Study on Environmental Recognition of Super High-rise Housing Residents

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Abstract
This paper discusses the appropriate design for super high-rise housing. The population of Tokyo, which had been decreasing, began increasing again in 1997. High-rise and super high-rise housing, which allow people to live in urbanized areas, are some of the factors behind this population growth. Super high-rise housing is a new living environment, one that is cross-sectional rather than planar. Creating these residential spaces requires a design technique incorporating a multiplicity of layers on the premises, as well as input from the prospective residents. This paper describes one part of the design technique for super high-rise housing. The research was conducted at Ohkawabata River City 21, a model of super high-rise urban housing. The research included a questionnaire, aggregative analysis theory, and aggregate curve. From the above research, the attributions of environmental cognition and life territory were determined, particularly those regarding the floors of residents of super high rise towers. This paper provides the appropriate attribution of the data for the design technique.

Keywords: super high-rise housing residents; livelihood sphere; environmental recognition; cognitive area; urban dwelling

1. Introduction
The population of Tokyo, which had been decreasing, began increasing again in 1997. High-rise and super high-rise housing, which allow people to live in urbanized areas, are some of the factors behind this population growth. Recently, the supply of super high-rise housing has increased considerably. Sixty percent of the super high-rise housing being planned is within the 23 wards of Tokyo. It is expected that the number of super high-rise housing will increase further in the future, making super high-rise housing the primary type of housing project. However, for the people that live in them, super high-rise housing is a new living environment that must reflect their needs and desires.

Super high-rise housing is now a mainstream concept of current housing projects. As residences, these living environments are cross-sectional rather than planar in design. Designing super high-rise housing requires a technique that incorporates a multiplicity of layers on the premises. In a previous study of super high-rise housing, Koitou (2004) examined the relationship between high-rise housing and the surrounding area from the aspect of recognition of inhabitants at the boundary, and determined the main factor leading the formation of the community between the residents and the inhabitants at the boundary. In terms of technique, Saitou (2003) simulated solar irradiation and daylight, then established attributes for each pattern. Regarding the perceptions of the residents, Asanuma (2001) studied recognition of housing by elderly persons living by themselves.

This paper studied the residents of a super high-rise housing project in the center of Tokyo called “Ohkawabata River City 21,” which is a pioneering model of super high-rise urban housing. This research investigates, analyzes, and considers the needs and desires of the resident (elementary school student age and older) in relation to the floors of their residences. Previous studies of housing projects have paid little attention to these needs and desires. The purpose of this research is to gain an understanding of the residents’ perceptions of their life and environment in super high-rise housing.
2. Research area

The research was carried out on Ohkawabata River City 21. Located just 2 km east of Tokyo station, this development contains super high-rise, high-rise, and mid-rise residential towers along the leafy waterfront of the Sumida River. Ohkawabata River City 21 is one of the pioneering Tokyo Bay waterfront development projects.

The development site was formerly a vacant lot owned by Ishikawajima-Harima Heavy Industries Co., Ltd, who once operated a large factory here. Development was carried out by the Tokyo Metropolitan Government, the Tokyo Metropolitan Government Bureau of Housing, the Housing and Urban Renaissance Agency (Urban Development Corporation, and Mitsui Real Estate Development Co., Ltd. The official name of the project is the Ohkawabata Area Urban Development Project.

The project contains seven super high-rise residential towers, each of which has more than 20 floors. The super high-rise, high-rise and mid-rise residential buildings contain a total of "approx. 4,000 residences. Several green areas and public parks lie along the Sumida River. The project also contains many public facilities. The high-rise towers have a commanding view of the entire Tokyo metropolitan area. (Figs. 2-1. and 2-2. and Table 1.)

![Fig.2-1. Arrangement Plan](image)

Project name and location
Ohkawabata Area Urban Development Project
Ohkawabata area (28.7ha)
Tsukuda 1-chome and 2-chome, and Shinkawa 2-chome, Chuou-ku Tokyo, Japan

![Table 1. Compendium of Data on Examinee](image)
3. Method of investigation and analysis

3.1 Survey (Table 2.)

The subject of this research study, the Ohkawabata River City 21, has seven super high-rise residential towers*1. Together with the middle and high-rise residential buildings, they provide 4,000 residences.

Period: August 2002

Method: a field survey was carried out using the sphere graphic method*2. The subjects of the survey were the residents of the seven super high-rise residential towers. (Table 1.) In order to elicit clear perceptions of the environmental conditions, the questionnaire was given only to residents who were more than 10 years old.

The survey was carried out in various living and working areas, including parks, promenades, and commercial facilities, in order to obtain samples from all of the different environments of the development. A total of 142 samples were obtained. (Table 2.)

3.2 Item of questionnaire

I. Subject Attribute

II. Perceived range of neighborhood

III. Routine route

IV. Perceived range of activities

V. Elements of perceived range of activities

VI. Perceived ranges of 'my town,' 'familiar waterside,' 'familiar green space,' and 'urban activity'

VII. Elements of perceived areas

VIII. Landmarks

IX. Comparison of past and present habitats

The analysis considered the date on which the survey was executed as well as the above-mentioned method and contents.

3.3 Contents and method of questionnaire (Table 3.)

I. Subject Attribute

Sex. Age. Occupation. Years of residence at current location. Former residence types. Name of residential building. Floor number of residence. Orientation of unit. Means of transportation.

II. Cognitive area

Perceived ranges of 'my town,' (hereinafter referred to as Town) 'familiar waterside,' 'familiar green space,' 'urban activity' 'Cognitive areas of Town, Sea, and Mountain,' 'Elements of each area'

Respondents were asked to circle areas on a map that represented their images of Town, Sea, and Mountain, and then circle the factors that contribute to their perceptions.

III. Perceived range of neighborhood

Respondents were asked to circle areas corresponding to the perceived range of their neighborhood on the map, and then circle the factors that contribute to their perceptions.

IV. Routine route

Respondents were asked to draw a map of their daily movements, and note the frequency of these movements ("Almost every day," "Once or twice a week," "Two or three times a month")
V. Perceived range of activities and elements of perceived range of activities

Respondents were asked to circle on a map the area corresponding to their perceived range of activities and specify the activities.

VI. Landmarks

Respondents were asked to draw on a map as many details and impressions of the Town as they could remember. Objects other than buildings were also acceptable. (Places, events, trees, signs, comparisons of past and present habitats, etc.)

Respondents were asked to compare past and present habitats and describe what had changed, improved, and/or deteriorated.

The analysis considered the date on which the survey was executed as well as the above-mentioned methods and contents.

4. Cognitive areas

Using the cognitive area map, this chapter examines the awareness of the residents' perceptions regarding the extent, cognitive degree, constituent factors, and character of the recognized area of each item. The cognitive area map is derived from an aggregative analysis based on the results of questionnaire surveys using the sphere graphic method. Comparisons of these maps show the mutual relationships of each area.

The considerations and cognitive area map of each area are described below.

My town (Fig.3-1.)

In this map, cognition is concentrated on the super high-rise residential tower group. Cognition tends to increase in the direction of the super high-rise residential tower group located on the Sumida River. For the aggregative indicator, the super high-rise residential towers are very frequently selected as the constituent factor of the cognitive area and the landmarks. And “living” is very frequently given as the reason for circling the area. According to the above, super high-rise residential towers are very important for the residents' cognition and feeling of belonging. The Sumida River is considered the boundary of the cognitive area, since cognition of the super high-rise residential towers is extremely high.

Familiar waterside (Fig.3-2.)

In this map, cognition is concentrated along the Sumida River, especially on the super high-rise tower side of the river. Cognition tends to increase toward the point where the river forks. For the aggregative indicator, the Sumida River is very frequently selected as the constituent factor of the cognitive area and the reason for circling the area. It also was often selected as a constituent factor of the cognitive area of the landmark. These results show that cognition is extremely concentrated around the Sumida River.

Familiar green space (Fig.3-3.)

In this map, cognition is concentrated around Tsukuda Park. Cognition tends to increase toward Tsukuda Park and the avenue along the promenade.
For the aggregative indicator, cherry-blossoms are most frequently given as the constituent factor of the cognitive area. After cherry blossoms, Tsukuda Park was most often selected. "Abundant green" is very frequently given as the reason for circling the area. These results show that Tsukuda Park has a significant effect on the residents' cognition.

**Bustle** (Fig.3-4.)

In this map, cognition is concentrated on the shopping district of Nishinaka, especially near Tsukishima Station. Cognition tends to increase toward the Nishinaka shopping district and the Rinkosu supermarket.

For the aggregative indicator, the Nishinaka shopping district is most frequently selected as the constituent factor of the cognitive area. A specific reason for this cognition is the "Monjayaki," a traditional and famous local cuisine of the area.

**Range of activities** (Fig.3-5.)

In this map, cognition is high in the entire River City 21 area, but is especially concentrated on the Rinkosu supermarket, Yunimarto, and a fitness gym. For the aggregative indicator, the above three answers ranked in the top 3 of items very frequently used.

Green space is the most frequently selected constituent factor of the cognitive area, followed by the Sumida River and the promenade. For the reason for circling the area, outdoor walking is most frequently mentioned, followed by "purchasing daily commodities." Because the constituent factor and the reason for circling the area have little in common, the cognitive area ranges widely throughout the entire River City 21 area.

The above trend in cognition indicates that the River City is convenient for daily life.

**Perceived range of the neighborhood** (Fig.3-6.)

In this map, cognition of the range of the neighborhood, like the range of activities, is high throughout the entire River City 21. It is particularly concentrated on the super high-rise residential towers and activity space.

For the aggregative indicator, both items are the main cognitive factors.

The above analyses are of two types. One type is attributable mainly to the residence in the perceived range of the neighborhood. Another type is the space to meet with people in the community.

The cognitive map of the range of activities and the perceived range of the neighborhood look very similar, which indicates a correlation.

The table in Fig.3-6. shows the rate of perception vs. no perception of the neighborhood inside the residence. In the vertical direction, upper floor residents frequently have higher rates of perception of neighborhood than lower floor residents.

5. Resident perceptions by floors
This study assumes that the floors of the residents influence the cognitive area. The residents are classified into one of four floor levels: low-rise, middle-rise, high-rise, and super-high-rise (Table 5).

Fig. 6 shows the attributes for the floors and the relationships between each cognitive area ('my town,' 'familiar waterside,' 'familiar green space,' 'bustle,' and 'perception of neighborhood'). (Fig. 6 and Table 5.)

The cognitive areas for 'familiar waterside,' 'familiar green space,' and 'my town' increased in size between the low to middle floors, but decreased in size between the high to super-high floors.

The cognitive area for 'bustle,' decreased in size between the low to high floors, but increased in size between the high to super-high floors.

The overlapping area for the four elements increased between the low to high floors, but decreased between the high to super-high floors.

The area of each cognitive area element correlated with the overlapping areas of the four elements. The area for 'perception of neighborhood (horizontal direction),' increased up to the middle floors, then decreased in the higher floors. The degree of neighborhood perception in the vertical direction continued to increase up to the super-high floors. In other words, there was a counter-correlation.

This study described the attributes of the residents on different floors of super high-rise residential towers, the formation of environmental cognition, and the living sphere.

6. Conclusions
The following are our findings obtained through analyses conducted on environmental recognition and life territory.

My town
Sumida River is the boundary line of the cognitive area, since cognition of the super high-rise residential towers is extremely high.

Water side
Cognition is highly concentrated around the Sumida River. The waterside and the promenade are extremely important spaces.
Green space
Tsukuda Park significantly affects the residents' cognition.

Bustle
The Nishinaka shopping district and Tukishima station are very important in the residents' cognition and consciousness of the area. “Monjayaki,” a traditional factor, is also important.

Range of activities
Cognition is high for the entire River City 21 area, but is particularly concentrated on facilities used in daily activities. Both daily activities and simple leisure activities can be satisfied in River City 21.

Perceived range of the neighborhood
There are two types of perceived range of the neighborhood. One type is attributable mainly to residences in the perceived range of the neighborhood. The other type is space for meeting with people in the community. Activities and perceptions of the neighborhood have an extremely high correlation.

The following are attributes relating to the floor of the residence.

Type I. Attributes of residents on 'low and middle floors'
I-A Residents have a tendency not to draw overlapping elements on the cognitive area map. Each element has its own cognitive area.

I-B The perception of 'neighborhood' in the horizontal direction is common and extends further on the lower floors than on the higher floors.

Type II. Attributes of residents on 'high and super-high floors'
II-A The elements of the cognitive area overlap, but become separated in the higher floors.

II-B The extent of the perception of neighborhood is low in the vertical direction and disappears completely in the higher floors.

The range of 'familiar green space' on the cognitive area map is broad and becomes broader in the higher floors.

The perception of 'neighborhood' in the vertical direction is relatively low on all floors.

This research determined the attributes of environmental cognition and life territory for the floors of residents of super-high-rise towers.

To extend this research and provide support for urban housing, future studies should consider the floors of the residences, more specifically, the relationships between each cognitive area, the relationships between the resident's perceptions, and the vicinity, prospective area, and aspects of space, should be considered. This data can be used to develop an appropriate design technique that incorporates a multiplicity of layers on the premises.

Notes
1. Super-high-rise housing tower
A residential building that is more than 60 meters tall is defined by regulations as a “super-high-rise.” In this study, the typical floor to floor height was 3 meters, so a tower of more than 20 stories high was defined as a “super-high-rise” residential tower. Residences on floors 1 to 3 are defined as "low-rise" residences, those on floors 4 and 5 as “middle-rise” residences, those on floors 6 to 19 as “high-rise” residences, and those above floor 20 as “super-high-rise” residences.

2. Sphere graphic method
This method is effective when focused on a subject who has adequate recognition of the area. It is suitable for studying relatively limited spaces in small areas, such as the area surrounding a personal dwelling. The subject's cognitive area is obtained by indirectly exploring the structure through a spread, a spatial break, etc.

3. Increasing rate*3
The value shows an increasing rate based on the floor group that had the lowest average area. Formula (%): (Average area of each recognition area for each classified floor group/Smallest average area of each recognition area among the four floor groups classified) - 1

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