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Visual Assessment on River Landscape in the Urban Fringe of Kobe City

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神戸市の河川の景観に対する視覚的判定に関する調査研究

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Résumé

In this research, residents from two districts (Ikegami and Zenkai) located in the Ikawadani region, west part of Kobe City were interviewed in order to evaluate the landscape of some design proposal for the Ikawa river which flows across this region. In previous research,[2] the river was assessed by residents as on of the most important landscapes to protect. Residents were asked to select the best, better, good and the worst, worse, bad landscapes, then the Semantic Differential Technique was applied to measure their visual perception in detail.

From the result, factor structure of the semantic judgements and their interpretation were obtained by factor analysis. The main factors for judging the selected landscapes were the evaluation, size and density factors. According to residents' opinions, the river has to be conserved in a natural way with a wide space on riverside where people can enjoy rural-woody landscape. Also the construction of recreational facilities has to be designed in a simple, modest and natural way which allows contact with water. This research seeks to evaluate residents' attitudes towards the landscape and aim that local planning authorities could consider these results in their development policies.

要　　旨

本研究は，神戸市西区伊川谷地域を縦貫する伊川を事例としてとりあげ，住民の河川景観に関する視覚的選好を分析，考察したものである。筆者らの同地域の先行調査ではこの地域の景観の中で最も保護すべきもののひとつとして，伊川があげられていた。今回の調査では，同地域の2地区の住民に各地区内の伊川とその周辺の景観デザイン例を見せてその選好を調査するとともにSD法を用いて分析した。

調査結果として，総合評価，規模及び密度が主たる因子として抽出された。住民の選好傾向としては，河川敷を散策しながら田園風景を楽しめるような自然的取り扱いが求められレクリェーション施設としても簡潔で自然的なデザインと親水性が求められた。

Introduction

In Japan, rapid urban growth has brought many difficulties to both urban and rural areas, making the urban fringe a crucial and interesting place in which to study land-use and landscape change. Here, an increasing demand for a better living environment con-

fronts a rising tide of development pressures and problems of landscape degradation. For a better development, a balance is necessary, and the studies about peoples attitudes towards the landscape could be a very useful tool for planners to achieve this balance.

As a case of study, the urban fringe of Kobe City was selected because in the last 15 years the construction of many development projects have changed drastically the rural-natural landscape.

Research Area

The Ikawadani region is a valley located in the west part of Kobe City where urban impact on environment has brought new social problems. Here, new and old residents live in the same district with various cultural backgrounds, therefore residents perceptions about the regions environment are varied and complex. Recently, the lack of communication between old and new residents, makes the unification of ideas toward the improvement of landscape quality difficult.[1] The region is mainly composed of two districts:

1. Ikegami District: Zoned according to the New City Planning Act (1969) as an Urbanization Promotion Area in order to improve urban environment as well urban land-use. Recently the construction of concrete banks along the riverside of Ikawa river has changed the landscape by eliminating many old trees. The district has many industries, residential and shopping areas, and is mainly structured by Ikegami 1 chome, 2 chome and 5 chome.
2. Zenkai District: Zoned as an Urbanization Control and Agricultural Promotion Area, where inhabitants with the local government can participate in decisions for planning programs under the context of farmland protection. The natural characteristics of the landscape are still maintained. The district has old agricultural communities and is structured by Zenkai shimo, Naka and Kami.

The Ikawa river, which crosses both districts is structured as a big and wide visual corridor. Along this river there are many good views towards natural landscapes like mountains, forests as well as agricultural lands. Unfortunately, the recent construction of the Ikawadani station and its railway line over the river creates a very strong impact on the landscape. According to residents opinion, there are some important places like temples and sanctuaries that should be protected from development. The most important of these is Taisanji Temple which has become the most favourite place due to its natural landscape, historic values, and tourist potential.[1,2]

Research objective

This research is based on a previous study,[2] in which the identification of public preferences about landscape and types of future developments in the area were the main research objective. It was concluded that old and new residents have different kinds of perceptions about their region. Also, most of them desire the development of a river con-

Figure 1. Nine design proposal for landscape judgement of Ikawa river (Ikegami district).

servation project with recreational facilities along the riverside as the best way to protect the landscape; integrating both districts (visually separated by the railway line) and facilitating the communication between residents.

As a result of this previous study, a proposal for the river conservation project based on residents opinions was presented. The objective of the present research is to visualize how

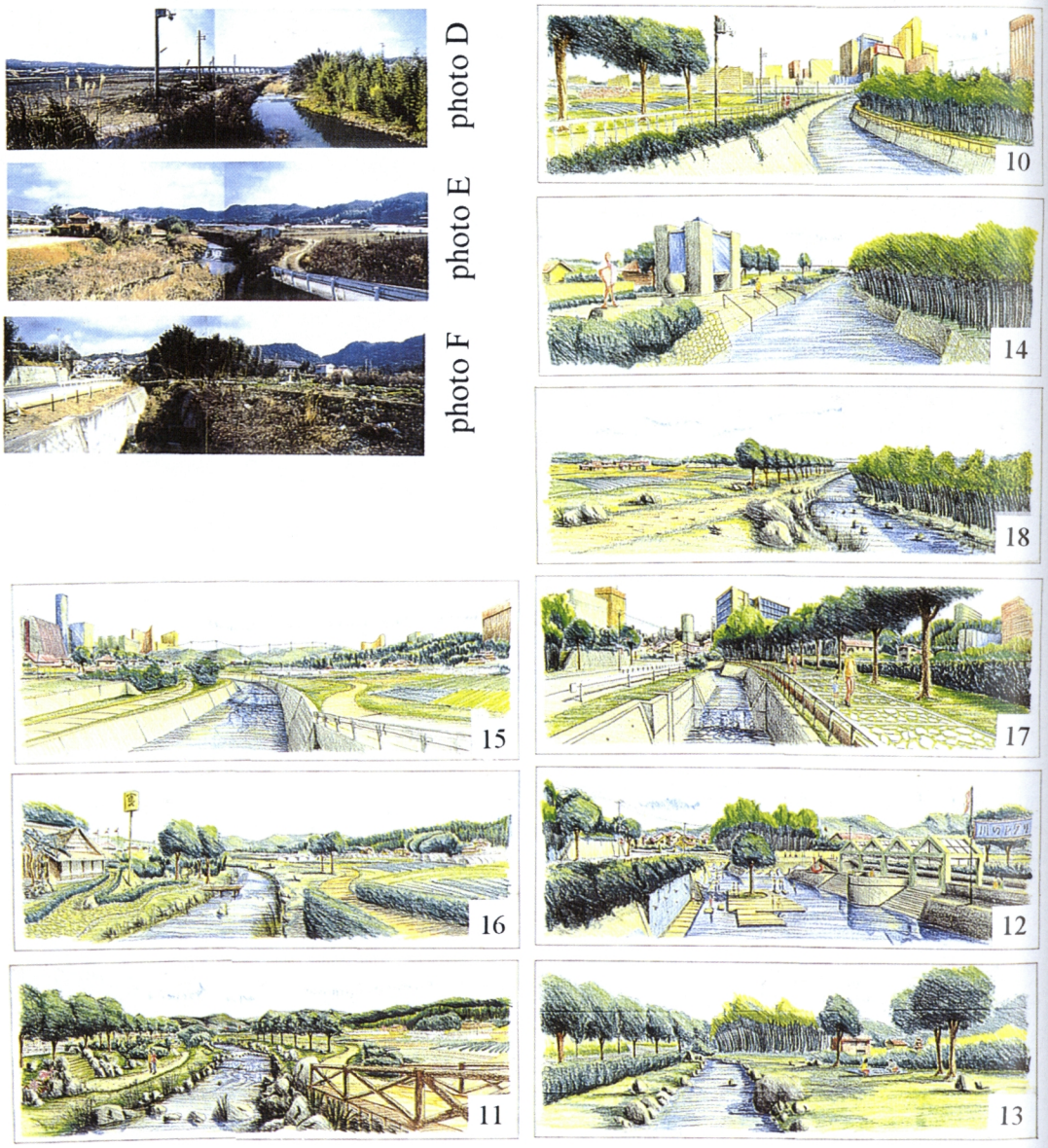

Figure 2. Nine design proposal for landscape judgement of Ikawa river (Zenkai district).

the river landscape has to be designed according to their attitudes towards the landscape.

In other research[3,4] the measurement of residents visual perception was based on photographs. Our study seeks to evaluate their perception based on design proposals, because it will allow us to work with different landscape options in order to obtain a good design solution.

Methodology

Landscape Selection Survey

Along the Ikawa river authors have taken 6 photographs (37cm×13cm), three in each district. From each photograph, three perspectives by crayon (58cm×26cm) were drawn as a design proposal (figure 1, 2). The design policy for river landscape was: (1) urban landscape design with development of some cultural, recreational or service facilities, and riverside concrete block banks in dense urban background; (2) suburban landscape design with development of recreational centers and riverside stone banks in residential landscape; and (3) rural landscape design without much human intervention with riverside soft or grass banks in agricultural or woody landscape. For each district nine perspectives (total: 18) were drawn. They were enumerated and placed on panels in a disordered way. The sites in the perspectives were not mentioned to avoid bias in ratings of the landscapes.

Between May and October of 1993, neighborhood associations (3 in each district) served as places to contact residents. All residents were called to assist the neighborhood association on a specific day, between 9:00 am to 5:00 pm. The surveys were conducted by university students who explained the procedure. Each resident selected the landscapes and answered the questionnaire in about 15 minutes.

Table 1. Personal data of responders. (%)

		Ikegami district	Zenkai district
Length of residence:	Less than 5 years	3 7.8	0
	5 to 10	4 6.0	3.1
	10 to 20	5.4	7.8
	20 to 30	0	9.4
	More than 30 years	1 0.8	7 9.7
Occupation:	Agriculture	2.6	5 7.8
	Company or government	4 3.6	1 7.2
	Own business	0	1.5
	Student	5.1	0
	Monk	0	3.1
	Shop, Store	1 0.3	3.1
	Professor	7.7	0
	Housewife	2 5.6	4.7
	Job less	5.1	1.6
	Others	0	1 1.0
Age:	Less than 29 years old	7.7	1.6
	30 to 39	3 3.3	1 4.1
	40 to 49	4 3.6	3 2.8
	50 to 59	1 0.3	2 3.4
	60 to 69	5.1	1 5.6
	More than 70 years old	0	1 2.5
Gender:	Male	5 3.8	7 0.3
	Female	4 6.2	2 9.7

The questionnaires were structured in the following manner: (a) First section: selection of the best, better and good landscape and selection of the worst, worse and bad landscape; (b) Second section: judgement of each selected landscape by the 22 bi-polar adjectives scale of the Semantical Differential Technique; and (c) Third section: personal data of the responder (length of residence, occupation, age and gender). As a result 101 responders (Ikegami: 37; Zenkai: 64) participated in the survey and their personal data are shown in table 1.

Table 2. Bi-polar adjective scale.

	X	1	2	3	4	5	Y
1	Simple	★	★	★	★	★	Complex
2	Woody	★	★	★	★	★	Woodless
3	Beautiful	★	★	★	★	★	Ugly
4	Dangerous	★	★	★	★	★	Safe
5	Favourite	★	★	★	★	★	Hateful
6	New	★	★	★	★	★	Old
7	Small	★	★	★	★	★	Large
8	High	★	★	★	★	★	Low
9	Artificial	★	★	★	★	★	Natural
10	Colorful	★	★	★	★	★	Colorless
11	Stable	★	★	★	★	★	Unstable
12	Week	★	★	★	★	★	Strong
13	Hard	★	★	★	★	★	Soft
14	Light	★	★	★	★	★	Heavy
15	Familiar	★	★	★	★	★	Unfamiliar
16	Modest	★	★	★	★	★	Conspicuous
17	Dense	★	★	★	★	★	Sparse
18	Harmonious	★	★	★	★	★	Dissonant
19	Dead	★	★	★	★	★	Alive
20	Rounded	★	★	★	★	★	Angular
21	Confused	★	★	★	★	★	Orderly
22	Good	★	★	★	★	★	Bad

Note: 1: extremely X, 2: slightly X, 3: neutral, 4: slightly Y, 5: extremely Y.

Semantic Differential Technique

The judgement of the landscape is very subjective. The increasing urban landscape in rural areas can represent different types of feelings. Also, due to differences in peoples cultural backgrounds, the obtaining an objective result is very difficult. The Semantic Differential Technique is one of methods applied widely in Psychology.[5] Residents who judge the landscapes represents their judgement in a multidimensional semantic space through the 5 grades that compose the 22 criteria's scales. In order to represent the meaning of the landscape, factor analysis technique is used to determine the dimensional characteristics of this semantic space. The bi-polar adjective scale is shown in table 2.

Results and Discussion

Selected Landscapes in each district

The rates of selected landscapes are indicated in table 3. In table 4 are identified the reason for this selection (representated by the percentage of main keywords).

1. Ikegami District:

In the range of favourite landscapes selected, the reason for selection of landscape No. 2 as the "most favourite" due to the presence of greenery and clean water. In addition, on each sides of the river there is a wide area with grass to protect property from overflow disasters and provide a space for people to walk and to enjoy rural-natural views. Landscape No. 4 was selected as the "more favourite" landscape also due to greenery. However, the river is very near to the houses, then residents were worries about overflow disas-

Table 3. Results of selection of favourite and hateful landscapes in each district.

Ikegami district

No. of Lands.	Rate of Favourite Lands.			Rate of Hateful Lands.		
	Most favourite	More favourite	favourite	Most hateful	More hateful	hateful
1	0	0	2.7	0	24.3	27.0■
2	51.3■	24.3	10.8	0	0	0
3	2.7	8.1	18.9	2.7	8.1	29.7
4	8.1	51.3■	10.8	0	5.4	0
5	0	2.7	5.4	0	0	8.1
6	0	2.7	0	8.1	45.9■	18.9
7	0	0	10.8	0	5.4	13.5
8	0	0	0	86.4■	10.8	2.7
9	37.8	10.8	40.5■	2.7	0	0

Zenkai district

No. of Lands.	Rates of Favourite Lands.			Rates of Hateful Lands.		
	Most favourite	More favourite	favourite	Most hateful	More hateful	hateful
10	4.6	0	9.3	20.3	20.3	20.3■
11	54.6■	12.5	9.3	3.1	6.2	1.5
12	3.1	14.0	3.1	32.8■	10.9	12.5
13	6.2	23.4	12.5	3.1	3.1	14.0
14	4.6	1.5	4.6	6.2	10.9	12.5
15	1.5	4.6	7.8	4.6	25.0■	15.6
16	9.3	28.1■	23.4	0	6.2	4.6
17	4.6	3.1	4.6	20.3	14.0	17.1
18	11.0	12.5	25.0■	9.3	3.1	1.5

Note: Points indicate the selected landscape

Table 4. Reason for selection of the most favourite and hateful landscapes. (represented by percentage of main keywords)

Most Favourite			Most Hateful		
	Ikegami	Zenkai		Ikegami	Zenkai
greenery	4 0.5	4.6	sad	2.7	3.1
soft	0	1.5	narrow	0	3.1
simple	0	3.1	danger	5.4	1.5
alive	0	1.5	heavy	0	1.5
wide	0	1.5	dissonant	0	1.5
beautiful	0	3.1	bad	0	1.5
nature	2 9.7	3 1.1	noise	0	1.5
trees	1 3.5	4.6	dead	5.4	0
countryside	0	4.6	no greenery	1 8.9	9.3
harmony	8.1	7.8	monotonous	8.1	0
familiar	0	4.6	hard	0	3.1
relax	8.1	1 0.9	tasteless	0	1.5
good	2.7	0	dirty	8.1	0
recreation	2.7	3.1	artificial	1 8.9	4 0.6
safe	2.7	3.1	cold	5.4	3.1
warm	0	1.5			
garden	0	3.1			

ters. Landscape No. 9 was selected as "favourite" because the river looks easily accessible. Recreation was also taken into account, but according to some residents opinions, recreation facilities does not have to play the most important role in the overall design.

In the range of hateful landscapes, No. 8 was selected as "most hateful" landscape. Here, even though the river appears safe from overflow disasters, it has a taste of sadness because it looks dirty without greenery and is too "civilized." As the "more hateful," landscape No. 6 was selected because there are many buildings in the landscape. Some residents likes the tennis court near the river, but according to their opinion the landscape looks "cold." Landscape No. 3 was selected as "hateful" because the recreation facilities

are to big and made by concrete walls, creating an "artificial" landscape.

2. Zenkai District:

In the range of favourites landscapes in Zenkai district, No. 11 was the "most favourite," because the river is conserved naturally. There are few houses and people can see mountains, trees and the agricultural lands. Responders also argued that they want to see more flowers and have some seating. As the "more favourite" landscape, No. 16 was selected because it is "natural, soft and warm." Landscape No. 18 was selected as the "favourite" because it is "friendly, green and clean."

In the range of hateful landscapes, No. 12 was chosen as the "most hateful" because it is "artificial, hard and tasteless." This answer means that recreational facilities do not need to be the main object in design (similar opinion to those residents in Ikegami district). As the "more hateful," landscape No. 15 was selected because the river divides the agricultural lands from the villages. Landscape No. 10 was selected as "hateful" because riverside concrete banks do not allow contact with water and riverside animals, who serve an ecological purpose such as water cleaners, can not survive.

Table 5. results of factor analysis in each district.

Ikegami district

ROTATED FACTOR PATTERN

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
A 1	0.05059	0.05991	0.76375	0.02565
A 2	0.85640	-0.03425	0.03830	-0.09959
A 3	0.91586	-0.07010	0.06813	0.01111
A 4	-0.34539	0.68154	-0.18349	-0.08585
A 5	0.90409	-0.09755	-0.03085	0.00177
A 6	0.06288	-0.00790	-0.28072	0.69910
A 7	-0.03433	0.61754	0.27567	-0.02762
A 8	-0.20984	0.08534	0.02147	0.57988
A 9	-0.75582	0.10512	-0.10792	0.32354
A10	0.76967	-0.11670	-0.25312	0.13241
A11	0.67256	-0.35517	0.10981	0.23843
A12	-0.20325	0.70233	0.08773	0.25913
A13	-0.69651	0.33642	0.04899	0.39977
A14	0.63853	-0.13586	0.15127	0.24143
A15	0.89468	-0.11911	0.01634	-0.03598
A16	0.16210	0.24726	0.67593	-0.02840
A17	0.20622	0.18407	-0.66797	0.14454
A18	0.87590	-0.11763	0.06574	-0.02370
A19	-0.83617	0.14788	0.12576	0.04676
A20	0.80846	-0.22252	-0.06779	-0.29290
A21	-0.25059	0.47282	-0.23003	-0.50453
A22	0.89683	-0.09438	0.03694	-0.01405

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
8.967098	2.075004	1.882395	1.674440

Zenkai district

ROTATED FACTOR PATTERN

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
A 1	0.31387	-0.29216	-0.54094	-0.33527
A 2	0.57438	0.20771	-0.15428	0.06277
A 3	0.76887	-0.12221	-0.11059	0.16152
A 4	-0.48030	0.37680	-0.16532	-0.06815
A 5	0.78466	-0.14048	-0.16865	0.21361
A 6	-0.38405	-0.45689	0.44306	0.11566
A 7	0.03986	0.40142	-0.39203	-0.17734
A 8	-0.39163	-0.46101	0.05112	0.17728
A 9	-0.74988	-0.23578	0.08494	0.14061
A10	0.34010	0.05654	0.19188	0.68574
A11	0.53069	-0.43393	0.00901	0.32552
A12	-0.00849	0.36808	-0.14326	-0.55760
A13	-0.69399	-0.24801	0.26105	-0.02769
A14	0.56738	-0.09592	0.10548	-0.36065
A15	0.84108	-0.07914	-0.06876	0.09326
A16	0.23644	0.21266	-0.58376	-0.15142
A17	0.03510	-0.03771	0.76920	-0.09293
A18	0.76051	-0.08079	-0.01627	0.08472
A19	-0.53268	0.11660	0.10376	-0.49407
A20	0.74556	0.11116	-0.12749	-0.02018
A21	-0.14002	0.66427	-0.01413	0.05035
A22	0.78599	-0.11551	-0.13943	0.23911

VARIANCE EXPLAINED BY EACH FACTO

FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
6.751615	1.880851	1.865027	1.658346

Factor analysis

For each district, the nine riverside landscapes were totally factored by means of SAS (Statistics Analysis System) at the Kyoto University Computer Center. The results is shown in table 5.

In the Semantic Differential procedure the riverside landscapes were denominated with the term "object" in a very general sense to refer the stimulus to be evaluated, the responders were denominated as "subjects" and the 22 pair of bi-polar adjectives list were denominated as "scale." The combination of objects, subjects and scales used in this study generates on cube of data for Ikegami district (9×37×22) and one cube of data for Zenkai district (9×64×22). In each cell of those cubes are contained a representative number of judgments (obtained in the scale from 1 to 5 and from left to right) for each particular object, subject and scale.

In Factor Analysis the Varimax method for analytic rotation[6] was applied to those cubes of data and three main factors were extracted and rotated into simple structure, maintaining orthogonality. The extraction of the factors in each object was stopped at the range where the eigenvalue of the correlation matrix had been more than 1.0 and also

Table 6. Factor structure of the semantic judgement.

Ikegami district			Zenkai district		
FACTOR 1			FACTOR 1		
A 3	Beautiful-Ugly	0.91	A15	Familiar-Unfamiliar	0.84
A 5	Favourite-Hateful	0.9	A22	Good-Bad	0.78
A22	Good-Bad	0.89	A 5	Favourite-Unfavourite	0.78
A15	Familiar-Unfamiliar	0.89	A 3	Beautiful-Ugly	0.76
A18	Harmonious-Dissonant	0.87	A18	Harmonious-Dissonant	0.76
A 2	Woody-Woodless	0.85	A 9	A rtificial-Natural	0.74
A19	Dead-Alive	0.83	A20	Rounded-Angular	0.74
A20	Rounded-Angular	0.8	A13	Hard-Soft	0.69
A10	Colorful-Colorless	0.76	A 2	Woody-Woodless	0.57
A 9	Artificial-Natural	0.75	A14	Light-Heavy	0.56
A13	Hard-soft	0.69	A19	Dead-Alive	0.53
A11	Stable-Unstable	0.67	A11	Stable-Unstable	0.53
A14	Light-Heavy	0.63	A 4	Dangerous-safe	0.48
FACTOR 2			FACTOR 2		
A12	Weak-Strong	0.7	A21	Confused-Orderly	0.66
A 4	Dangerous-safe	0.68	A 8	High-low	0.46
A 7	Small-Large	0.61	A 6	New-Old	0.45
FACTOR 3			A 7	Small-Large	0.4
A 1	Simple-Complex	0.76	FACTOR 3		
A16	Modest-Conspicuous	0.67	A17	Dense-Sparse	0.76
A17	Dense-Sparse	0.66	A16	Modest-Conspicuous	0.58
FACTOR 4			A 1	Simple-Complex	0.54
A 6	New-Old	0.69	FACTOR 4		
A 8	High-Low	0.57	A10	Colorful-Colorless	0.68
A21	Confused-Orderly	0.5	A12	Weak-Strong	0.55

Note: structured by scales with high loadings

where most of the variance had been approximately extracted as it was done in the Yoshidas study.[4] The factor structure of the semantic judgement in each district is shown in table 6. The factors represent the dimensional characteristics of the semantic space by those bi-polar adjectives scale with high loadings. The interpretation of the first three factors is as follows: Factor 1, Represents an "evaluation factor" by listing the scales which have high loadings on it. These are beautiful-ugly, favourite-hateful, good-bad, familiar-unfamiliar, harmonious-dissonant, woody-woodless, dead-alive, rounded-angular, colorful-colorless, artificial-natural, hard-soft, stable-unstable and light-heavy as common factors in both districts. Factor 2, was interpreted as a "size factor" with small-large as common factor in both districts. Factor 3, is defined as "density factor" with simple-complex, modest-conspicuous, and dense-sparse as common factors in both districts.

Several other factors were not interpreted because they are less clearly defined. The percentages of total variance explained by each factor are given at the bottom of table 5. These values suggest that the evaluation factor in both districts plays a dominant role in meaningful judgments.

Factor Scores

The results of the semantic judgement by means of factor score were similar to the landscape selection survey. The factor scores of selected landscapes were plotted on two dimensions (from factor 1 to facto 3) and the results are show in figure 3.

Landscapes No. 2, 4, 9 and 11, 16, 18 (selected as favourite landscapes in both districts) were plotted at the bottom-left side of the semantic space where the positive adjective scale of those factors is located. In all these landscapes, greenery is an important element in the design, This means that these landscapes have the meaning of favourite, good, woody, soft or harmonious.

Landscapes No. 8, 6, 3 and 12, 15, 10 (selected as hateful landscapes in both districts) were plotted at the upper-right side of this space. All these landscapes might be considered as bad, woodless, hard or dissonant due to the presence of many buildings and river-side concrete banks.

Preference based on length of resident

In this research, the percentage of residents preferences based on how many years they had been living in their district was obtained. The results are shown in figures 4 and 5.

Residents who live in Ikegami district have a high percentage of preference on landscapes because increasing urban landscape creates in them a strong desire about greenery and an increasing antipathy towards big urban structures. Residents with 30 years of residence observed how landscape has changed and like new residents are living now without an identity to the new and changing landscape.

New residents who live in Zenkai district, show a high percentage of preference for landscapes (similar to those residents in Ikegami district) because of their short length of residence, lack of communication with people and lack of identity with the environment. This produces in them an extreme feeling about what they want and hate about the

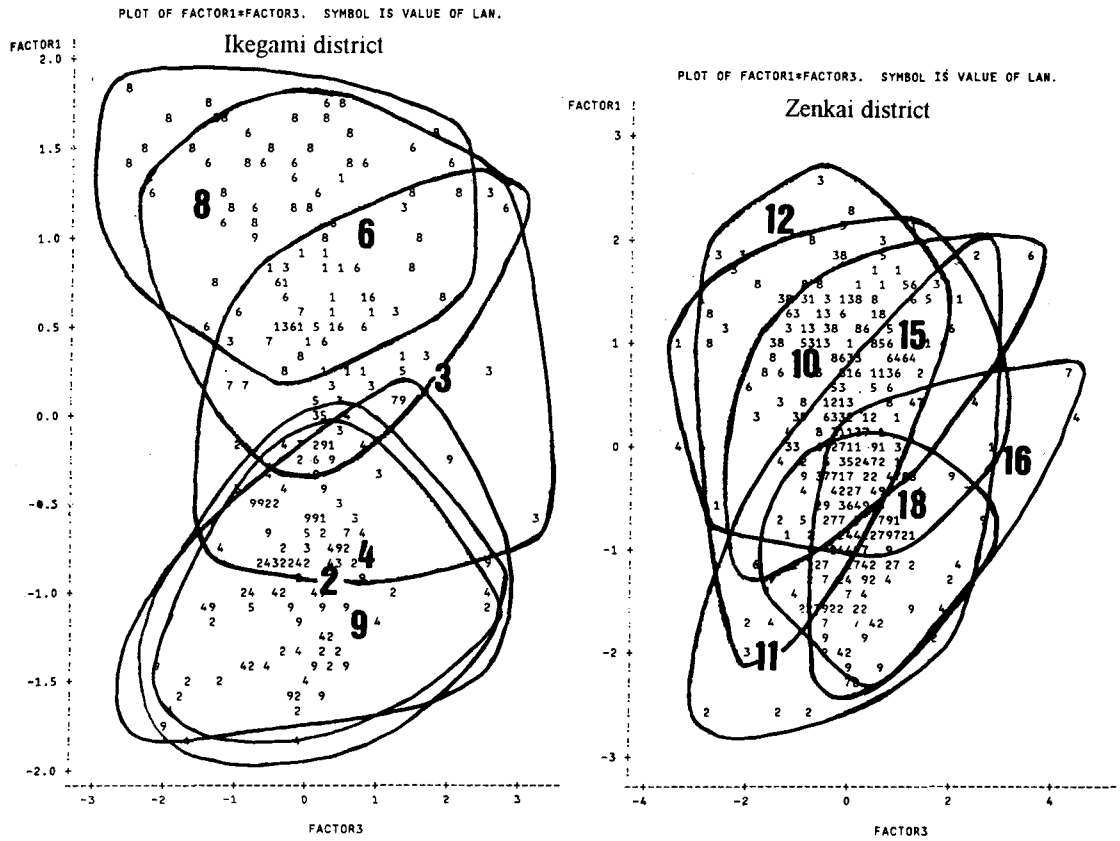

Figure 3. Factor score in each district.

Note: In Zenkai: 1=10, 2=11, 3=12, 4=13, 5=14, 6=15, 7=16, 8=17, 9=18.

Note: Landscapes No. 1, 5, 7 and No. 13, 14 17 were not representated because there were not selected.

landscape. The percentage of preference decreases by length of residence. Residents with more than 30 years of residence have a low and variegated percentage of preference on landscapes because even though they are the ones who most want to protect the rural landscape, they also recognize the need for the construction of some urban services.

Conclusion

The analysis of the Ikawa riverside landscape evaluation was discussed by means of the Semantic Differential Technique and the results are as follows:

(1) Landscape No. 2 and No. 11 were selected as the most preferred by residents in both districts. In those landscapes the river is conserved in a natural way with a wide space to protect properties from overflow disasters and where people can walk and enjoy rural-woody views.

(2) Landscapes No. 8 and 12 were selected as the most hateful by residents in both districts. It is confirmed that responders did not like a dense urban landscape and big recreational centers along the riverside.

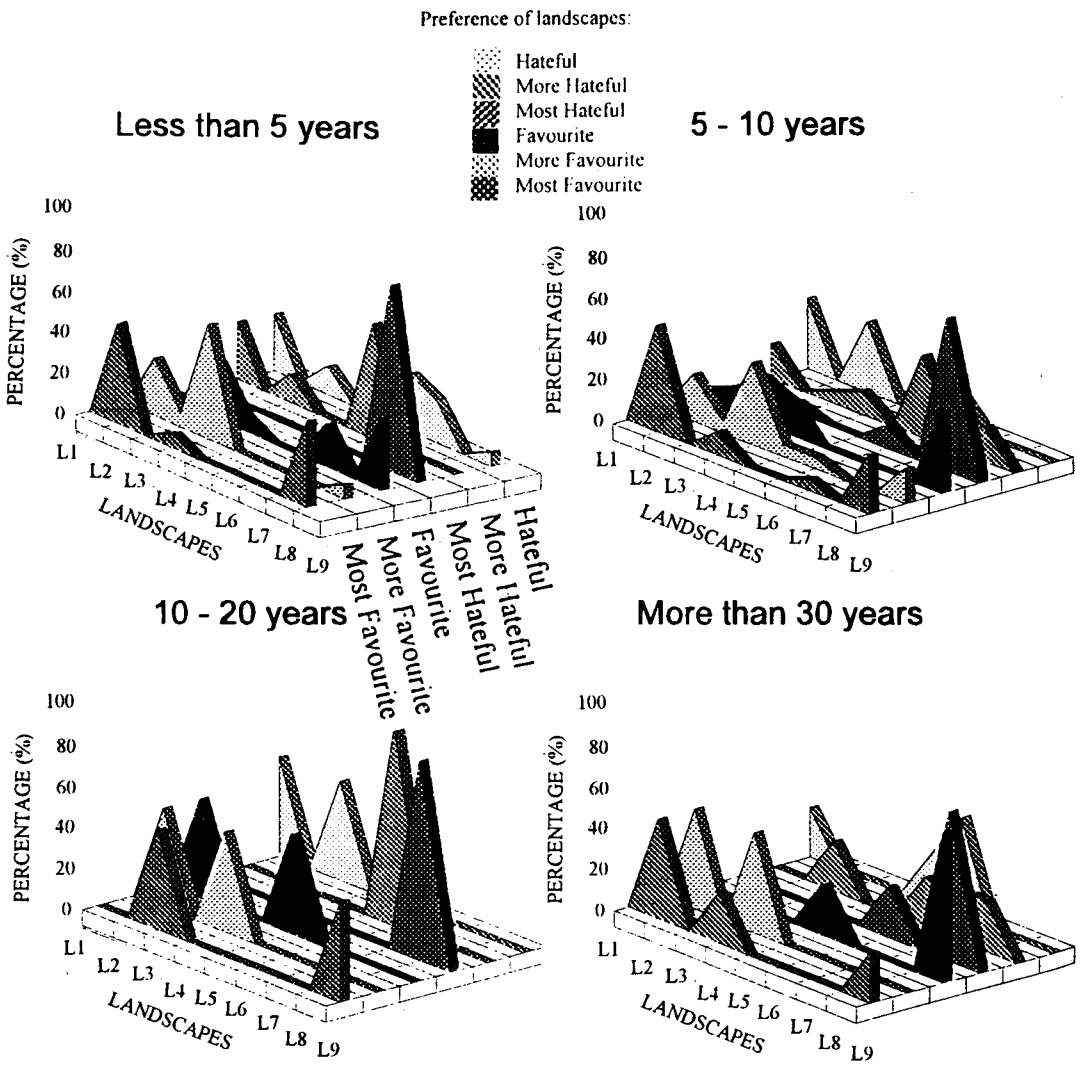

Figure 4. Preference of landscapes based on length of residence in Ikegami district.

(3) The construction of recreational facilities has to be designed in a simple, modest and natural way which can allow accessibility to the water.

(4) The fundamental factors for judging the landscapes in both districts were the evaluation, size and density factors.

(5) Results of the semantic judgements by means of factor score were similar to the landscape selection survey. Favourite selected landscapes were plotted into positive adjective scale and hateful ones into the negative scale.

(6) The residents visual perception has been influenced by the increase of urban landscapes. People who live in Ikegami district have a strong desire for greenery landscapes and people who have lived for a long time in Zenkai district want to protect

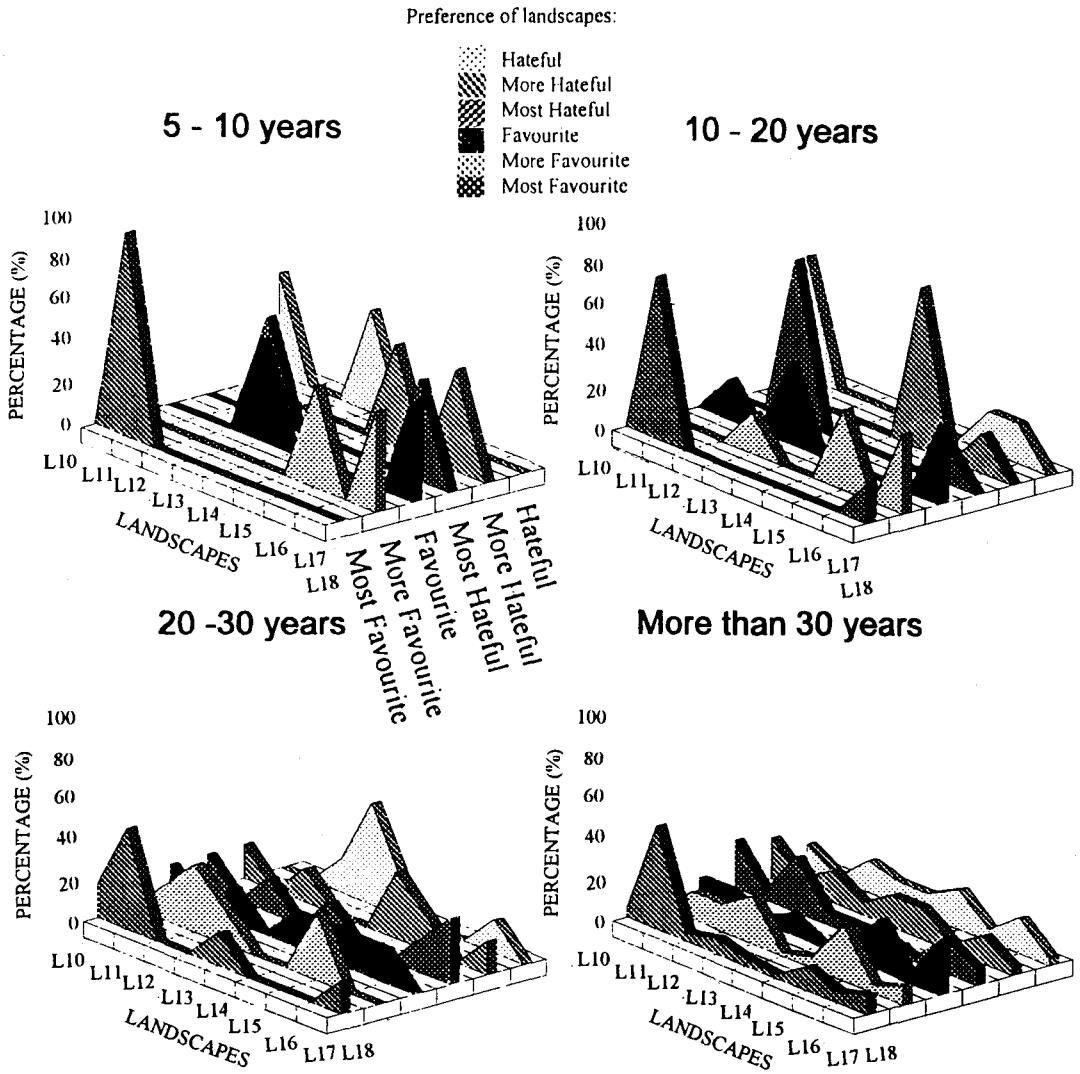

Figure 5. Preference of landscapes based on length of residence in Zenkai district.

the agricultural areas from development, but due to their necessity of some urban facilities, they are representing the more variegated selection on landscapes.

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