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Comparative Study of View Point Types on Landscape Evaluation

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Abstract**—**The purpose of this study was to examine the viewpoints in terms of changing distances and levels and thereby, comparatively analyze the visual sensitivity to the elements of the natural views. The questionnaire survey was conducted separately for experts and non-experts. Summing up, it was confirmed that the visual sensitivity to the elements of the same natural views differed significantly depending on subjects' professionalism, changes of the viewpoint levels and distances, while the visual sensitivity to 'openness of visual/view axes' did not differ significantly when only the distances of the viewpoints were varied. In addition, the visual sensitivity to visual/view axes differed between experts and ordinary people when the levels of the viewpoints were varied, while the visual sensitivity to 'damaged natural view resources' differed between two groups when the distances of the viewpoints were varied.

.***Keywords*****—**Landscape Evaluation, Visual Sensitivity, Viewpoint.

I. Introduction

CONSCIOUSNESS about life environment has been increased with the improvement of economy, so interest in landscape has also risen since 1990s. It is easy to find the term of landscape in life, and Scenic Conservation Act is established by law for systematic planning and management [8]. Although people realize the importance of landscape and operate businesses for landscape management, only few experts and researchers are working for the analysis and evaluation of landscape [3].

Research about validity and methods of view point is at an early stage in this respect, and objectified index about selection criteria of the view point is quite insufficient.

The purpose of this research is to compare and analyze the view point types on landscape evaluation. The result of this research will be able to be used as the preliminary data to select objective and reasonable view point.

The site of this research is the Housing Site Development Project Zone in Pyeongtaek because the site is well reputed for its diverse views of forests, plains and sea, and thereby, photographed the natural views by varying the distances of the viewpoints among near (500m), middle (1km) and far (2km) views and the levels of the viewpoints among eye level, 60m and 10m over ground.

For the study, literature review, field study and survey were conducted. In the literature review, grasped the elements of landscape and considered the standard of view point selection. In the field study, grasped appropriacy about view point selection by case study, and collected preliminary data for graphic works through investigation by distance and evaluation. Survey was conducted by two groups, experts and non-experts. Experts are working for urban planning, architecture, landscape in Seoul and Gyeonggi, and non-experts are living in the districts.

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II. Literature Reviews

A. The Concept and Classification of Landscape

Landscape includes every environment and artificial scenery that people can see through eyes, and involves land, ecosystem, and cultural and social activities [1]. Also, landscape is a mental phenomenon and has dynamic, subjective, relative features [2]. Therefore, landscape does not exist by itself, is evaluated by value judgment of humans who see the landscape.

TABLE I
CLASSIFICATION OF LANDSCAPE

Classification	Landscape	
1. by Christian Noberg-Schulz	- romantic landscape - classical landscape	- spatially landscape - complex landscape
2. by Environment landscape	- panoramic landscape - surround landscape - focus landscape - temporary landscape	- topography landscape - irrigation landscape - detailed landscape
3. by Interpretation of landscape	- as environment - as artificial - as problem - as ideology - as location	- as residence - as system - as wealth - as history - as beauty
4. by spectrum of environment and artificial landscape	- primitive landscape - riverside landscape - history landscape - residence landscape	- suburb landscape - city landscape - huge city landscape
5. by Townscape point of view	- mountain landscape - river-axis landscape - history landscape - residence landscape	- hill landscape - road-axis landscape - park green landscape -commercial landscape
6. by Form(artificialness)	- environment landscape · forest landscape · plain landscape · ocean landscape	- culture landscape (artificial landscape) · city landscape · rural landscape
7. by Resources	- environment landscape · green landscape · water landscape	- artificial landscape · history landscape · living landscape

[Table I] shows that the seven types of; Christian Noberg-Schulz, Environment landscape, Interpretation of landscape, spectrum of environment and artificial landscape, townscape point of view, form(artificialness), and resources. Among the classification, this research focuses on the classification by form [5].

B. Components of landscape

The components of landscape are divided into two; material and non-material. The distinction of specific landscape components is shown in [Table II]. In this research, to extract landscape components that have high status among the material elements, examine various landscape components of city landscape, environment landscape, and mountain environment.

TABLE II
LANDSCAPE COMPONENTS [4]

Division		Landscape Components
Material	Environment	Climate, topography, geological features, soil, sluice
		Vegetation, wild animals, etc.
	Artificial	Flat: roads, lots
		Three dimensional: structures, buildings
	Complex	Open spaces
		skyline
Non-Material	Artificial	History, economy, culture, system, administration
	Behavior	Humans, cars

C. Concept of View Point

View point means that the point where it is possible to see a view target. In environment landscape, the main view point that is called LCP (Landscape Control Point) includes a main road, a trail, a place has nice view and so on. If a survey area generally has similar components, a view point could be selected by space scale and shape. However, if there is a disparate element or place in the survey area, it would need to select view point considering the best features of the area [7].

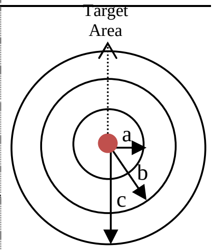
D. Selection Criteria of View Point

Although researches about view point has been proceeded to protect landscape, clear evaluation about criteria to select view point is not exist yet. In this research, View point selection process and selection criteria are summarized with natural scenery as the center. The types of view point selection criteria are shown in the [Table III][9].

TABLE III
TYPE OF VIEW POINT SELECTION CRITERIA

Division		View Point Selection Criteria
Division by Center	Landscape Resources	The place where see excellent landscape resources
	Users	The place where density is high
Division by Location of View	Inside View Point	A main point inside of the area
	Outside View Point	A main point surrounding of the area
	Distance View/Middle Distance/Close-range	Prediction point of landscape change by distance
Division by View Point Use	Reputational	A standard view point to protect good landscape
	Formational	A standard point to form good landscape
	Management type	A standard point to manage poor landscape

TABLE IV
VIEW POINT SELECTION CRITERIA BY DISTANCE [6]

Divide		Distance of Viewpoint Selection	Example
Close -range (a)	Point and area development projects	Located in radius of 500m from the target business area	
Middle Distance (b)		Located in radius of 1km from the target business area	
Distance View (c)		Located in radius of 2km from the target business area	

* Largest area of business development, should be determined by considering the size of the business view point selection distance

III. RESEARCH METHOD

A. Site Selection

To compare and analyze the view point types on landscape evaluation select the Housing Site Development Project Zone in Pyeongtaek as Fig. 1. The site has good views of forests because of the Baram Mountain, Hamback Mountain and Boockak Mountain, and also Jinwee-cheon and Seojung-cheon flow the site. There are huge arable lands at the west and south of the site, so it is possible to observe the change of plain landscape. Therefore, the site includes all components of environment landscape by form.

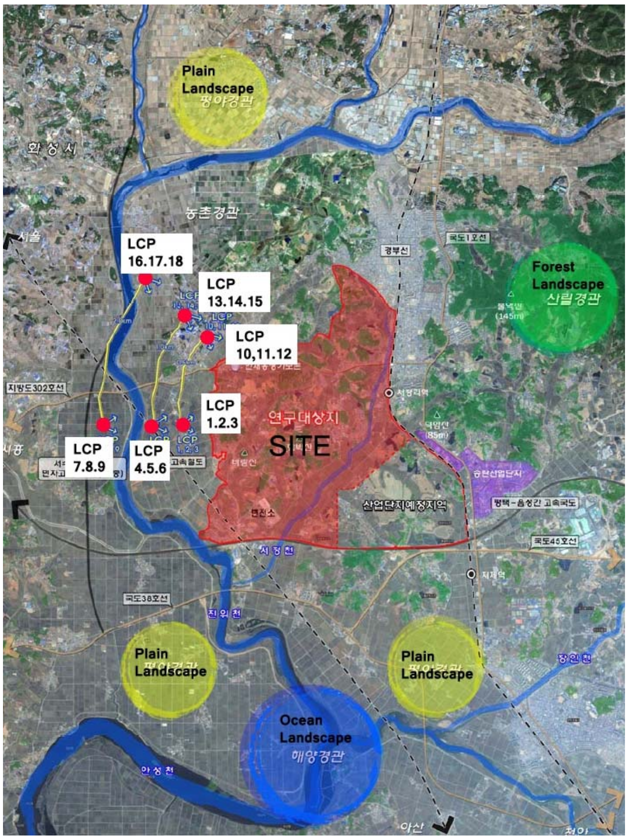


Fig. 1 Target Site

B. LCP Location Selection

TABLE V
LCP LOCATION AND SELECT REASON

No. of LCP	Altitude (m)	Distance (m)	Utilization			Select reason	Div.
			Habitat	Road	River		
1	1.5	500		O		Good view point	C
2	60	500		O		Good view point	C
3	100	500		O		Good view point	C
4	1.5	1000		O	O	Good view point	M
5	60	1000		O	O	Good view point	M
6	100	1000		O	O	Good view point	M
7	1.5	2000		O	O	Good view point	D
8	60	2000		O	O	Good view point	D
9	100	2000		O	O	Good view point	D
10	1.5	500		O		View point, density of use	C
11	60	500		O		View point, density of use	C
12	100	500		O		View point, density of use	C
13	1.5	1000	O	O		View point, density of use	M
14	60	1000	O	O		View point, density of use	M
15	100	1000	O	O		View point, density of use	M
16	1.5	2000		O		View point, density of use	D
17	60	2000		O		View point, density of use	D
18	100	2000		O		View point, density of use	D

* D: Distance View, M: Middle Distance, C: Close-range

According to the standard by Ministry of Environment [5], LCP locations were selected for this study. Close-range is 500m, Middle distance is 1km, and Distance view is 2km. Also to research the changes by altitude, select view points; eye level, 60m from ground, 100m from ground. [TABLE V] shows the location of each LCPs and the reasons why the LCPs are selected.

C. Analyze Method

In order to get reliability data 106 questionnaires are used for the analysis among 146(expert: 90, non-expert: 46). Data are analyzed by SPSSWIN 12.0. Frequency Analysis is used to check the specialization of respondents, Two-way ANOVA is used to compare by distance and altitude, and One-way ANOVA is also used for analysis.

IV. Analysis Results

A. Basic Statistical Analysis of Survey Respondents

To check the specialization of respondents does the Frequency Analysis, and result is like [Table VI].

TABLE VI
SPECIALIZATION OF RESPONDENTS

	Frequency	Percentage
Urban	180	9.2
Architecture	234	11.9
Landscape	738	37.6
Others	810	41.3
Total	1962	100.0

B. Environment Landscape Compared Analysis

It is possible that people have a different view to wee the landscape because of their characters and experiences, and because of this, sensitive of sight also can be different. Therefore, analyze environmental landscape by specialization, altitude, distance, and components. Assessment items on the landscape use 7 Likert Scale, and accomplish One-way ANONVA and Repeated Measure ANOVA to find out differences of environment landscape by specialization, altitude, distance, and components.

1. Environment Landscape Compared Analysis by Specialization

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TABLE VII
VISUAL SENSITIVITY OF THE BASIC STATISTICS
(ENVIRONMENT LANDSCAPE BY SPECIALIZATION)

		Urban	Architecture	Landscape	Others	total
Damage of the landscape resources	Average	4.05	4.56	4.24	4.36	4.31
	S.D.	1.216	1.450	1.528	1.580	1.519
Openness of view axis	Average	3.72	3.41	3.83	3.75	3.73
	S.D.	1.229	1.378	1.481	1.553	1.482
The visual feel of the skyline	Average	3.54	3.37	4.23	3.81	3.89
	S.D.	1.392	1.271	1.578	1.626	1.576

TABLE VIII
THE IMPACT OF THE SPECIALIZATION IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Specialization	Damage of the landscape resources	32.053	3	10.684	4.655**	.003
	Openness of view axis	31.851	3	10.617	4.860**	.002
	The visual feel of the skyline	175.09	3	58.364	24.343***	.000

** P<.01, *** P<.001

The result of [Table VIII] shows that specialization has effect on visual sensitivity about landscape components.

2. Environment Landscape Compared Analysis by altitude differences

TABLE IX
VISUAL SENSITIVITY OF THE BASIC STATISTICS
(ENVIRONMENT LANDSCAPE BY ALTITUDE)

		Eye level	60m	100m	Total
Damage of the landscape resources	Average	3.53	4.53	4.86	4.31
	S.D.	1.623	1.271	1.313	1.519
Openness of view axis	Average	4.15	3.44	3.61	3.73
	S.D.	1.503	1.391	1.461	1.482
The visual feel of the skyline	Average	4.30	3.69	3.68	3.89
	S.D.	1.557	1.540	1.553	1.576

TABLE X
THE IMPACT OF ALTITUDE CHANGES IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Specialization	Damage of the landscape resources	624.359	2	312.18	156.937***	.000
	Openness of view axis	176.672	2	88.381	41.911***	.000
	The visual feel of the skyline	163.191	2	81.595	33.963***	.000

*** P<.001

The result of [Table X] shows that altitude changes have effect on visual sensitivity about landscape components.

3. Environment Landscape Compared Analysis by Distance changes

TABLE XI
VISUAL SENSITIVITY OF THE BASIC STATISTICS
(ENVIRONMENT LANDSCAPE BY DISTANCE CHANGE)

		Close-range	Middle Distance	Distance View	Total
Damage of the landscape resources	Average	4.75	4.12	4.06	4.31
	S.D.	1.445	1.556	1.4660	1.519
Openness of view axis	Average	3.74	3.75	3.71	3.73
	S.D.	1.401	1.503	1.542	1.482
The visual feel of the skyline	Average	4.07	3.70	3.90	2.89
	S.D.	1.626	1.476	1.603	1.576

TABLE XII
THE IMPACT OF THE DISTANCE CHANGES IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Specialization	Damage of the landscape resources	182.802	2	93.401	42.179***	.000
	Openness of view axis	0.652	2	0.326	.148	.862
	The visual feel of the skyline	43.900	2	21.950	8.909***	.000

** P<.01, *** P<.001

The result of [Table XII] shows that distance changes has effect on visual sensitivity about landscape components, 'Damage of the land resources' and 'The visual feel of the skyline'.

4. Environment Landscape Compared Analysis by Altitude and Distance Changes

TABLE XIII
VISUAL SENSITIVITY OF THE BASIC STATISTICS
(ENVIRONMENT LANDSCAPE BY ALTITUDE AND DISTANCE CHANGES)

		West 500m Eye Level	West 500m 60m	West 500m 100m	West 1km Eye level	West 1km 60m	West 1km 100m	West 2km Eye level	West 2km 60m	West 2km 100m	TOTAL
Damage of the landscape resources	Avg.	4.22	4.82	5.19	3.12	4.39	4.83	3.25	4.38	4.56	4.31
	S.D.	1.493	1.315	1.359	1.648	1.238	1.201	1.497	1.209	1.302	1.519
Openness of view axis	Avg.	3.78	3.49	3.95	4.28	3.43	3.54	4.39	3.40	3.33	3.73
	S.D.	1.376	1.361	1.432	1.569	1.393	1.401	1.490	1.423	1.484	1.482
The visual feel of the skyline	Avg.	4.31	3.92	3.98	4.09	3.51	3.50	4.51	3.62	3.58	3.89
	S.D.	1.608	1.647	1.601	1.498	1.417	1.440	1.540	1.523	1.577	1.576

TABLE XIV
THE IMPACT OF THE ALTITUDE AND DISTANCE CHANGES IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Specialization	Damage of the landscape resources	851.709	8	106.464	56.690***	.000
	Openness of view axis	266.916	8	33.364	16.128***	.000
	The visual feel of the skyline	230.185	8	28.773	12.113***	.000

*** P<.001

The result of [Table X IV] shows that altitude and distance changes have effect on visual sensitivity about landscape components.

5. Environment Landscape Compared Analysis by Group

1) Compared Analysis by Altitude

TABLE XV
VISUAL SENSITIVITY OF THE BASIC STATISTICS (ENVIRONMENT LANDSCAPE BY ALTITUDE CHANGES AND GROUP)

	Altitude		Expert	Non-Expert	Total
Damage Degree	Eye Level	Avg.	3.5758	3.4644	3.5294
		S.D.	1.61229	1.63883	1.62297
	60m	Avg.	4.4686	4.6119	4.5277
		S.D.	1.25609	1.28902	1.27075
	100m	Avg.	4.7717	4.9963	4.8646
		S.D.	1.25984	1.37542	1.31255
	Total	Avg.	4.2732	4.3595	4.3088
		S.D.	1.47452	1.58020	1.51927
Openness	Eye Level	Avg.	3.9815	4.3985	4.1502
		S.D.	1.47543	1.51122	1.50268
	60m	Avg.	3.5052	3.3545	3.4431
		S.D.	1.37801	1.40801	1.39136
	100m	Avg.	3.6877	3.5019	3.6108
		S.D.	1.40285	1.53473	1.46059
	Total	Avg.	3.7242	3.7475	3.7338
		S.D.	1.43150	1.55262	1.48239
Visual Feel	Eye Level	Avg.	4.2955	4.3071	4.3003
		S.D.	1.54723	1.57377	1.55705
	60m	Avg.	3.7539	3.5821	3.6831
		S.D.	1.49089	1.60429	1.53977
	100m	Avg.	3.7900	3.5428	3.6831
		S.D.	1.51935	1.59144	1.55317
	Total	Avg.	3.9457	3.8097	3.8895
		S.D.	1.53790	1.233	1.57605

TABLE XVI
THE IMPACT OF THE ALTITUDE AND GROUP IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Altitude Changes	Damage Degree	632.345	2	316.173	159.239***	.000
	Openness	198.241	2	99.121	47.337***	.000
	Visual Feel	168.304	2	84.152	35.080***	.000
Group	Damage Degree	3.468	1	3.468	1.747	.186
	Openness	.267	1	.267	.128	.721
	Visual Feel	8.706	1	8.706	3.629	.057
Altitude Change * Group	Damage Degree	9.614	2	4.807	2.421	.089
	Openness	34.847	2	17.423	8.321	.000
	Visual Feel	5.567	2	2.784	1.160	.314

*** P<.001

The result of [Table X VI] indicates that visual sensitivity changes in the view point of looking at the same view of the target at an altitude of expert and non-expert about the landscape components in the openness.

2) Compared Analysis by Distance

TABLE XVII
VISUAL SENSITIVITY OF THE BASIC STATISTICS (ENVIRONMENT LANDSCAPE BY DISTANCE CHANGES AND GROUP)

	Distance		Expert	Non-Expert	Total
Damage Degree	Close-range	Avg.	4.6132	4.9331	4.7458
		S.D.	1.41434	1.46959	1.44501
	Middle Distance	Avg.	4.1152	4.1185	4.1166
		S.D.	1.50322	1.63171	1.55648
	Distance View	Avg.	4.0921	4.0226	4.0636
		S.D.	1.44903	1.47692	1.45981
	Total	Avg.	4.2732	4.3595	4.3088
		S.D.	0.47452	1.58020	1.51927
Openness	Close-range	Avg.	3.7711	3.3.6989	3.7411
		S.D.	1.38697	1.42291	1.40134
	Middle Distance	Avg.	3.7696	3.7259	3.7515
		S.D.	1.43057	1.60125	1.50256
	Distance View	Avg.	3.6316	3.8189	3.7085
		S.D.	1.47487	1.62987	1.54196
	Total	Avg.	3.7242	3.7475	3.7338
		S.D.	1.43150	1.55262	1.48239
Visual Feel	Close-range	Avg.	4.1632	3.9331	4.0678
		S.D.	1.57477	1.68929	1.62590
	Middle Distance	Avg.	3.7775	3.5926	3.7009
		S.D.	1.42906	1.53665	1.47622
	Distance View	Avg.	3.8974	3.9057	3.9008
		S.D.	1.58405	1.63374	1.60340
	Total	Avg.	3.9457	3.8097	3.8895
		S.D.	1.53790	1.62633	1.57605

TABLE XVIII
THE IMPACT OF THE DISTANCE AND GROUP IN ENVIRONMENT LANDSCAPES

Source	Dependent Variable	sum of squares	Degrees of freedom	Mean-squared	F	Significant probability
Distance Changes	Damage Degree	198.515	2	99.257	44.931***	.000
	Openness	.161	2	.080	.037	.964
	Visual Feel	42.139	2	21.069	8.563***	.000
Group	Damage Degree	3.377	1	3.377	1.529	.216
	Openness	.267	1	.267	.122	.727
	Visual Feel	8.670	1	8.670	3.523	.061
Altitude Change * Group	Damage Degree	13.473	2	6.736	3.049*	.048
	Openness	6.344	2	3.172	1.442	.237
	Visual Feel	5.023	2	2.511	1.021	.361

*P<.1, ** P<01, *** P<.001

[Table XVIII] shows that the point of view of looking at the same view of the target distance changes in visual sensitivity from expert and non-expert feel about the landscape components, there were significant differences on the degree of damage.

V. CONCLUSION

The purpose of this study was to examine the viewpoints in terms of changing distances and levels and thereby, comparatively analyze the visual sensitivity to the elements of the natural view, and the results of this comparative analysis can be summarized as follows;

First, it was found that the visual sensitivity to the elements of the natural views (damaged natural view resources, openness of visual/view axes and visual sense of the skylines) differed significantly depending on subjects' jobs.

Second, it was disclosed that the visual sensitivity to the elements of the natural views (damaged natural view resources, openness of visual/view axes and visual sense of the skylines) differed significantly, when the viewpoints toward the same view had the same X and Y coordinate values on the plan, while the level of the viewpoints (Z value) were varied.

Third, it was found that the visual sensitivity to 'damaged natural view resources' and 'visual sense of the skylines' differed significantly when the distances of the viewpoints were varied among near (500m), middle (1km) and far (2km), but that the visual sensitivity to openness of visual/view axes did not differ significantly.

Fourth, it was found that the visual sensitivity to the elements of the same natural view (damaged natural view resources, openness of visual/view axes and visual sense of the skylines) differed significantly when distances and levels of the viewpoints were varied.

Fifth, it was revealed that the visual sensitivity to 'openness of visual/view axes' differed significantly between experts and ordinary people, but the differences of the visual sensitivity to such elements of the natural views as 'damaged natural view resources' and 'visual sense of the skylines‘ were not significant.

Sixth, it was found that the visual sensitivity to the element of the same natural views 'damaged natural view resources' differed significantly between experts and ordinary people when the distances of the viewpoints were varied, while the visual sensitivity to such elements as 'visual/view axes' and 'visual sense of the skylines' did not differ significantly between the two groups.

Summing up, it was confirmed that the visual sensitivity to the elements of the same natural views (damaged natural view resources, openness of visual/view axes and visual sense of the skylines) differed significantly depending on subjects' professionalism, changes of the viewpoint levels and distances, while the visual sensitivity to 'openness of visual/view axes' did not differ significantly when only the distances of the viewpoints were varied. In addition, the visual sensitivity to visual/view axes differed between experts and ordinary people when the levels of the viewpoints were varied, while the visual sensitivity to 'damaged natural view resources' differed between two groups when the distances of the viewpoints were varied.

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