Academic Article

Investigation and Research on the Green Visual Ratio and its Psychological Effects Using an Omnidirectional Camera

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ABSTRACT

In this study, the green visual ratio is investigated and calculated in the Iizuka urban area; the purpose is to clarify the correlations between the green visual ratio and the psychological effects.

Using an omnidirectional camera, RICOH THETA®, the area was photographed at 69 sites, including schools, traffic-related facilities, other facilities, and green spaces in Iizuka City, Fukuoka Prefecture. The photography points were neighborhood doorways as the point of contact for roadside trees and facilities. The photographic height was set to 150 cm and the period of photography was from August 6 to August 29, 2015.

Using Adobe Photoshop®, the green area was extracted, and the green visual ratio was calculated to divide the number of green pixels by the number of pixels in the circle image.

In addition, through a questionnaire to university students, the correlation between the green visual ratio and the psychological effect was analyzed.

Key Words : Green visual ratio, Green psychological effect, Omnidirectional camera, Iizuka City

1. Introduction

Urban greenery has the function of improving the urban thermal environment by shutting out the sunlight and changing the land surface. Adding to such physical effects, it has been pointed out that there are psychological effects of raising comfort levels and calm feelings [(1)].

In this study, the green visual ratio is investigated and calculated in the Iizuka urban area; the purpose is to clarify the correlations between the green visual ratio and the psychological effects.

Green coverage ratio and green visual ratio are available as an index for grasping the green amount.

Green coverage ratio is the percentage of green covered area in a region or district. It is an index to grasp the amount of planar green, and it is used for urban planning.

On the other hand, the green visual ratio is the percentage of green in the field of view.

It is a concept considered as an index close to a spatial real feeling with respect to green coverage ratio that can be captured in a planar view.

Previous measurement of green visual ratio has been mainly a method of calculating by visual discrimination and manual work, based on the photograph taken at a specific viewing angle, fixing the line of sight from a certain point in the horizontal forward direction.

Conventional metrology method is highly adaptable to reality and is often used as a method of current situation analysis.

The actual view of a human being varies depending on the situation and behavior at each occasion. The green existence evaluation has a great influence not only on the amount of green forward in the progressing direction but also on the amount of overhead green. In addition, the crown looking up from under the high tree and the green like the grass surface spreading out at the foot exist on a daily basis.

So it is necessary not only the measurement of the conventional green visual rate with fixed gaze direction and viewing angle but also the measurement of omnidirectional green visual rate.

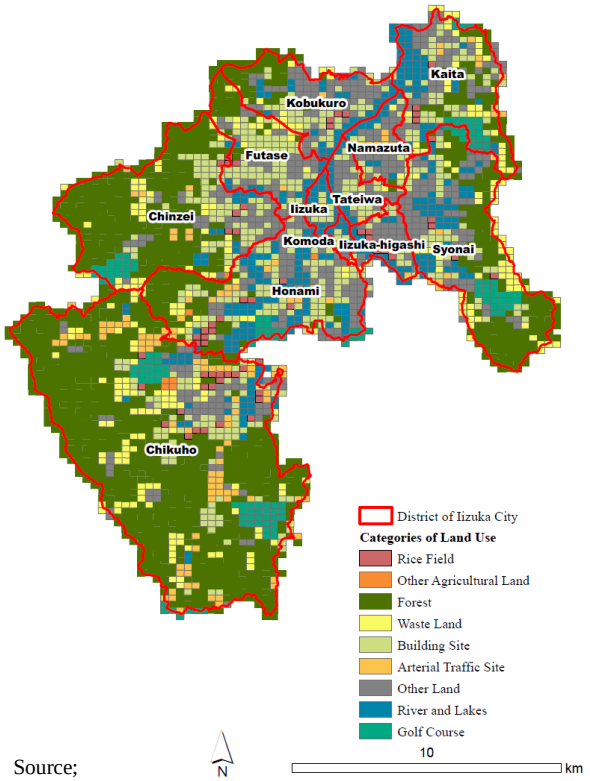
The Iizuka City in the Fukuoka Prefecture has a total area 214.07 km^2, and a population of 131,492 as of the end of June 2016.

Natural land use consists of forest, agricultural land, and water, constitutes about 65% of the total of Iizuka City. Unnatural land use consists of roads, residential sites,

commercial/office sites, industrial sites, and others.

The green quantity of land area is 14,755 ha, or approximately 69% of the total of Iizuka City as of the end of March 2008. The green area ratio of agricultural land is 18.8%, the forest is 72.0%, river, reservoir, and waterways are 3.4%, facilities' green tracts of land such as urban parks are 1.7%, and the golf course is 4.1% [(2)].

The land use map of Iizuka City is shown in Figure 1.



Source;
The land use by the Digital National Land Information in Japan, FY 2006

Figure 1. Land use map of Iizuka City

2. The Green Visual Ratio

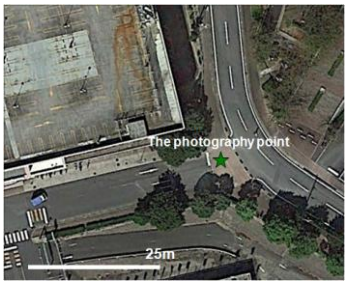
Using an omnidirectional camera, RICOH THETA® [1)], the area was photographed at 69 sites, including schools, traffic-related facilities, other facilities, and green spaces in Iizuka City. The photography points were neighborhood doorways as the point of contact for roadside trees and facilities. The photographic height was set to 150 cm and the period of photography was from August 6 to August 29, 2015.

Figure 2 shows the site of view by the satellite image. Figure 3 shows the procedures from photographing to extracting of greenery. The summary of the investigation on the green visual ratio is shown in Table 1.

The photographed equidistant cylindrical projection image was converted to the stereographic projection image by the application software of RICOH THETA®. This stereographic projection image can be transferred to a smartphone for viewing. Further, the transferred still image on the touch panel can be pinched in/pinched out, can be rotated by sliding it, can be freely moved and can be seen with favorite angle.

The stereographic projection image was converted to the orthograpic projection image by SPCONV ver.0.7, projection converter [3)].

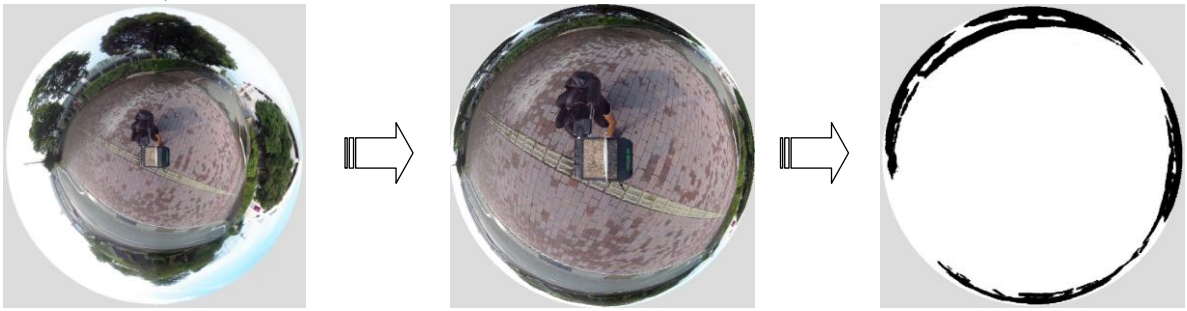
The green area was roughly extracted by Photoshop®'s "automatic selection tool", and then extracted by visual interpretation. The green visual ratio was calculated to divide the number of green pixels by the number of pixels in the circle image.



Source; Google Earth, 2014/10/17

Figure 2. Site of view by the satellite image
(e.g. Aeon Honami Shopping Center)

(a) Equidistant cylindrical projection image



(b) Stereographic projection image (c) Orthograpic projection image (d) Extracted image of greenery

Figure 3. Procedures from photographing to extracting of greenery (e.g. Aeon Honami Shopping Center)

Table 1. Summary of the investigation on the green visual ratio

Investigation enforcement days	from August 6 to August 29, 2015

69 photography sites

1. Futase District
   Igisu Elementary School, Futase Junior High School, Kyushu Institute of Technology, Futase Community Center, Kawazu Green Way
2. Kobukuro District
   Kobukuro Community Center
3. Chinzei District
   Yakiyama Elementary School, Kaho High School, Chinzei Community Center
4. Komoda District
   Komoda Elementary School, Kyushu Junior College of Kindai University, Komoda Community Center, Iizuka Station
5. Tateiwa District
   Tateiwa Elementary School, Iizuka Nisshinkan Elementary/Junior High School, Kahohigashi High School, Iizuka High School, Iizuka City Hall Headquarters, Sunabilities-iizuka, Honami Welfare Research Center, Shin-iizuka Station
6. Iizuka-higashi District
   Iizuka-higashi Community Center, Iizuka-daini Junior High School, Faculty of Humanity-oriented Science and Engineering, Kindai University, Iizuka-higashi Community Center, Kamimio Station, Kayanomori Greenery
7. Iizuka District
   Iizuka Elementary School, Katashima Elementary School, Chuo Community Center, Iizuka Library, Iizuka Gymnasium, Aso Iizuka Hospital, Iizuka Bus Center, Iizuka Green Way, Katsumori Park
8. Namazuta District
   Namazuta Community Center, Urata Station, Namazuta Station
9. Honami District
   Takata Elementary School, Rakuichi Elementary School, Iizuka City Hall Honami Branch, Honami Community Center, Honami Gymnasium, Honami Library, Iizuka City Hospital, Saiseikai Iizuka Kaho Hospital, Aeon Honami Shopping Center, Tento Station
10. Chikuho District
    Daibu Elementary School, Iizuka City Hall Chikuho Branch, Chikuho Community Center, Chikuho Gymnasium, Chikuho Library, Chikuho Health and Welfare Research Center, Chikuzen-daibu Station, Kuroubaru Station, Chikuzen-uchino Station, Kami-honami Station
11. Shonai District
    Shonai Elementary School, Iizuka City Hall Shonai Branch, Shonai Library, Shonai Community Center, Shonai Gymnasium, Shonai Health and Welfare Research Center, Chikuzen-syonai Station, Chikuho Greenery
12. Kaita District
    Kaita Community Center, Kaita Library, Kaita Elementary/Junior High School, Iizuka City Hall Kaita Branch, Kaita Gymnasium, Kaita Hospital
13. Other District
    Kaho-Sogo High School, Keisen Station

The green visual ratio of the investigation sites are shown in Figure 4. The average total was 8.8%. Forty-seven sites (68.1%) had less than a 10% green visual ratio, eighteen sites (26.1%) had a 10–20% ratio, one site (1.4%) had a 20–30% ratio, and three sites (4.3%) had a ratio over 30%.

By looking at the green visual ratio of districts, the average score at Namazuta District was the largest at 17.3%, followed by Futase District at 14.0%, and Iizuka-higashi District at 11.8% (in Figure 5).

In addition, by looking at the green visual ratio of facilities, it was found that the largest average score of green spaces was 18.4%.

The average score of public facilities was the smallest at 7.1%, followed by education facilities and other ones at 8.5% (in Figure 6).

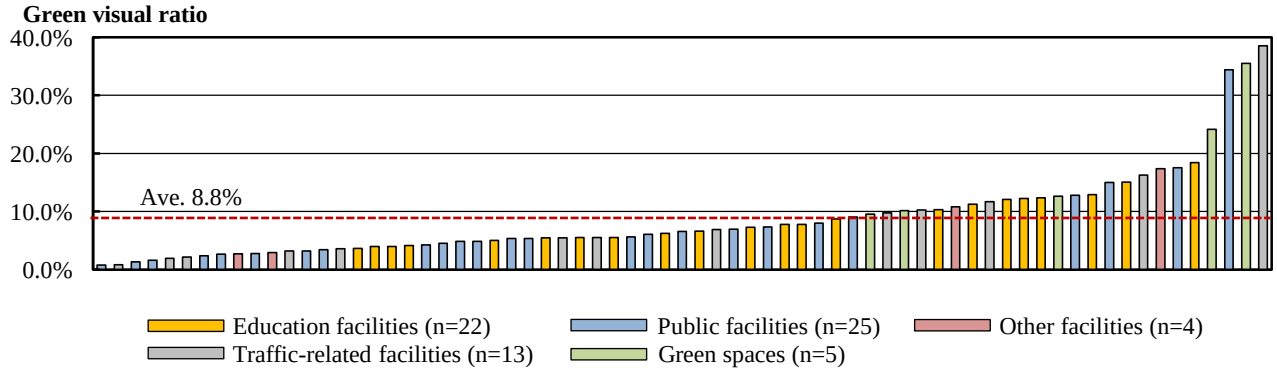


Figure 4. Green visual ratio at 69 photography sites (ascending order)

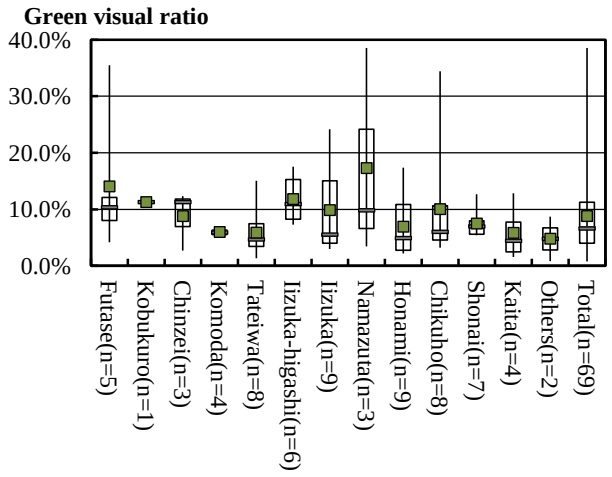


Figure 5. Green visual ratio of districts

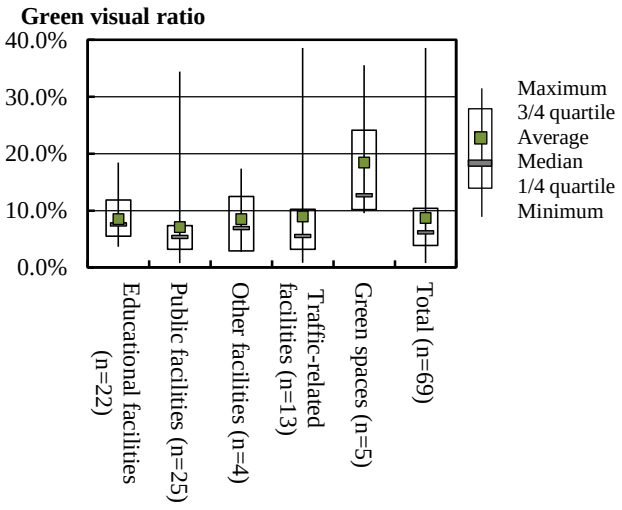


Figure 6. Green visual ratio of facilities

3. The Correlation between the Green Visual Ratio and the Psychological Effect

In addition, through a questionnaire to university students, the correlation between the green visual ratio and the psychological effect was analyzed.

The questionnaire, involving 85 university students, was carried out on January 18 and 22, 2015.

The questionnaire contents included gender, hometown, amount of greenery in hometown, amount of greenery in Iizuka City compared with hometown, feelings about greenery, and impressions of greenery (in Table 2).

Table 2. Summary of the questionnaire about the green visual ratio and the psychological effect

Investigation enforcement days	January 18 and 22, 2015
Execution object of the questionnaire	84 students, 1st grade, Department of Architecture and Design, Faculty of Humanity-Oriented Science and Engineering, Kindai University
Execution sites of the questionnaire	20 sites
How to show images to subjects	The stereographic projection image have installed to a smartphone for viewing can be seen with favorite angle.

Questionnaire contents

1. Gender
   Are you male or female? *Male/Female*
2. Hometown
   Where is your hometown? □*Prefecture* □*City*
3. Amount of greenery in hometown (five-grade relative estimation), a little (-) ↔ much (+)
   How much greenery is your hometown? *A little/Rather little/Neutral/Rather much/Much*
4. Amount of greenery in Iizuka City compared with hometown (five-grade relative estimation) , a little (-) ↔ much (+)
   How much greenery is Iizuka City compared with your hometown? *A little/Rather little/Neutral/Rather much/Much*
5. Feelings about greenery (five-grade relative estimation) , dislike (-) ↔ like (+)
   How about your feelings about greenery? *Dislike/Rather dislike/Neutral/Rather like/Like*
6. Impressions of greenery (five-grade relative estimation)
   How do you feel by looking at the image?
   1) narrow (-) ↔ extensive (+) ; Very narrow (-2)/Quite narrow (-1)/Neither (±0)/Quite extensive (+1)/Very extensive (+2)
   2) deserted (-) ↔ lively (+) ; Very deserted (-2)/Quite deserted (-1)/Neither (±0)/Quite lively (+1)/Very lively (+2)
   3) dreary (-) ↔ charming (+) ; Very dreary (-2)/Quite dreary (-1)/Neither (±0)/Quite charming (+1)/Very charming (+2)
   4) thorny (-) ↔ friendly (+) ; Very thorny (-2)/Quite thorny (-1)/Neither (±0)/Quite friendly (+1)/Very friendly (+2)
   5) unpleasant (-) ↔ comfortable (+) ;
   Very unpleasant (-2)/Quite unpleasant (-1)/Neither (±0)/Quite comfortable (+1)/Very comfortable (+2)
   6) boring (-) ↔ attractive (+) ; Very boring (-2)/Quite boring (-1)/Neither (±0)/Quite attractive (+1)/Very attractive (+2)
   7) cold (-) ↔ warm (+) ; Very cold (-2)/Quite cold (-1)/Neither (±0)/Quite warm (+1)/Very warm (+2)
   8) messy (-) ↔ refreshing (+) ; Very messy (-2)/Quite messy (-1)/Neither (±0)/Quite refreshing (+1)/Very refreshing (+2)
   9) uncomfortable (-) ↔ comfortable (+) ;
   Very uncomfortable (-2)/Quite uncomfortable (-1)/Neither (±0)/Quite comfortable (+1)/Very comfortable (+2)
   10) undesirable (-) ↔ desirable (+) ;
   Very undesirable (-2)/Quite undesirable (-1)/Neither (±0)/Quite desirable (+1)/Very desirable (+2)
   11) poor greenery (-) ↔ rich greenery (+) ;
   Very poor greenery (-2)/Quite poor greenery (-1)/Neither (±0)/Quite rich greenery (+1)/Very rich greenery (+2)

To get an evaluation in the form that is almost sight, the stereographic images were used in the questionnaire. The execution sites of the questionnaire, and the comparison between the green visual ratio by stereographic image and by orthographic image is shown in Table 3.

With regard to amount of greenery in hometown, 47.6% of all students responded that they felt as either “much” or “rather much”. And 15.5% of all students responded that they felt as either “a little” or “rather little”.

With regard to amount of greenery in Iizuka City compared with hometown, 58.4% of all students responded that they felt as either “much” or “rather much”. And 19.0% of all students responded that they felt as either “a little” or “rather little” (in Table 4).

With regard to both amount of greenery in hometown and amount of greenery in Iizuka City compared with hometown, the students felt as “much” or “rather much” are high percentage (in Table 5).

Therefore, with regard to feelings about greenery, 75.9% of all students responded that they felt either “like” or “rather like”, and only one student expressed a “rather dislike”. This shows that many have a feeling friendly to greenery (in Table 6).

The result of a chi-square test assuming a level of significance of 5%, did not show any meaningful difference between gender, hometown, amount of greenery in hometown, amount of greenery in Iizuka City compared with hometown, or feelings about greenery; only the amount of greenery in the hometown and the amount of greenery in Iizuka City compared with hometown showed a significant correlation (in Table 4 to Table 9).

As the amount of greenery in the hometown increases, the amount of greenery in Iizuka City compared with hometown tends to be lower (in Table 7).

Table 3. Execution sites of the questionnaire, and the green visual ratio by stereographic projection image and by orthographic projection image

Sites	**Districts**	**Facilities**	**Green visual ratio**	
			by stereographic projection image	**by orthographic projection image**
Kyushu Institute of Technology	Futase	Educational facility	26.6%	10.3%
Kawazu Green Way	Futase	Green space	47.5%	35.5%
Kyushu Junior College of Kindai University	Komoda	Educational facility	12.1%	6.2%
Iizuka Station	Komoda	Traffic-related facility	6.7%	5.5%
Iizuka City Hall Headquarters	Tateiwa	Public facility	2.0%	1.3%
Shin-iizuka Station	Tateiwa	Traffic-related facility	1.7%	2.0%
Faculty of Humanity-oriented Science and Engineering, Kindai University	Iizuka-higashi	Educational facility	14.7%	7.3%
Kayanomori Greenery	Iizuka-higashi	Green space	19.0%	9.6%
Iizuka Green Way	Iizuka	Green space	31.9%	24.1%
Katsumori Park	Iizuka	Green space	31.2%	10.2%
Urata Station	Namazuta	Traffic-related facility	33.0%	38.5%
Namazuta Station	Namazuta	Traffic-related facility	12.0%	9.8%
Iizuka City Hall Honami Branch	Honami	Public facility	3.7%	2.4%
Tento Station	Honami	Traffic-related facility	4.9%	2.2%
Iizuka City Hall Chikuho Branch	Chikuho	Public facility	8.3%	4.9%
Chikuzen-daibu Station	Chikuho	Traffic-related facility	6.8%	3.6%
Iizuka City Hall Shonai Branch	Shonai	Public facility	14.3%	6.9%
Chikuho Greenery	Shonai	Green space	13.0%	12.7%
Iizuka City Hall Kaita Branch	Kaita	Public facility	1.8%	1.6%
Keisen Station	Other	Traffic-related facility	0.8%	0.8%

Table 4. Cross tabulation of questionnaire contents, gender and amount of greenery in hometown, a chi-square test (α=5%)

		Amount of Greenery in Hometown					
		a little (-) ↔ much (+)					
		-2	-1	±0	+1	+2	Total
Gender	Male	4 6.5%	7 11.3%	20 32.3%	17 27.4%	14 22.6%	62 100%
	Femal	0 0.0%	2 9.1%	11 50.0%	7 31.8%	2 9.1%	22 100%
	Total	4 4.8%	9 10.7%	31 36.9%	24 28.6%	16 19.0%	84 100%

✓ no significant differences

Table 5. Cross tabulation of questionnaire contents, gender and amount of greenery in Iizuka City compared with hometown, a chi-square test (α=5%)

		Amount of Greenery in Iizuka City compared with Hometown					
		a little (-) ↔ much (+)					
		-2	-1	±0	+1	+2	Total
Gender	Male	5 8.1%	8 12.9%	13 21.0%	16 25.8%	20 32.3%	62 100%
	Female	2 9.1%	1 4.5%	6 27.3%	8 36.4%	5 22.7%	22 100%
	Total	7 8.3%	9 10.7%	19 22.6%	24 28.6%	25 29.8%	84 100%

✓ no significant differences

Table 6. Cross tabulation of questionnaire contents, gender and feelings about greenery, a chi-square test (α=5%)

		Feelings about Greenery					
		dislike (-) ↔ like (+)					
		-2	-1	±0	+1	+2	Total
Gender	Male	0 0.0%	0 0.0%	16 26.2%	24 39.3%	21 34.4%	61 100%
	Female	0 0.0%	1 4.5%	3 13.6%	8 36.4%	10 45.5%	22 100%
	Total	0 0.0%	1 1.2%	19 22.9%	32 38.6%	31 37.3%	83 100%

✓ no significant differences

Table 7. Cross tabulation of questionnaire contents, amount of greenery in Iizuka City compared with hometown and amount of greenery in hometown, a chi-square test (α=5%)

			Amount of greenery in hometown					
			a little (-) ↔ much (+)					
			-2	-1	±0	+1	+2	Total
Amount of greenery in Iizuka City compared with hometown	a little (-) ↔ much (+)	-2	1 14.3%	0 0.0%	1 14.3%	1 14.3%	4 57.1%	7 100%
		-1	0 0.0%	0 0.0%	3 33.3%	2 22.2%	4 44.4%	9 100%
		±0	0 0.0%	0 0.0%	8 42.1%	9 47.4%	2 10.5%	19 100%
		+1	2 8.3%	6 25.0%	6 25.0%	7 29.2%	3 12.5%	24 100%
		+2	1 4.0%	3 12.0%	13 52.0%	5 20.0%	3 12.0%	25 100%
		Total	4 4.8%	9 10.7%	31 36.9%	24 28.6%	16 19.0%	84 100%

✓ significant differences

Table 8. Cross tabulation of questionnaire contents, amount of greenery in hometown and feelings to greenery, a chi-square test (α=5%)

			Feelings to greenery					
			dislike (-) ↔ like (+)					
			-2	-1	±0	+1	+2	Total
Amount of greenery in hometown	a little (-) ↔ much (+)	-2	0 0.0%	0 0.0%	0 0.0%	3 75.0%	1 25.0%	4 100%
		-1	0 0.0%	0 0.0%	5 55.6%	3 33.3%	1 11.1%	9 100%
		±0	0 0.0%	1 3.2%	4 12.9%	13 41.9%	13 41.9%	31 100%
		+1	0 0.0%	0 0.0%	6 25.0%	11 45.8%	7 29.2%	24 100%
		+2	0 0.0%	0 0.0%	4 26.7%	2 13.3%	9 60.0%	15 100%
		Total	0 0.0%	1 1.2%	19 22.9%	32 38.6%	31 37.3%	83 100%

✓ no significant differences

Table 9. Cross tabulation of questionnaire contents, amount of greenery in Iizuka City compared with hometown and feelings to greenery, a chi-square test (α=5%)

			Feelings to greenery					
			dislike (-) ↔ like (+)					
			-2	-1	±0	+1	+2	Total
Amount of greenery in Iizuka City compared with hometown	a little (-) ↔ much (+)	-2	0 0.0%	0 0.0%	2 28.6%	0 0.0%	5 71.4%	7 100%
		-1	0 0.0%	0 0.0%	2 22.2%	2 22.2%	5 55.6%	9 100%
		±0	0 0.0%	1 5.3%	1 5.3%	10 52.6%	7 36.8%	19 100%
		+1	0 0.0%	0 0.0%	7 29.2%	12 50.0%	5 20.8%	24 100%
		+2	0 0.0%	0 0.0%	7 29.2%	8 33.3%	9 37.5%	24 100%
		Total	0 0.0%	1 1.2%	19 22.9%	32 38.6%	31 37.3%	83 100%

✓ no significant differences

The correlation of the green visual ratio and the average score of impressions of greenery is shown in Table 10.

Figure 7 shows the correlation between the 20 sites' green visual ratio and the score on impressions of greenery.

The "narrow (−) ↔ extensive (+)" and the other six items showed a plus average score for 84 student respondents.

The opposite to the "deserted (−) ↔ lively (+)" and the other three items was a minus average score for the same 84 students.

The items of "poor greenery (−) ↔ rich greenery (+)," "uncomfortable (−) ↔ comfortable (+)," "messy (−) ↔ refreshing (+)," "undesirable (−) ↔ desirable (+)," "thorny (−) ↔ friendly (+)," "cold (−) ↔ warm (+)," "boring (−) ↔ attractive (+)," "dreary (−) ↔ charming (+)," and "unpleasant (−) ↔ comfortable (+)" showed positive correlations.

Moreover, the items of "narrow (−) ↔ extensive (+)" and "deserted (−) ↔ lively (+)" showed negative correlations.

The items of "poor greenery (−) ↔ rich greenery (+)" and "uncomfortable (−) ↔ comfortable (+)" showed high positive correlations.

There was a correlation between the green visual ratio and the impression about green amount, and it was felt that there was rich green, if over 15.5% green visual ratio in this study. The items of "messy (-) ↔ refreshing (+)," "uncomfortable (-) ↔ comfortable (+)," "undesirable (-) ↔ desirable (+)," and "poor greenery (-) ↔ rich greenery (+)" correlated with the green visual ratio in a statistically significant level of 5% or 1%, but the other items did not. It is inferred that this is due to the influence of other factors such as green type, green position, green condition, green maintenance situation, non-green structure shown in the image.

Figure 8 shows the average score of impressions of greenery of facilities.

The facilities with the higher average green visual ratio are biased toward "rich greenery". Average green visual ratio of educational facilities is 17.8%, next to the green spaces, but the score on impressions of greenery of educational facilities are biased toward "deserted", "dreary", and "boring". Not only the green visual ratio of the facilities but also the surroundings affects the impressions of greenery.

Table 10. Correlation of green visual ratio and average score of impressions of greenery

Items	**Average score**	**Coefficient of determination**	**Green visual ratio with impression score of greenery of ±0**
narrow (-) ↔ extensive (+)	+ 0.48	0.034	17.0%
deserted (-) ↔ lively (+)	- 0.10	0.018	14.4%
dreary (-) ↔ charming (+)	- 0.03	0.022	14.8%
thorny (-) ↔ friendly (+)	+ 0.16	0.095	12.9%
unpleasant (-) ↔ comfortable (+)	+ 0.22	0.005	13.4%
boring (-) ↔ attractive (+)	- 0.10	0.038	15.2%
cold (-) ↔ warm (+)	+ 0.09	0.077	14.0%
messy (-) ↔ refreshing (+)	+ 0.25	0.293 **	8.7%
uncomfortable (-) ↔ comfortable (+)	+ 0.11	0.450 **	11.6%
undesirable (-) ↔ desirable (+)	+ 0.12	0.207 *	12.9%
poor greenery (-) ↔ rich greenery (+)	- 0.07	0.657 **	15.5%

Note; ** Correlated in a statistically significant level of 1%
* Correlated in a statistically significant level of 5%

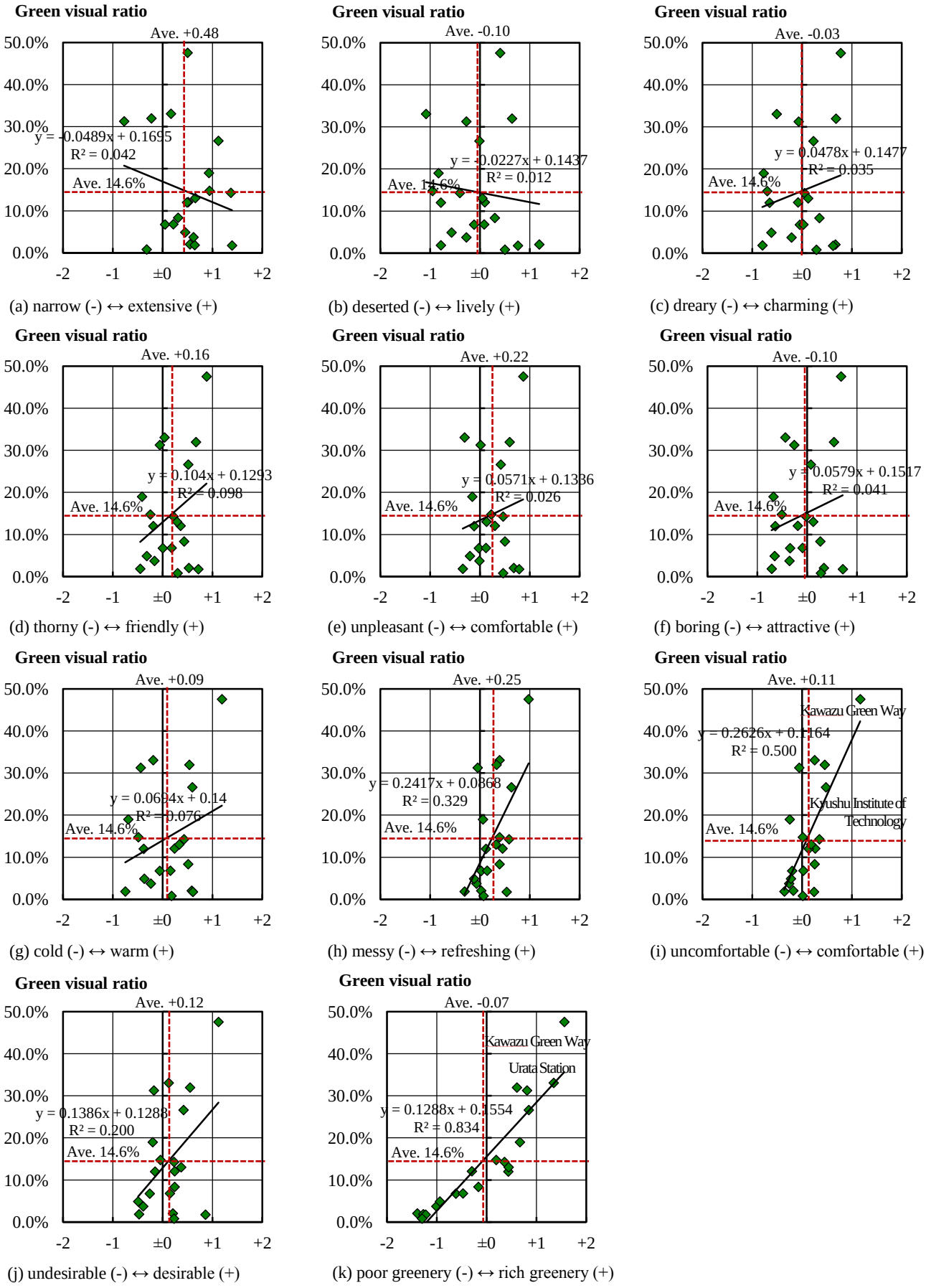


Figure 7. Correlation between 20 sites' green visual ratio and score of impressions of greenery

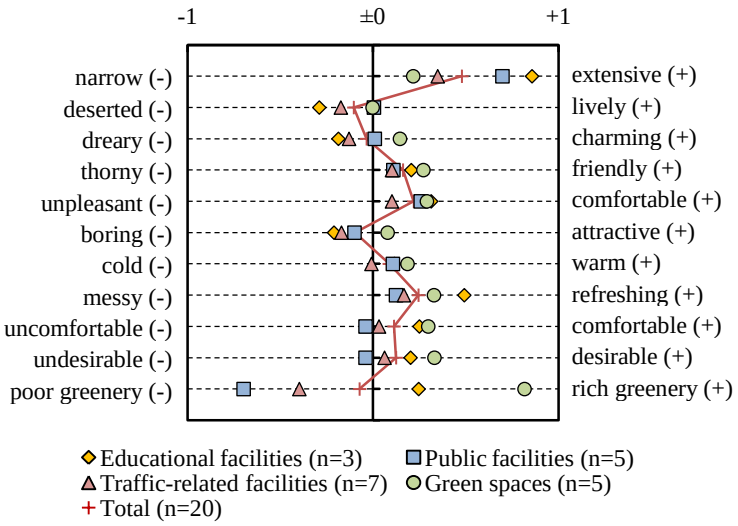


Figure 8. Average score of impressions of greenery of facilities

Table 12. Average green visual ratio of facilities

Facilities	Average green visual ratio
Educational facilities	17.8%
Public facilities	6.0%
Traffic-related facilities	9.4%
Green spaces	28.5%
Total	14.6%

4. Conclusion

In this study, the green visual ratio is investigated and calculated in the Iizuka urban area; the purpose is to clarify the correlations between the green visual ratio and the psychological effects.

The average total green visual ratio of the investigation sites was 8.8%. By looking at the green visual ratio of districts, the average score at Namazuta District was the largest at 17.3%. And by looking at the green visual ratio of facilities, the average score of green spaces was the largest at 18.4%.

The result of a chi-square test assuming a level of significance of 5%, the amount of greenery in the hometown and the amount of greenery in Iizuka City compared with hometown showed a significant correlation.

Shown as the correlation of the green visual ratio and the average score of impressions of greenery, the items of “poor greenery (−) ↔ rich greenery (+)” and “uncomfortable (−) ↔ comfortable (+)” showed high positive correlations.

There was a correlation between the green visual ratio and the impression about green amount, and it was felt that there was rich green, if over 15.5% green visual ratio in this study. The items of “messy (-) ↔ refreshing (+),” “uncomfortable (-) ↔ comfortable (+),” “undesirable (-) ↔ desirable (+),” and “poor greenery (-) ↔ rich greenery (+)” correlated with the green visual ratio in a statistically significant level of 5% or 1%, but the other items did not. It is inferred that this is due to the influence of other factors such as green type, green position, green condition, green maintenance situation, non-green structure shown in the image.

We will continue our research in the future and clarify the relevance between items other than green visual ratio and impressions of greenery.

Notes

1) RICOH THETA® [8]

Table 11. Main specifications of the device

Shooting distance	Approximately 10cm to infinity (from front of lens)
Shooting mode	Still image: Auto, shutter priority, ISO priority *5, Video: Auto
Exposure control mode	Automatic
Exposure compensation	Still image: Manual compensation (-2.0 - +2.0EV, 1/3EV step)
ISO sensitivity (standard output sensitivity)	Still image: ISO 100 to 1600, Video: ISO 100 to 400
White balance mode	Still image: Auto, indoors, outdoors, cloudy, incandescent lamp 1, incandescent lamp 2, daylight color fluorescent lamp, natural white fluorescent lamp, white fluorescent lamp, light bulb color fluorescent lamp*5, Video: Auto
Shutter speed	Still image:1/8000 to 1/7.5 secont, Video:1/8000 to 1/15 secont
Memory	Internal, approximately 4GB
Storage capacity	Still image: Approx. 1200, Video (time per recording): Max. 3 minutes, Video (total recording time): Approx. 40 minutes.
Power Battery life	Internal lithium ion battery Approximately 200 captures
Image file format	Still image: JPEG (Exif Ver. 2.3), DCF2.0 compliant, MOV (Video: MPEG-4 AVC/H.264, Audio: LinearPCM)
External interface	microUSB2.0
Dimensions (L x W x D)	42mm x 129mm x 22.8mm (17.4mm)
Weight	Approx. 95g
Operating temperatures	0 to 40℃
Operating humidity	Under 90%
Storage temperatures	-20℃ to 60℃

Figure 9. Photograph of the device

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