

## ANALYSING DIFFERENCES IN REGIONAL AESTHETIC FACTORS OF ‘COLOURSCAPE’ IN JAPAN

Ryoma Yamashita<sup>1\*</sup>, Shoma Nagaya<sup>1</sup>, Takashi Hanari<sup>2</sup>, and Mikiko Kawasumi<sup>1</sup>

<sup>1</sup>Graduate School of Science and Technology, Meijo University, Japan

<sup>2</sup>School of Culture-Information Studies, Sugiyama Jogakuen University, Japan

\*Corresponding author: Ryoma Yamashita, [233426019@ccmailg.meijo-u.ac.jp](mailto:233426019@ccmailg.meijo-u.ac.jp)

### ABSTRACT

This study aims to clarify the differences in regional aesthetic factors of the ‘colourscape’ and to apply them to develop colour townscape guidelines based on regional characteristics. The ‘Beautiful Colourscape in Japan’ project started in 2020 in the context of the COVID-19 pandemic. Over four hundred beautiful townscapes were nominated by the regular members of the Color Science Association of Japan (CSAJ) for two years[1], and a data library was built that can be browsed and searched according to place, time, and eleven basic colour terms[2]. In this study, we first examined aesthetic factors of the regional features of photo images of three towns in Aichi prefecture, *Ichinomiya*, *Tokoname*, and *Arimatsu*, using the CSAJ’s data library. Twenty-eight CSAJ members reported their visual impressions of each photo image using Japanese adjectives such as ‘vivid’, ‘calm’, ‘dynamic’, and ‘high contrast’. The semantic differential (SD) method was used to quantify the observers’ visual impressions, and principal component analysis was used to visualise the structure of the impressions of each townscape. The factors affecting aesthetic appeal were shown to differ among the towns, and industrial and cultural traditions were reflected in the results. For instance, ‘high contrast’ is important for the textile industry town *Ichinomiya*, while ‘orderly’ is the effective aesthetic factor in the ceramic industry town *Tokoname*. Secondly, the symbolic colours of each photo image were visualised to examine the effect of colour on the aesthetic factors in townscapes. The RGB values of all pixels on the photo image were converted to L\*a\*b\* values, and the ratio of colours in each photo image was calculated using k-means clustering. As a result, the townscapes that contain more cold than warm colours tend to be closer to ‘beautiful’, and the townscape with a simple colour composition might be effective for aesthetic impression. For future research, we will use various approaches for full analysis including text mining and statistics, because the ‘Beautiful Colourscape in Japan’ data library contains much information such as memorial stories by the poster, the reason for the aesthetic elements, and eleven basic colour terms. In the near future, we plan to expand the project to the ‘Beautiful Colourscape in the World’ in English.

**Keywords:** Townscape, Regional factors, Photo image, SD method, Principal component analysis

### INTRODUCTION

The ‘Beautiful Colourscape in Japan’ project was established in 2020 during the COVID-19 pandemic by interested members of the Color Science Association of Japan (CSAJ). In this project, CSAJ members nominate images of diverse beauty in their own familiar daily environments for inclusion in an online library. This library can be browsed and searched according to place, time, and eleven basic colour terms. Although the project website already contains more than four hundred items[1] from over a two-year period, we continue to collect more, and we plan to apply a similar process to future human resource development in various fields and value education for children. The purpose of this study is to identify differences in regional aesthetic elements of townscapes from a colour perspective so they can be applied to develop colour townscape guidelines based on regional characteristics.

The next sections will show the results of structural analysis of townscapes from three towns and discuss the effects of colour on aesthetic factors.

### STRUCTURAL ANALYSIS OF TOWNSCAPES

Six photo images of *Ichinomiya*, *Arimatsu*, and *Tokoname* were selected from the ‘Beautiful Colorscape in Japan’ website, as shown in Figure 1. These three towns in Aichi prefecture are famous for their textile industry, pottery, and dyeing and have a long history and tradition. The semantic differential (SD) method was used to quantify the visual impression of the photo images. Twenty pairs of antonym adjectives, including ‘vivid’–‘dull’, ‘calm’–‘excited’, ‘dynamic’–‘static’, and ‘high contrast’–‘low contrast’, were prepared in Japanese and applied to five-point rating scales. Twenty-eight CSAJ members responded on these scales about the visual impression observed in each photo image. The SD data were analysed using principal component analysis (PCA) to visualise the structure of the impression.

Table 1 shows the results of PCA summarizing principal components with a contribution rate of 10% or more, and Figure 2 describes the positioning of eighteen photo images on the PCA score diagrams. Factors affecting aesthetic appeal clearly differed among the towns, and industrial and cultural traditions were reflected in the results. For instance, ‘high contrast’ is important for the textile industry town *Ichinomiya*, while ‘orderly’ is effective as the aesthetic factor in the ceramic industry town *Tokoname*, and ‘calm’ and ‘static’ are located near ‘beautiful’ in the dyeing cultural town *Arimatsu*.

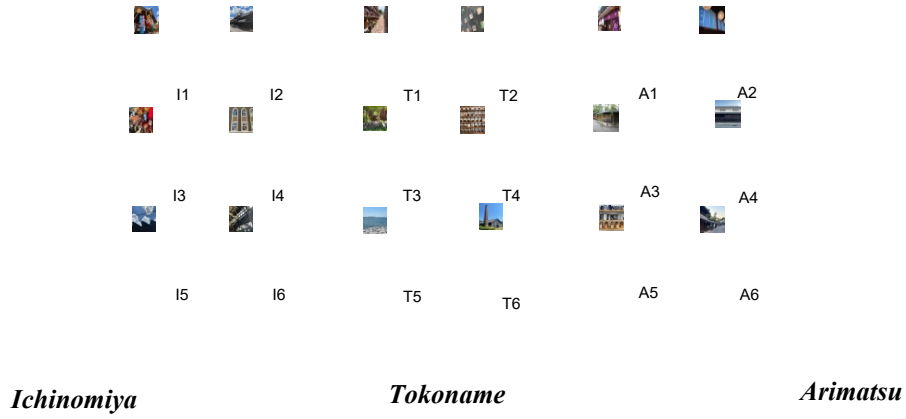


Figure 1: Photo images of townscape

Table 1: Results of PCA  
 Ichinomiya                      Tokoname                      Arimatsu

Component	Variable	Loadings	Comm.	Cum.
1	rough	0.85	21.5	21.5
	orderly	0.78	19.2	40.7
	high-contrast	0.72	18.1	58.8
	new	0.65	16.4	75.2
	bright	0.62	15.6	90.8
	stagnant	0.58	14.6	105.4
	stagnant	0.55	13.9	119.3
	stagnant	0.52	13.2	132.5
	stagnant	0.48	12.2	144.7
	stagnant	0.45	11.4	156.1
2	high-contrast	0.82	20.8	20.8
	rough	0.75	18.9	39.7
	orderly	0.68	17.2	56.9
	new	0.62	15.6	72.5
	bright	0.58	14.6	87.1
	stagnant	0.55	13.9	101.0
	stagnant	0.52	13.2	114.2
	stagnant	0.48	12.2	126.4
	stagnant	0.45	11.4	137.8
	stagnant	0.42	10.6	148.4

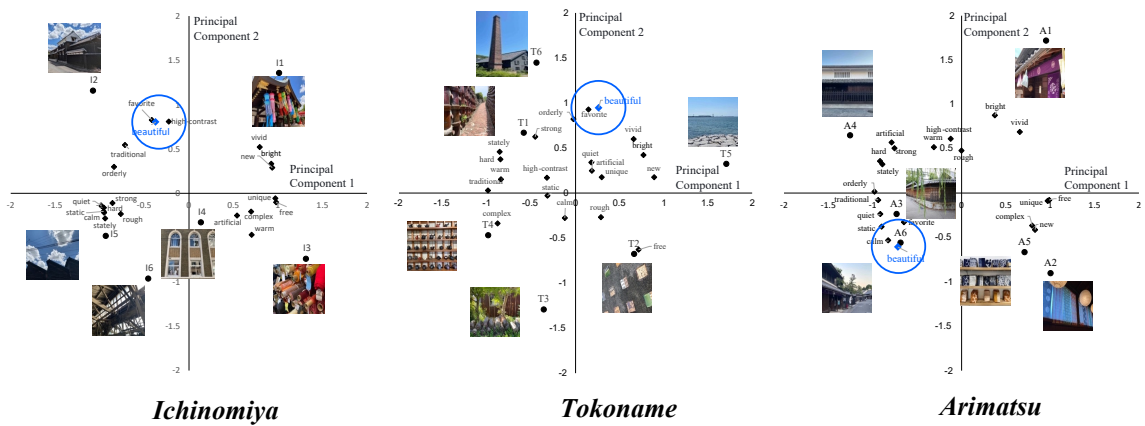


Figure 2: Positioning of eighteen photo images on the PCA score diagrams

### EFFECTS OF COLOUR ON AESTHETIC FACTORS

The symbolic colours of each photo image are visualised in the procedure shown in Figure 3 to examine the effect of colour on aesthetic factors in townscapes. As the first step, the RGB values of all pixels on the photo image are converted to L\*a\*b\* values and considered in three-dimensional space, as in the figure. Second, the three-dimensional data are clustered using k-means. For townscapes such as the one shown in Figure 1, ten clusters are sufficient, although twenty may be necessary for colourful images. In the last step, the ratio of the number of pixels in the same cluster is represented as a band graph in descending order. In the following, this will be represented as a colour palette.

A colour palette was generated for each photo image using the procedure described above and pasted into the scatter plot of the principal component scores, as shown in Figure 4. The townscapes that contain more cold than warm colours tend to be rated more closely to ‘beautiful’, especially those with a high ratio of monotone colours, such as black, white, and grey. In addition, colour palettes with many colours tend to be rated as far from ‘beautiful’. A small number of colours may mean that symbolic colours are emphasised. Based on these findings, a townscape with a simple colour composition may be effective in creating an aesthetic impression.

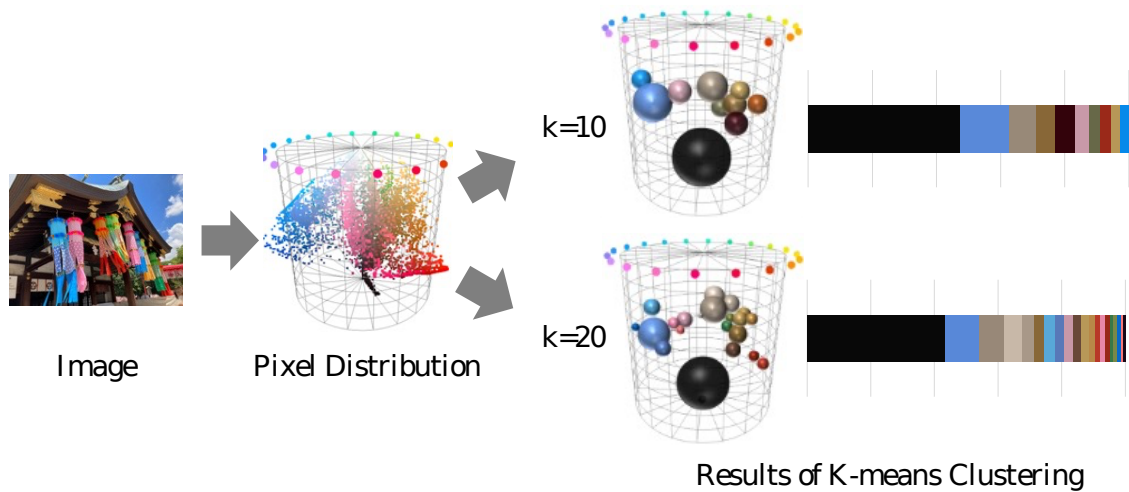


Figure 3: Method to derive symbolic colors from each photo image

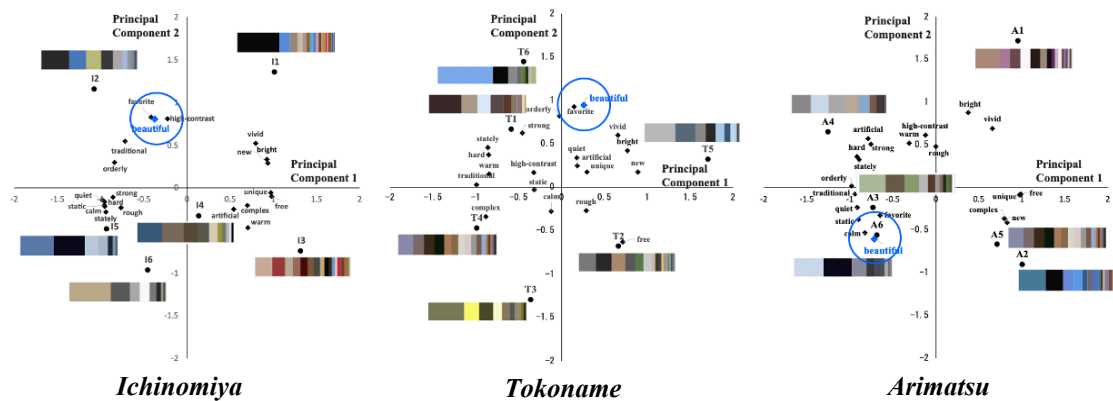


Figure 4: Positioning of eighteen color palettes on the PCA score diagrams

### CONCLUSION

The differences in regional aesthetic elements of townscapes in three towns were compared using structural analysis by PCA and colour pallets, and it became clear that the psychological factors and colour characteristics affecting aesthetic appeal differed among the towns. Future research should use various approaches for complete analysis including text mining and statistics, because the ‘Beautiful Colorscape in Japan’ data library contains much other information, such as memorial stories of the poster, the reasons for the aesthetic elements, and eleven basic colour terms. Additionally, townscapes change depending on the season and time and differ on special days such as festivals. Future research should focus on breaking down the components into universal or variable factors. In the future, we plan to extend the project to a ‘Beautiful Colorscape in the World’ in English.

### **ACKNOWLEDGEMENT**

This work was supported by Ichihara International Scholarship Foundation, Shikishima Academic and Cultural Promotion Foundation.

### **REFERENCES**

- [1] The Color Science Association of Japan. (2020). *Beautiful Colorscape in Japan*. Retrieved September 7, 2023, from <https://color-science.jp/colorscape/>
- [2] Berlin, B. and Kay, P. (1969). *Basic Color Terms: Their Universality and Evolution*. *Studies in English Literature*, 1972, p.170–184