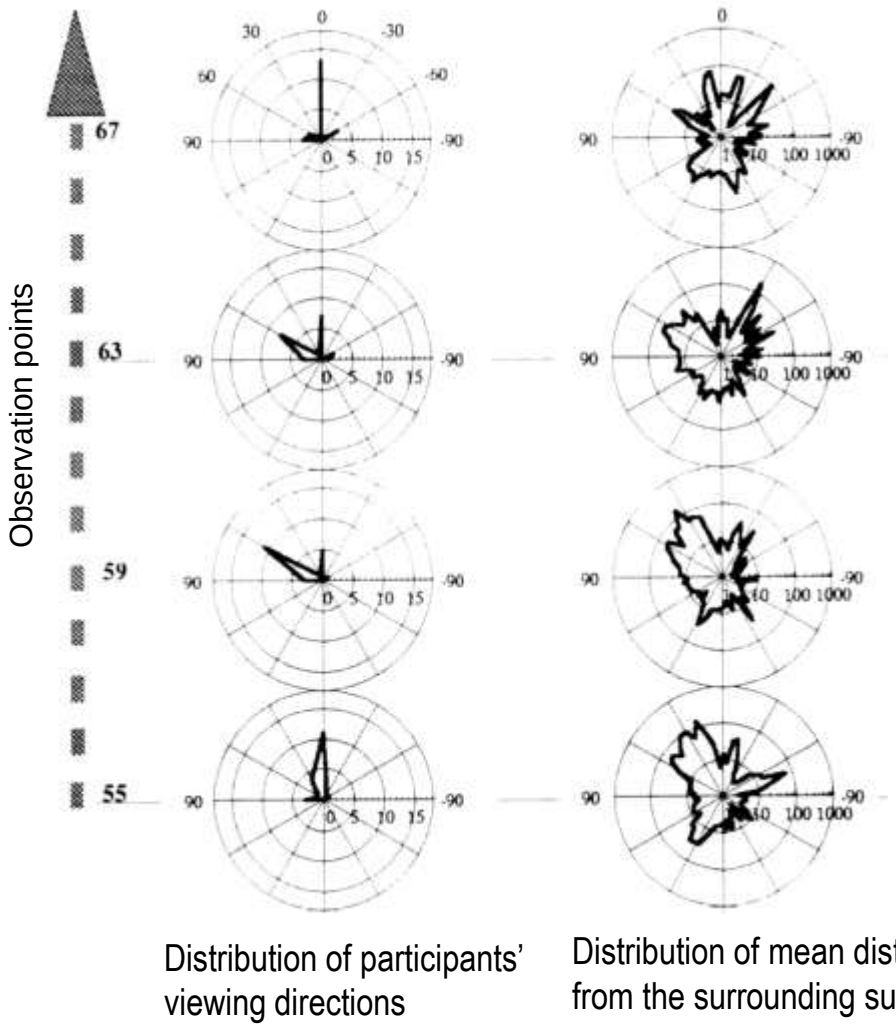
Correspondence between measured expanse of the surrounding space and viewing direction

- The figure exemplifies the relationship between the direction seen by the participants and the expanse of the surrounding space.
- It seems that the deflection of the viewing direction can be explained by the asymmetry of the spread of the visible space.

Conclusion

This study revealed that the participants commonly change their behavior when their ambient vision detects a sudden change in the surrounding scenes.

This study suggests that measurements of sensory information in the environment can help predict human behavior to some extent.



Correspondence between the direction seen by the participants and the spatial volume

Applied study example 3:

Feeling of oppression from the surrounding environment while walking*

The experimental site: Suzukakedai campus of Tokyo Institute of Technology (1998)

A series of experiments was conducted to record the pedestrian's feelings of "oppression" and "release" experienced while moving through an exterior space. And it was discussed using measured ambient visual information.

(present)

*Ohno R., Tsujiuchi R., Inagami M.: A Method of Continuous Rating for Psychological Impact while Moving through Exterior Space: A study on description method of ambient visual information and its application (Paart2), *J. Archit. Plann*., AIJ, No. 570, 65-69,Aug., 2003.

(Further research: Inagami M., Ohno R.: Anisotropy of environmental perception caused by spatial changes during locomotion, *Journal of Environmental Psychology*, Elsevier Science Ltd., Vol. 30, no. 2, pp. 258-266, Jun. 2010.)

Experimental route
（425m）













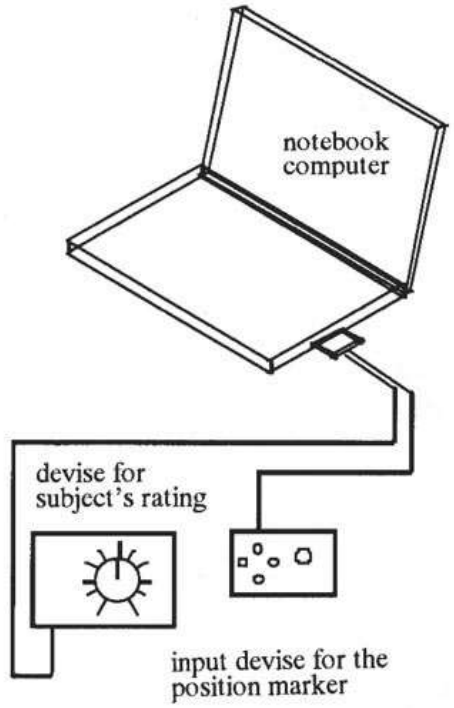



Experimental apparatus

We developed an apparatus to continuously record the varying intensity of psychological impacts during a participant moving through an environment.

The apparatus transformed the turning angle the knob into an electrical signal, which was recorded every 0.2 seconds on a laptop computer in a backpack carried by the participant.

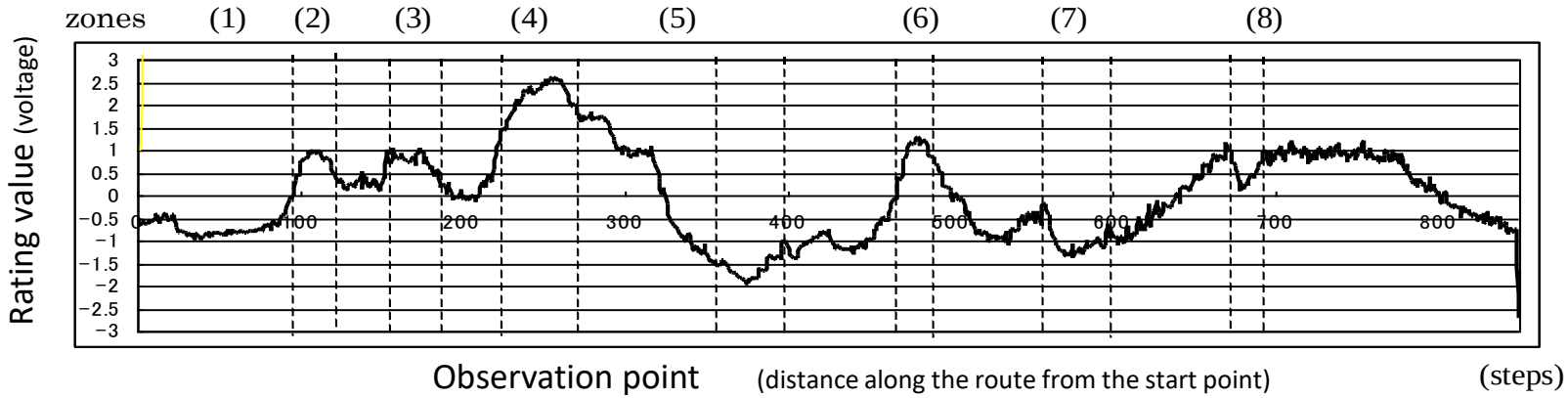
An experimenter walked behind the participant and operated a position-marking device when he or she passed a designated position along the route.



The experimental apparatus

Result of Experiment

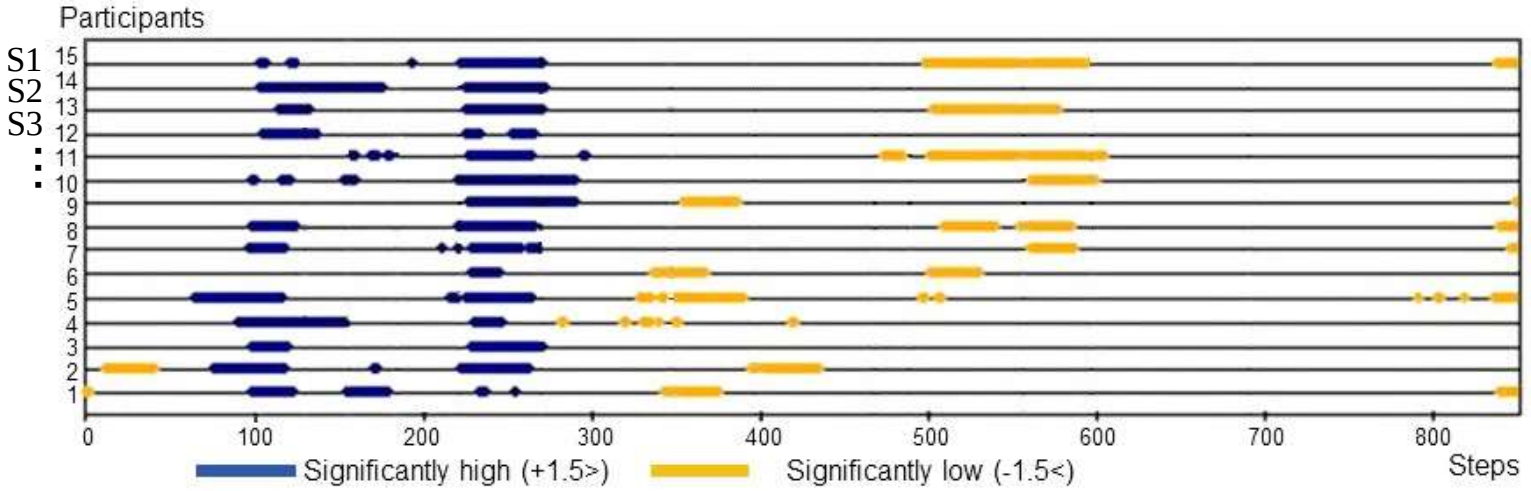
The feeling of oppression is great in the gaps between tall buildings (Zone 2), in the tunnel (Zone 4), and beside the high concrete retaining wall (Zone 8).



An example of rating results for the feeling of “oppression”

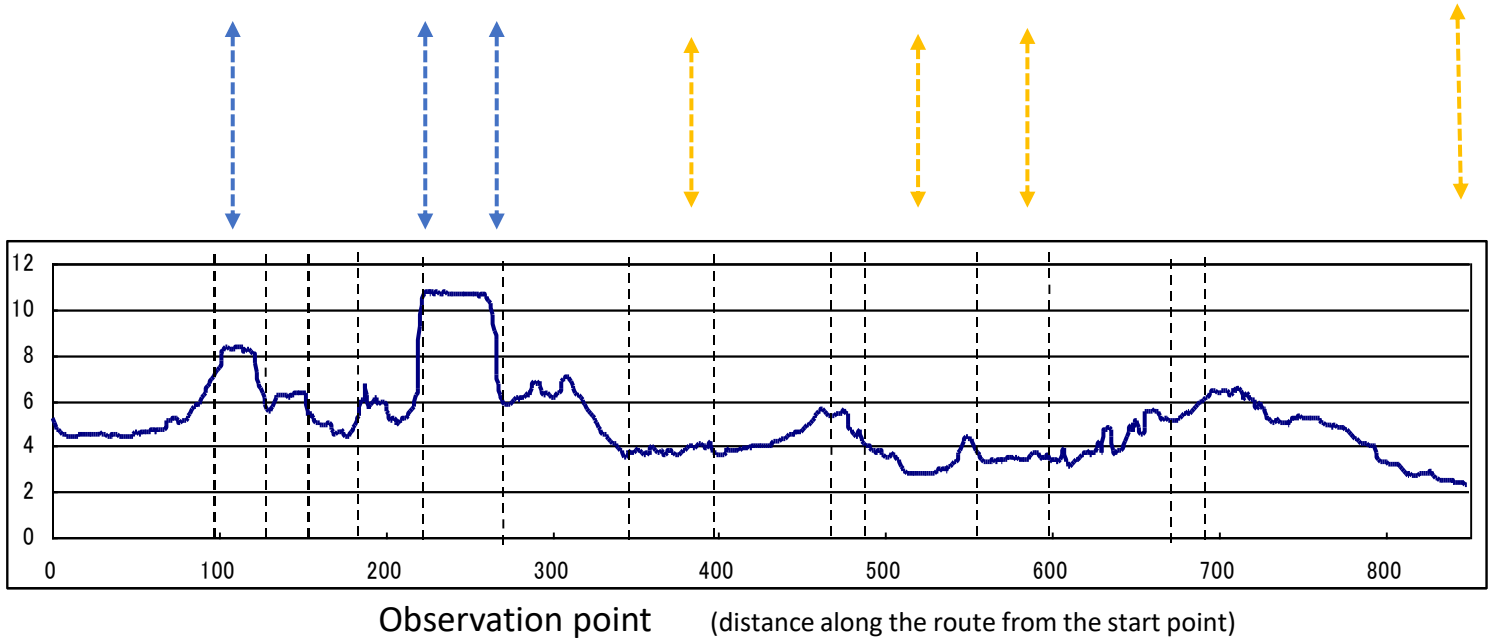
Result of Experiment

- This figure shows the rating results of each participant with a single horizontal line.
- The blue and yellow bands on the line indicate where the participants rated the "feeling of oppression" as significantly higher or lower, respectively.



The feeling of “oppression” rated by all participants

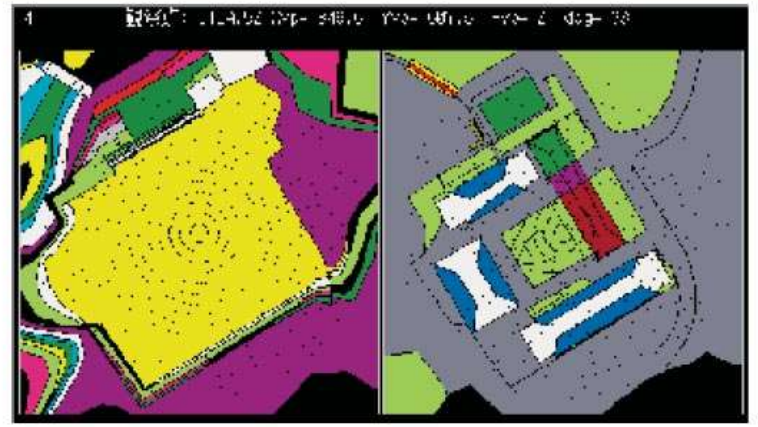
- This result shows that the high and low ratings of oppressive feeling are quite common among the participants.
- Therefore, we decided to use the average value of all participants to express the degree of oppression of the tested route.

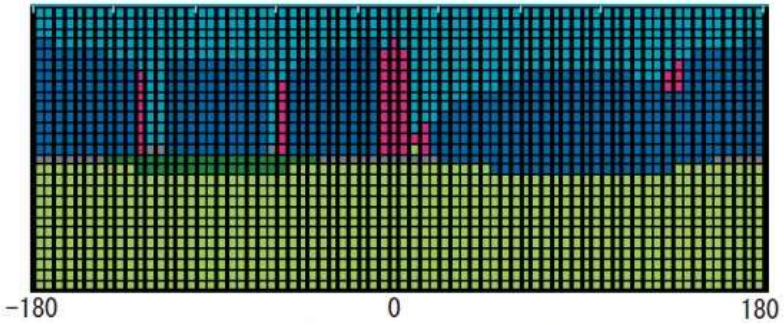


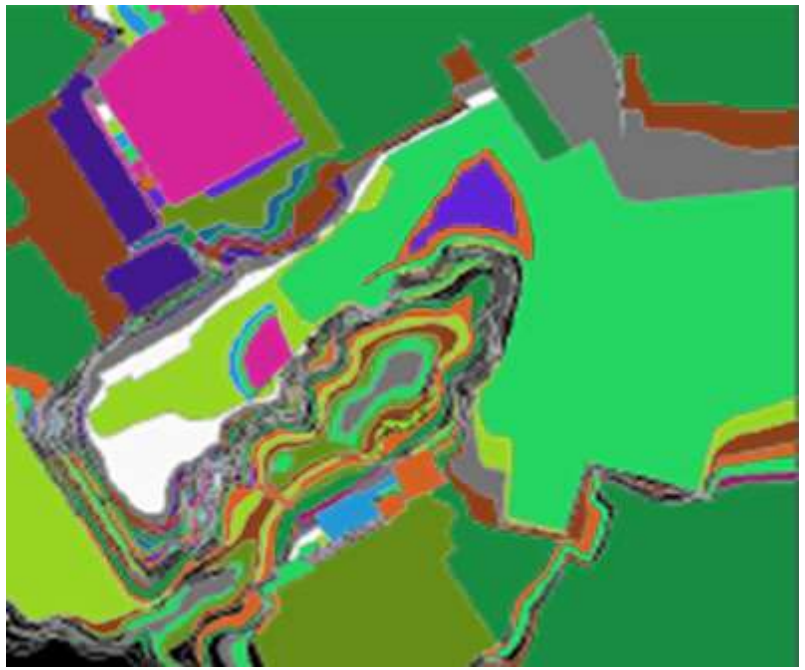
Average value of "feeling of oppression" rating along the tested route

Measurement of ambient visual information

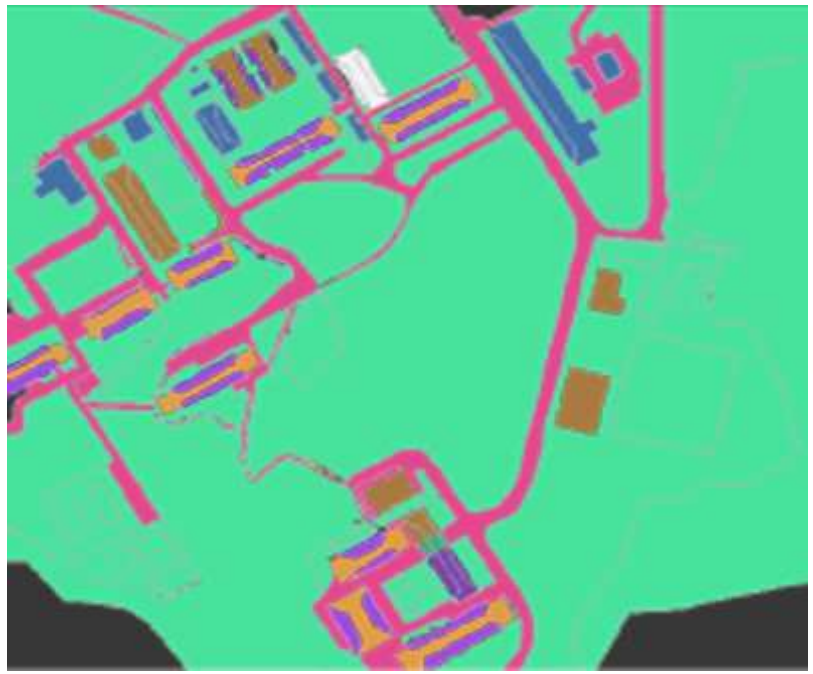
The program was again applied to a sequence of observation points along the experimental route.







(a) Terrain data

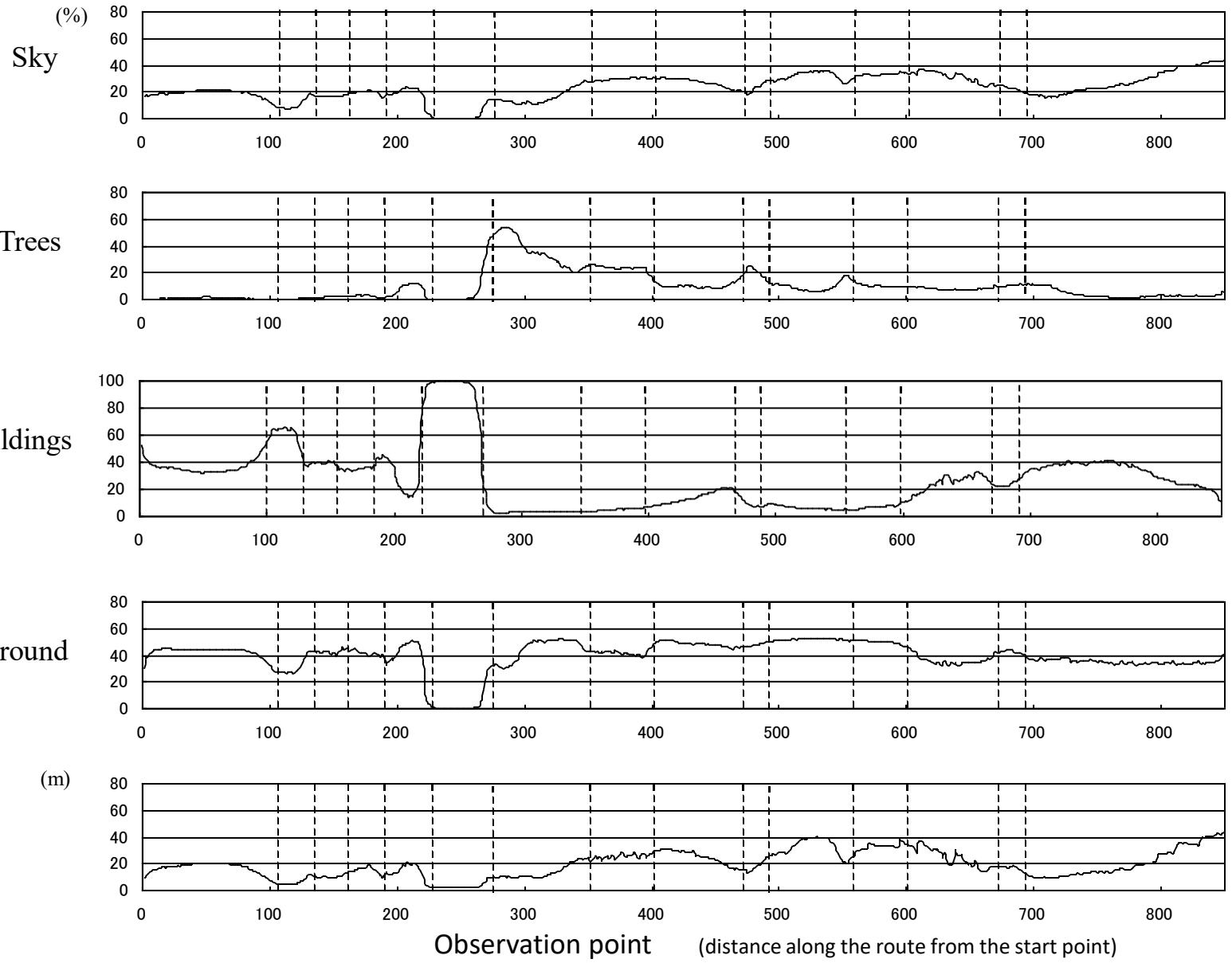


(b) Site plan data

Procedure of computer analysis

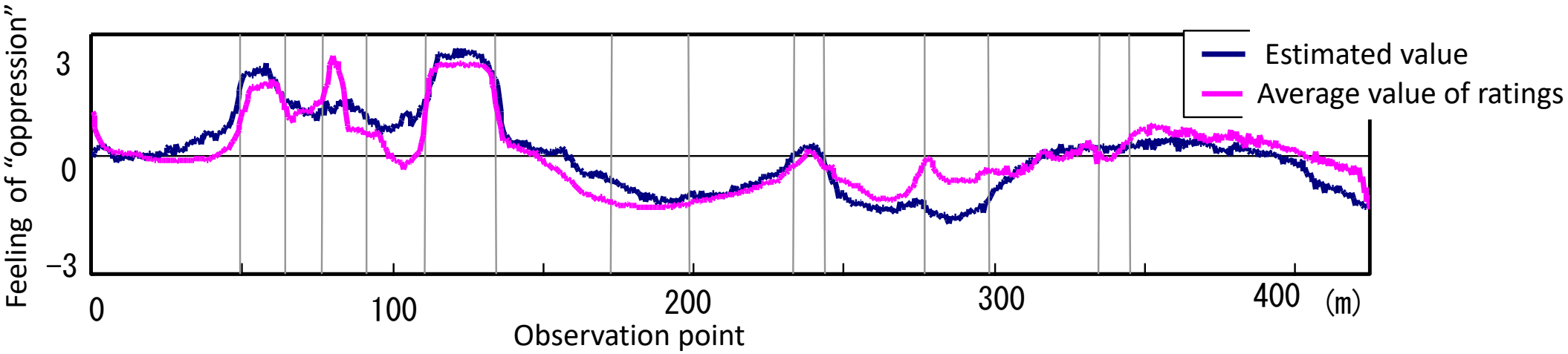
Results of measurement

Measured profiles of component's visibility



Spatial volume

Estimation of the feeling of “oppression” by ambient visual information



$$So = 0.057 \times B + 0.045 \times T_B + 0.060 \times T_S - 2.019$$

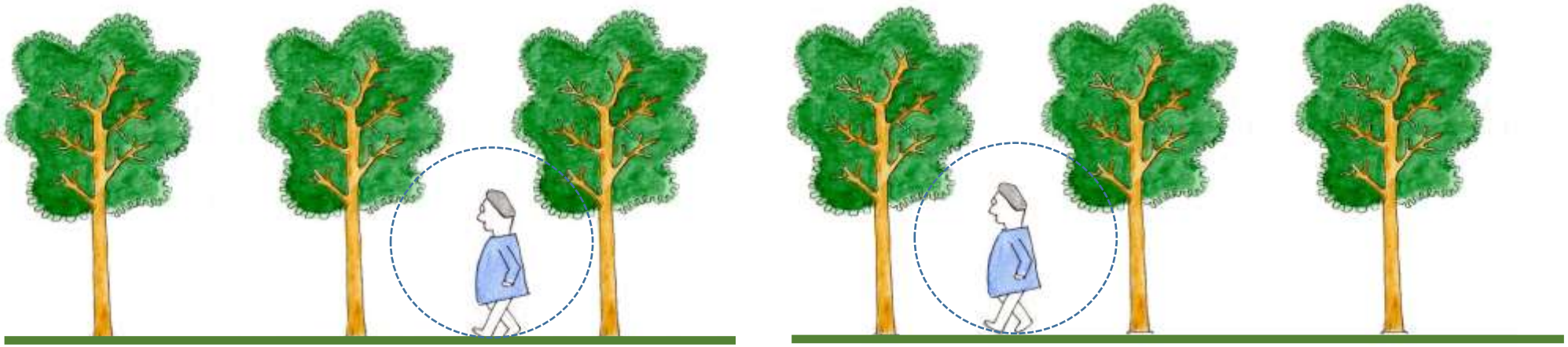
Where
So : Estimated value of “oppression”
B : the visible areas of buildings
T_B : the visible areas of trees that overlay buildings
T_S : the visible areas of trees that overlay the sky

Conclusion

From this study, it was found that the feeling of oppression can be fairly well predicted by the amount of visibility of buildings and trees measured evenly from **all directions**.

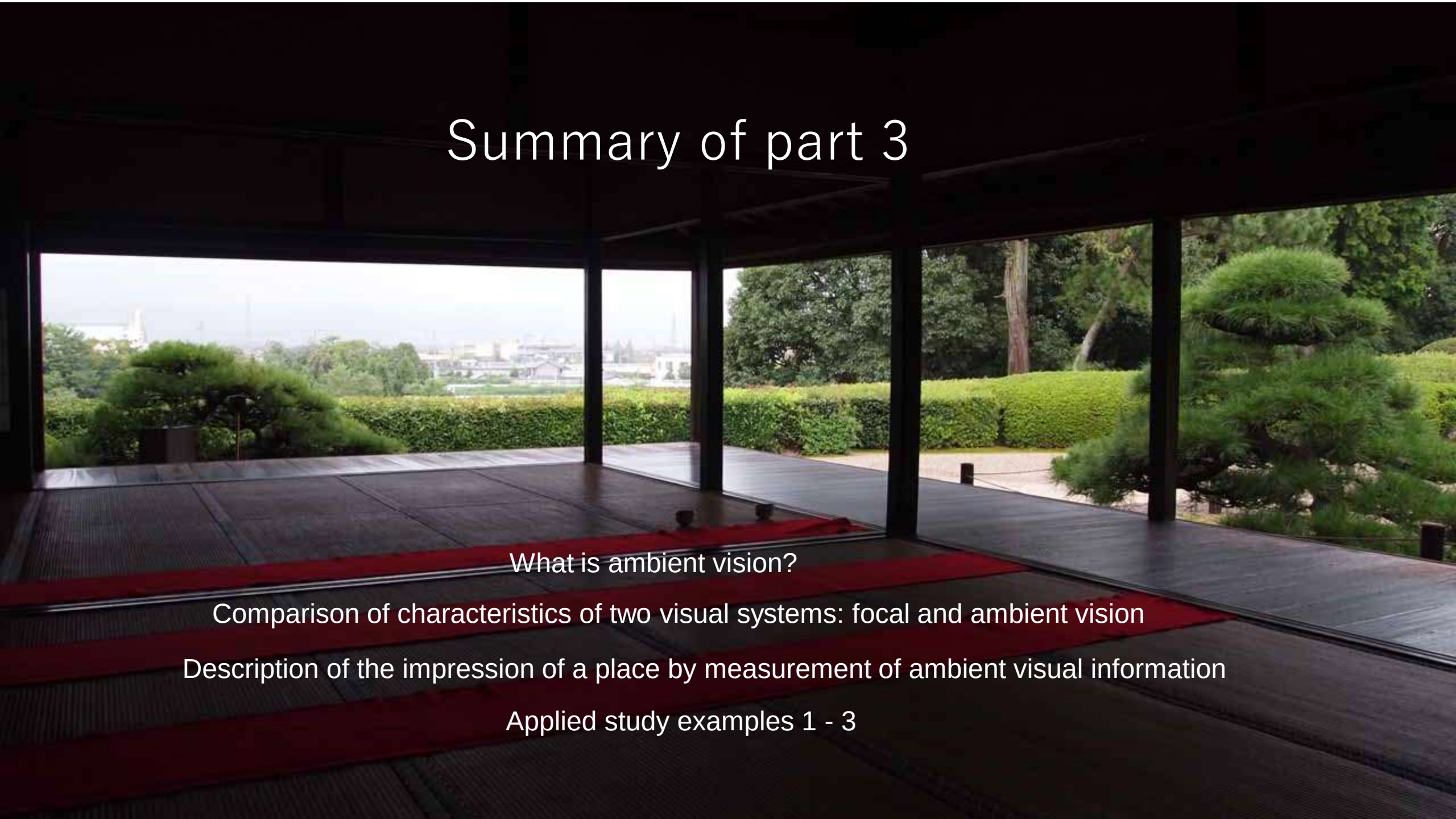
Furthermore, it is suggested that the impression received from a place generally depends not only on the visual information in the visual field at a certain moment.

Impression of a place received by Ambient vision



The impression of a place by ambient vision depends not only on the scene you are seeing at a certain moment, but also on the scenes you have experienced before and cannot see it at the present.

Summary of part 3



What is ambient vision?

Comparison of characteristics of two visual systems: focal and ambient vision

Description of the impression of a place by measurement of ambient visual information

Applied study examples 1 - 3

Review of major points

1. Gap between users and environment designers: different schema
2. Characteristics of environment perception as contrasted with object perception
3. Environmental design considering senses other than vision
4. Sequential experience during locomotion
5. Concept of ambient vision and its application

URL: http://www.ohno-lab.jp