

Study on visibility and evaluation of color combination of Braille pavers and sidewalk

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ABSTRACT

The design of Braille pavers is a peculiar, barrier-free design of Japan. However, there is an undesirable reality in the colors of Braille pavers and the sidewalk for persons with low vision and also persons with normal vision. Therefore, this research aimed to obtain the material for a desirable color plan for persons with low vision and persons with normal vision.

A person with low vision doesn't improve the visibility by the chroma difference, and improves it by the value difference or the hue difference. Colors with a big value difference and a little chroma difference for Braille pavers and the sidewalk can make the visibility and the view harmony meet.

1. INTRODUCTION

Recently, the sidewalk beautifully paved as a walking space has come to occupy a big position as an element of landscape. The color is disorderly used at times while the design is diversified, and the excess of the design makes a design disharmony and becomes a problem. When the paved floor is constructed, it is necessary to consider the relation to the Braille pavers. The Braille pavers equipped as the peculiar barrier-free design in the urban area in Japan, the yellow of them completely becomes familiar. But there is an opinion that yellow of them damages the cityscape. Therefore, the color of the Braille pavers is brought close to the color of the sidewalk and the example of making it unremarkable can be seen. However, "the colors in consideration of the landscape" are inadequate for people with the low vision.

Moreover, according to concise handbook of environmental design –barrier-free design¹ of Architectural institute of Japan, "The principle of the color of the Braille pavers is yellow. However, when it is not possible to secure enough difference or luminance ratio in consideration of the contrast with a circumferential floor, a color excluding yellow is used. The luminance ratio of the sidewalk and the Braille pavers is 2.5 or more and the difference of value of them is about 5." However, the standard is vague.

There are experimental studies on assessment of color of sidewalk pavement²⁻³, an experimental study on color combination of sidewalk and raised type of block⁴, and a study about a way of recognition improvement of tactile indicators⁵⁻⁶. However, the research that examined the color of the Braille pavers for various landscapes has not found, though it is thought that the color of the sidewalk is often decided from relations with the landscape.

2. METHOD

At first, colors of sidewalk s and Braille pavers were measured by colorimeter (CR-310, MINOLTA CO., LT). And, the landscape photographs including Braille pavers were taken with the digital camera.

After that, 36 color cards that were assumed as the sidewalk and Braille pavers were used for the first experiment. The visibility of assumed color to be Braille pavers, preference of color combination, and harmony of colors were evaluated. Subjects are five persons with low vision.

Next, three landscapes were selected from the color research. They are as follows:

- ? Around the station.
- ? Cityscape with green.
- ? Shopping street.

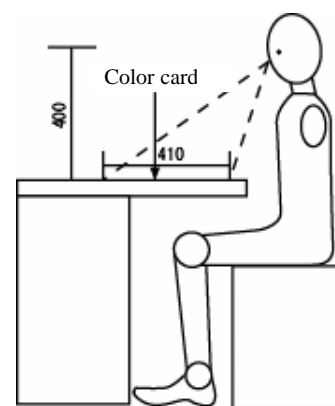


Figure 1 Condition of the experiment

Thirteen kinds of color combinations, which added the prototype to 12 kinds of color combinations for a person with low vision to distinguish easily, were adopted for the experiment. As for the landscape image, Adobe Photoshop processed the colors of Braille pavers and the sidewalk. The images were printed on the papers of A3, and 44 young persons evaluated the visibility of Braille pavers and the harmony of a landscape.

3. RESULTS

According to the color measurement investigation, YR (51%), Y (28%), and R (13%) are being used for the hue of the sidewalk, and it is understood that there are a lot of warm colors. In the color of Braille pavers, all hue is YR or Y, because it is necessary to use yellow for them as a rule in Japan.

As for the value difference of Braille pavers and the sidewalk, 0 is 38%, 1 is 27%, and it is thought that almost 2/3 of all pavements are not obtained suitable luminance ratio. As for the chroma difference, 3 or more is 44%, and it is understood that there are a lot of pavements with the big chroma difference.

From the first experiment for persons with low vision, an object with the contrast hues, the contrast values and the similar chromas had the highest visibility. The combination of the colors with high visibility has the tendency to lower the evaluation of harmony. The color with high chroma stands out to persons with normal vision, and it is easy to recognize, but persons with low vision can hardly distinguish the chroma difference. Therefore, it is not desirable to use a color with high chroma needlessly in a landscape. In addition, the visibility improves by using the contrast of hue when the luminance ratio is not provided fully. However, it is necessary to note that there are many cases that do not harmonize with landscapes as for the contrast of the hue.

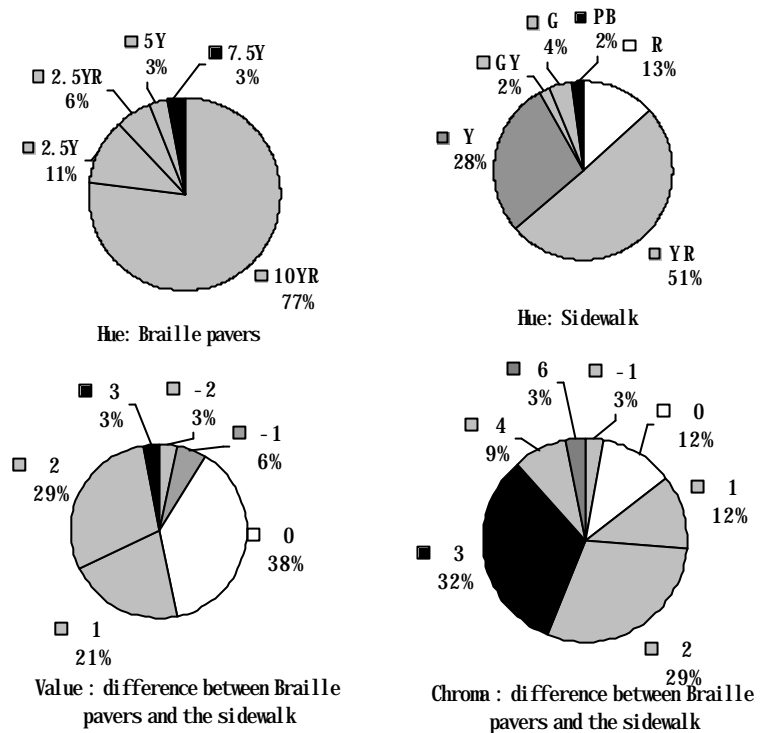


Figure 2 Results of color research

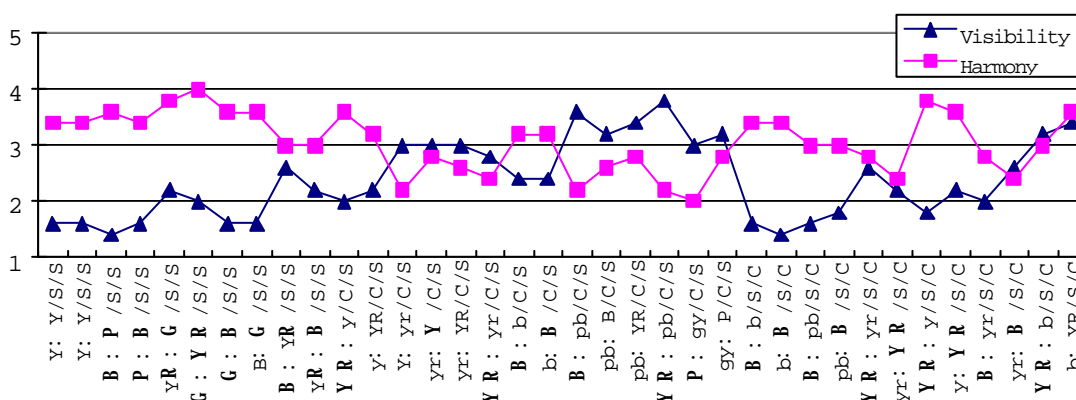


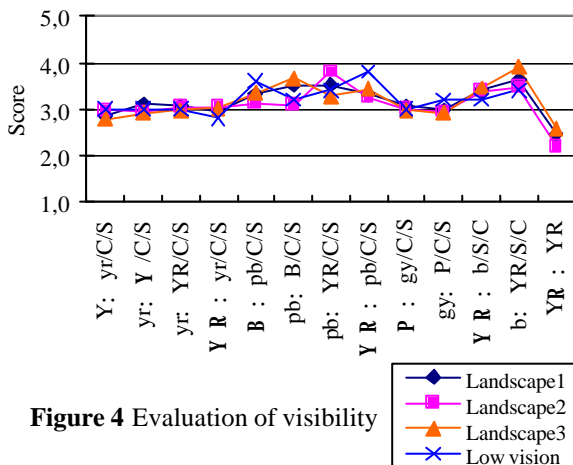
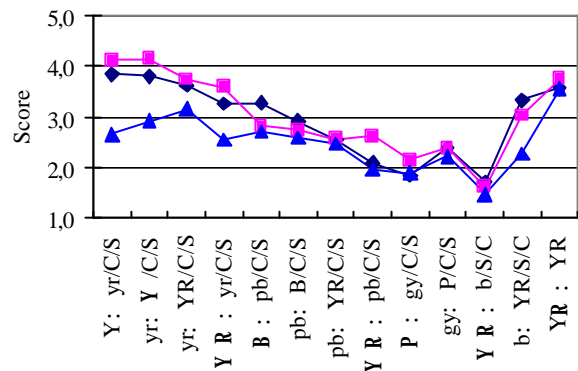
Figure 3 Evaluation of persons with low vision

The second experiment was done on the assumption that there was a desirable color combination of the sidewalk and Braille pavers for each landscape. Table 1 shows thirteen combinations of colors used for the experiment. There is no difference in the visibility to any color combination between persons with low vision and persons with normal vision. The visibility of the prototype, which is the combination of the colors used actually often, is not good.

However, the combination of the colors with the similar hues of YR or Y, the contrast values and the similar chromas harmonized with any landscape for this experiment. The combination of colors with the similar hues of B or PB, the contrast value, and the similar chromas can obtain an intermediate harmony feeling, but it can be said that this is a safe combination of colors. The harmony feeling of the combination of colors with the contrast hues is not good.

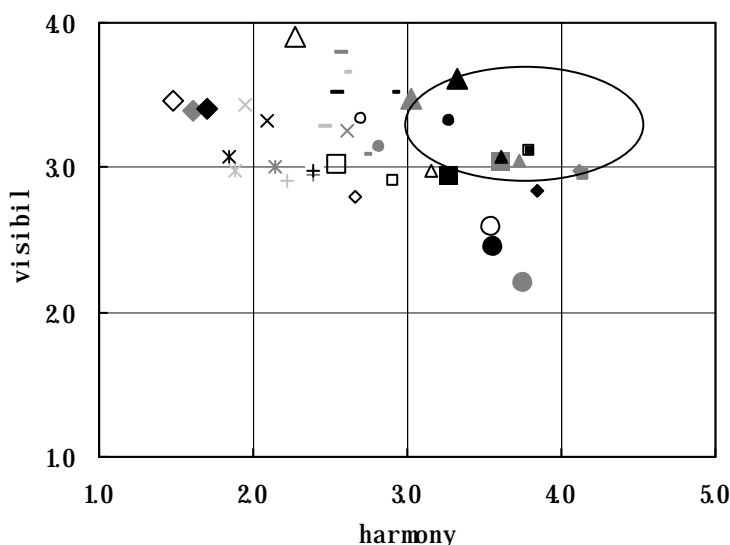
Table 1 Used colors for the second experiment

Sidewalk	Braille pavers	
0.1Y7.1/3.5	3YR4.8/3.2	Similar hues Contrast values Similar chromas
3YR4.8/3.2	0.1Y7.1/3.5	
3YR4.8/3.2	6.6YR8.4/4.4	
6.6YR8.4/4.4	3YR4.8/3.2	
5.4B7.8/2.6	4.5PB3.5/3.2	
4.5PB3.5/3.2	5.4B7.8/2.6	Contrast hues Contrast values Similar chromas
4.5PB3.5/3.2	4.6YR7.5/2.6	
4.6YR7.5/2.6	4.5PB3.5/3.2	
5.8P7.8/1.5	7.1GY4.2/1.9	
7.1GY4.2/1.9	5.8P7.8/1.5	
6.7YR7.6/10.8	1.5B6.3/2.3	Contrast hues Similar values Contrast chromas
1.5B6.3/2.3	6.7YR7.6/10.8	
10YR4/1	10YR6/4	Prototype

**Figure 4** Evaluation of visibility**Figure 5** Evaluation of harmony

4. CONCLUSIONS

Persons with low vision don't improve the

**Figure 6** Relation between harmony and visibility

◇ ? Y: yr/C/S	□ ? yr: Y/C/S
△ ? yr: YR/C/S	□ ? YR: yr/C/S
○ ? B : pb/C/S	- ? pb: B/C/S
- ? pb: YR/C/S	× ? YR: pb/C/S
× ? P : gy/C/S	+ ? gy: P/C/S
◇ ? YR: b/S/C	△ ? b: YR/S/C
○ ? YR: YR	◆ ? Y: yr/C/S
■ ? yr: Y/C/S	▲ ? yr: YR/C/S
■ ? YR: yr/C/S	● ? B : pb/C/S
- ? pb: B/C/S	- ? pb: YR/C/S
× ? YR: pb/C/S	× ? YR: pb/C/S
+ ? gy: P/C/S	+ ? gy: P/C/S
▲ ? b: YR/S/C	● ? YR: YR
◆ ? Y: yr/C/S	■ ? yr: Y/C/S
▲ ? yr: YR/C/S	■ ? YR: yr/C/S
● ? B : pb/C/S	- ? pb: B/C/S
- ? pb: YR/C/S	× ? YR: pb/C/S
× ? P : gy/C/S	+ ? gy: P/C/S
◆ ? YR: b/S/C	▲ ? b: YR/S/C
● ? YR: YR	

visibility by the chroma difference. However, they improve it by the value difference or the hue difference. Using colors with a big value difference and a little chroma difference for Braille pavers and the sidewalk can make the visibility and the harmony of the landscape meet. Especially, the combination of the colors with the similar hues of YR or Y, the contrast values and the similar chromas harmonized with any landscape for this experiment. Moreover, a lot of actual pavements are not obtained suitable luminance ratio. Therefore, it is necessary to examine the colors of the sidewalk and Braille pavers that satisfy the visibility and the harmony of a landscape furthermore.

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