On the Landscapes Elements from a Bird's-Eye View Scape

Nobuaki Tanaka and Kazunari Tanaka

***Abstract*—**When it comes to landscapes, beautiful landscapes are formed from local climates such as history and customs by elements such as varying nature and demographic structures. A feature that creates these beautiful landscapes is the linear landscape element. This linear element is characterized as being beautiful because landscape elements that can be continuously viewed form a beautiful landscape such as a building that looks continuous due to the shape and color, in addition to linear landscape elements such as rivers and roads. Hypotheses concerning continuity and image are present not only in urban landscapes, but also in the landscape of rural areas and mountainous regions. Therefore, in this research, focusing on a bird's eye view from high vantage points, we aim to examine urban landscapes by analyzing their elements, shape, view and area. As for the examination method, analyzed and expressed the continuity of streets, rivers, green roads etc., using image analysis and GIS. From the results, extract and consider the relationship between the position and shape of elements with regards to continuity and the beauty of urban landscapes.

***Keywords*—**High-rise building, Bird's eye view, Landscape, Continuity, Visibility analysis, continuity

I. Introduction

In Japan, there are various climates. There are places to enjoy beautiful scenery, such as views from a natural observation point such as a mountain, or a view from man-made point such as a bridge. The view from a mountain or high-rise building etc., provides a majestic landscape that people cannot see much in everyday life. The landscape from this altitude is called an "overhead view", which is important when viewing landscapes (Fig. 1).

Meanwhile, in recent years, various techniques have been used to capture attractive urban landscapes. A combination of elements such as arrangement and shape of buildings and trees etc., that is continuous is what forms a beautiful landscape. Sexuality is also one of the elements that directs the appeal of the landscape, for example, a sprawling grassland, the scenery of a city from the top of a mountain or the roof of a building, the continuous light in a night view, etc., all feel beautiful. Such continuity is important in forming a beautiful landscape because it is possible to view from various places and angles. We believe that future landscape design can be done by grasping the relationship between the continuity of the city, and the overlooking landscape.

Nobuaki Tanaka, Osaka Institute of Technology University, Japan
Kazunari Tanaka, Osaka Institute of Technology University, Japan

Fig. 1 Picture of bird's eye view

II. Purpose

There are many places where we can see the urban landscape, for this research we focused on high-rise buildings. In Japan there are more than 500 buildings over 100m tall. Offices and condominiums are becoming taller, and it is becoming more common for people to view the urban landscape from a bird's eye view.

Also, beautiful urban landscapes are related to shapes and colors that are continuous. Hypotheses about continuity and image are established not only in the city, but also in the landscape of rural areas and mountainous areas. However, in general high-rise buildings are concentrated in big cities, and therefore, in some cases the buildings obstruct the view. Therefore, for this research it is crucial to be able to observe the unobstructed urban landscape from a bird's-eye view from a high-rise building in Osaka city, and subsequently examining the urban landscape by analyzing elements and shapes, view and areas.

III. Method

First of all, will discover where we can see many elements when looking at a target area. By analyzing the depression angle from the test building, we grasp how much we can see continuously from a bird's-eye view. Taking this into account,, a questionnaire survey was conducted to grasp the relationship between the overhead view and the landscape elements in a linear direction. From the results, when looking at the city from a bird's-eye view, it was more attractive when the roads, rivers, and greens were linear as landscape elements.

https://doi.org/10.17758/EIRAI4.F0918107

IV. Target Area

The target area of this research is Osaka city. Osaka city has rivers that are wide and winding with rich greenery and parks along the banks, along with numerous buildings and structures. In addition, large-scale roads are stretched in a lattice pattern, and the landscape is formed taking into consideration the continuity of buildings and harmony between the roads and buildings (Fig. 3).

Fig. 2 Target area

V. Selection of Viewpoint

We selected high-rise buildings as viewpoints. To do the selection, we use skyline possibility analysis from existing research. The reason for using this analysis is that this analysis identifies the areas where you can see the skyline from various places. The area where the frequency of occurrence of skyline possibility is high is a boundary line that separates the ground from the sky, which can be said to be an obstacle or a noticeable object. On the contrary, when viewed from the building, you can see a wide range of landscapes. From this relationship you can see the area where urban space is regarded as a wide area landscape. To do this analysis, we created a 250m mesh DSM (Digital Surface Model) from existing research; Osaka city, which is the target area, has a generation range of about 20km square. Using this DSM, we identified a place where you can see a wide area overlooking the city of Osaka. The darker the blue color, the easier it is to view the skyline. As a result, it came out that the Osaka station neighborhood and Tennoji station would be high visibility. Narrowed further, Abeno Harukasu, a place with public nature was selected as an optimal location.

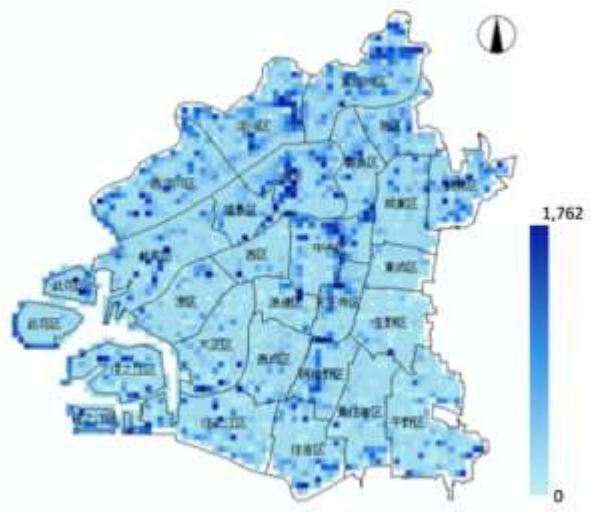
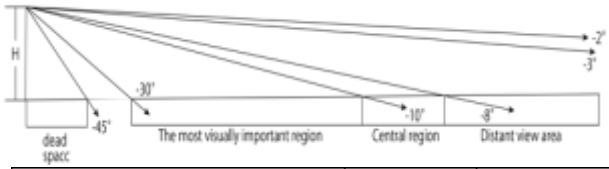


Fig. 3 Skyline possibility appearance distribution1)

VI. Depression Analysis

Depression angle analysis was conducted in order to grasp the area that would be visible from a bird's-eye view from the selected building. The depression angle analysis was carried out using the DSM to grasp the overhead view that can be seen from each viewpoint, and the position of the point was set at a height of the observation platform (at 1.5m). As for the depression angle, we also verified the bird's-eye view from existing research and obtained quantitative analysis results (Figure 3). From this result it is possible to analyze at the lower limit of the depression angle of 30 °or more.



Viewpoint height (H)	angle	distance (D)
Visual axis (Central vision)	8～10°	5.7H~7.1H
Depression general lower limit	30°	1.7H
Minimum depression angle lower limit	45°	H
Hypersurface general upper limit	2～3°	19H~29H

Fig. 4 Hypothetical number of Bird's eye view scape2)

The analysis results from the observatory of Abeno Harukasu is shown in Figure 6. From the results, it was possible to grasp the area that can be viewed from a bird's eye view from the viewpoint. Specifically, there were many areas in the southern part of Osaka city which are in the good visible region. However, the scope of view in Umeda is limited because there are many high-rise buildings.

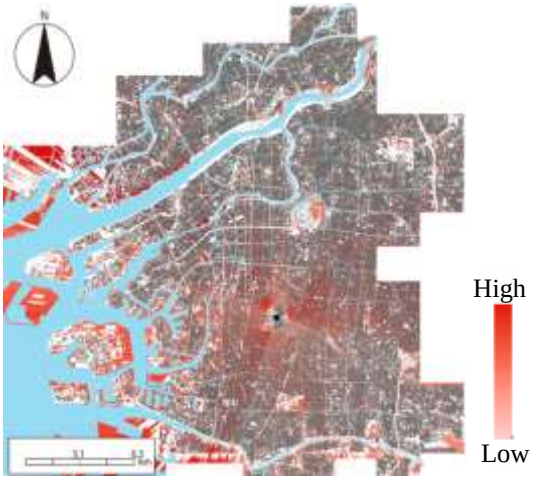


Fig. 3 Result of declination analysis

Based on this result, we thought that we could see a lot of buildings so we could see it together. Therefore, only the building was extracted (Fig. 5). The figure is expressed by height information. From now on, think that you can look at it collectively, analyze the landscape with cohesion and continuity.

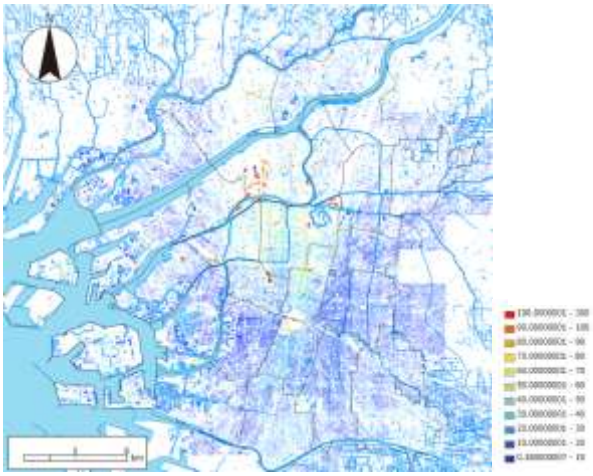


Fig. 4 Picture of bird's eye view

VII. Investigation

A questionnaire survey was conducted using the paired comparison method for the influence of continuity from an overhead view (Table 1). This investigation is a method of choosing which one is perceived as more attractive by showing two images. This time, we collected 10 pictures randomly taken from a high-rise building. From these images, we altered them by removing linear roads, rivers, and greens (Fig. 2~3). We had 20 of these images randomly arranged. The questionnaire date and time and target number of people are as shown in Table 1. The average of the questionnaire results was graphed (Fig. 2). Results showed that overall the landscape was considered more attractive when the linear elements exist. However, in the case of 1 and 8, the image without the linear landscape elements was more attractive. The reason for this is that in the case of 1, we believe that shadows affected the outcome. In the original image, the difference between light and dark is small, and in the created image, the created image is better because the light and dark areas are clear. In the case of 8, we thought that the miscellaneous townscape looked beautiful, thus making the created image more attractive.

TABLE I
OUTLINE OF QUESTIONNAIRE SURVEY

Target	Osaka Institute of Technology students 78 people
Date and time	9-May-18
Method	Questionnaire survey by pair comparison

Fig. 5 Original image

Fig. 6 Create image

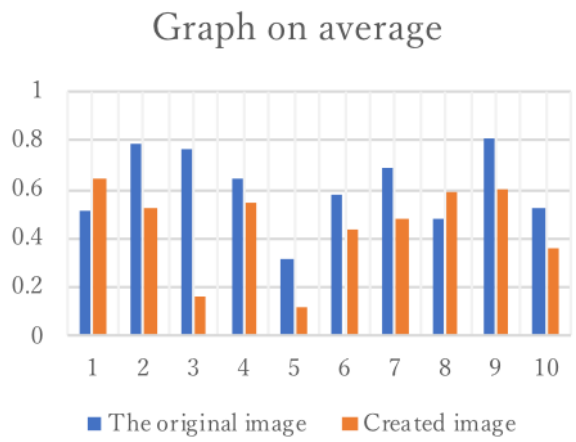


Fig. 7 Average value of the questionnaire result

In order to ascertain the validity of this result, a t-test was performed (Table 2). By conducting this test, it can be confirmed as to whether or not the given results were by chance. Since the absolute value of the t value is larger than the absolute value of the boundary value of the t value from the table, and the

value of the p value is smaller than 0.05 even from the p value, there is some statistically significance between the two variables. This means that the difference between the average values cannot be said to be 0. Therefore, from this result it can be said that the more continuous the road, river, greenery etc., the more statistically significant and attractive the landscape. However, there were some results that did not have significance.

TABLE II
RESULT OF T TEST OF 1 AND 11

name	1	11
average	0.512820513	0.641025641
variance	0.253080253	0.233100233
Observed number	78	78
Pearson correlation	0.767771896	
Difference from hypothesized average	0	
degree of freedom	77	
t-ratio	-3.365045232	
P(T<=t) One side	0.000597877	
t Boundary value One side	1.664884537	
P(T<=t) both sides	0.001195754	
t Boundary value on both sides	1.991254395	

VIII. CONCLUSION

In this research, we analyzed the overhead view and continuity. At first, when looking at the bird's-eye view, we investigated whether it is more attractive to have linear landscape elements such as roads and rivers. As a result, it was concluded that it is better to have linear elements. From this, we analyzed Osaka city. From the perspective of the skyline appearance, we found a viewpoint with a nice view which one can see the various landscape components in Osaka city such as concrete, declination analysis, continuously as an overlooking landscape.

As a future prospect, we analyzed the depression angle only from a close-up view, but since the viewable display area changes according to the height, analysis including the distant view area is necessary. Moreover, by visualizing the boundary between the color difference, we also want to represent the continuity of the landscape component quantitatively.

REFERENCES

[1] Yuki O, Shin Y and Kazunari T. Landscape Analysis of Skyline in Building Group and Mountains. Conference of Geographical Information Systems Conference Presentation Papers, Vol. 25, D-4-4, (CD)

[2] O. Shinohara, D. Higuchi, "Natural terrain and landscape," Civil Society year Science Lecture IV,1971.