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# THE ROLE OF THE COLORS OF INTERIOR ACCESSORIES IN FORMING AN IMPRESSION OF A ROOM

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## ABSTRACT

When purchasing home interior furniture and accessories, several factors determine the color of the items that are chosen. People imagine how the item will look when actually placed in the room, anticipating whether it will fit in with the room or create the image they want. In order to help people make such decisions during shopping in stores and online, we analyzed the relationship between room color and item color. We prepared a photo of a home interior, processed the color of one item in the photo, and asked subjects about their impression of it. The color of the item was chosen from the colors used in the picture so that it could work in harmony with the room. Through the experiment, we found that even the color of a small item can affect the impression of an entire room.

*Keywords:* visual impression, color image, representative colors

## 1 INTRODUCTION

The color and design of an interior layout has a psychological impact on the occupants and the people who work there. (Haller, 2017). The interior design scheme differs as per the purpose of the room, such as working, relaxing, or socializing. In other words, it is important to match the interiors to the purpose of the room. When it comes to actually purchasing furniture and accessories for interior decoration, it is not just about the desirability of individual items but also about the compatibility of their colors with the colors of the room. There are various efforts regarding the relationship between the color characteristics and impressions of the entire room

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(Takahashi et al, 2018, Takahashi et al. 2021). There have been various efforts towards identifying the relationship between the colors used and the impression created by a room.

In other words, color coordination is necessary to fulfill the purpose of a room while maintaining color harmony. In this study, we will clarify the characteristics that are favored among the items that are in harmony with the color environment of the room. Using the same interior photo, we change the color of one item in the photo. Since all remaining items are unchanged, it is possible to examine the change in impression caused by the change in color of the item in question. The new finding of this study is that preferred color for small items can be extracted from an entire image using probability density.

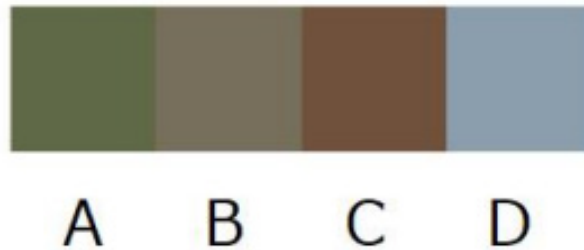
## 2 METHOD

For the images of the interiors used in the experiment, we used images from websites of the top 20 ranked home builders in the national edition of the SUUMO website (SUUMO, 2022). The tag data of the top 20 architectural examples from each company was compiled, and a total of nine images of interiors were selected from the top three genres: simple modern, natural, and Japanese modern, with three images from each. Figure 1-(b) shows a sample design of a Japanese modern interior image.

The color to be used as the changed color of the items in each image was selected. Since a color that is inconsistent with the overall color of the image will receive a low evaluation regardless of whether it fits the image of the interior or not. Therefore, four colors that were used in the image were extracted and used, i.e., four representative colors.

There are various methods for extracting representative colors from images such as the method proposed by Takahashi (Takahashi et al, 2018). However, most of the pixel values are low-saturation colors, and many low-saturation colors have been extracted by the conventional representative color extraction method. In this research, we focus on the difference in image due to the difference in color, therefore, the four colors to be selected must be different from each other. Thus, we devised a simple representative color extraction method. We used hierarchical clustering based on hue to select colors that are likely to make a difference in the image. The reason for emphasizing hue is that it makes a greater difference in impression than saturation or lightness. The reason for ignoring saturation and lightness is that when changing the color of an object, the color is changed while maintaining the original color tone. However, since clustering the hue values of all pixels is computationally expensive, we first reduced the number of colors to 64 using k-means and then further clustered the hue values of the centroids to obtain four color clusters. When performing hierarchical clustering, colors with a saturation of five or less were excluded. This is because colors categorized as achromatic have practically no meaning in hue values. Each of the final hue clusters were assigned a subset of the pixels of the source image. A color patch was created by averaging the CIE Lab values (CIE, 2022) of the pixels assigned to each cluster. The four colors obtained were used to change the color of one item in the same interior. This item must be an item that can change color and occupies a large area in the image. However, the color patch was created using GIMP (GIMP, 2022). Furthermore, the color patches

obtained from the design shown in Figure 1-(b) are shown in Figure 1-(a). The four colors obtained in Figure 1-(a) are named A, B, C, and D from left to right.



(a) Color Patches



(b) An original image

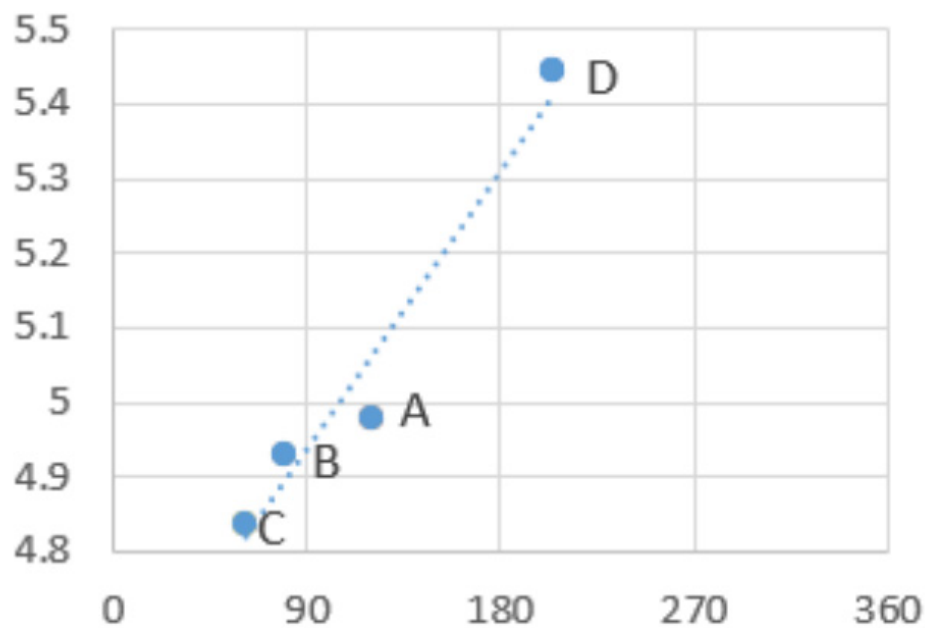
**Figure 1.** An example of extracted color patches

Impressions of a total of 36 images of interiors were evaluated using a Google Form. The subjects were 43 men and women who were in their teens to 40s. Their impressions were evaluated in the 7-step SD method as "dark – bright," "cool – warm," "out of harmony - in harmony," "dislike – like," "ordinary – unique," "hard – soft," "not beautiful – beautiful," "artificial – natural," "restless – calm," and "unfriendly – friendly."

### 3 RESULTS AND DISCUSSION

The average value of the obtained data was calculated for each of the 10 adjective pairs. This paper describes the results of the analysis of the images of interiors shown in Figure 1, and the

rest of the paper summarizes the results of the analysis. Figure 2 shows a comparison of the mean value of "dislike - like" and the color angle of the changed color based on the CIELab color space chromaticity diagram for the color scheme pattern shown in Figure 1.



**Figure 2.** An example for relationship between hues of extracted colors (horizontal) and preference (vertical)

In the example shown in Figure 1, "D" has a relatively small area in the color scheme in the interior image, while "C" has a relatively large area, indicating a proportional relationship between desirability and hue. Similar or opposite trends were observed in other images. From the above, it is considered that the base color and the accent color have different effects on the evaluation of desirability.

Therefore, we considered that the desirability of a room differs depending on the degree to which the colors are used in the interior. We determined the amount of color information as an indicator of the degree to which each of the four colors were used. We plotted the lab values of all pixels on the lab color space and estimated the kernel density for the changed colors. The larger the density, the more similar colors are used in the image, and the more the color-changed items are based on the base color. The smaller the density, the more prominent the color is in the image and the more likely it is to be based on the accent color. Table 1 shows the relationship between the density of the changed colors and the average value of "dislike - like" for each genre. Table 1 shows that there is a negative correlation between the simple modern and Japanese modern genres and a positive correlation between the natural genres. From the above, it is desirable to use accent colors in modern interior images such as simple modern and Japanese modern. In contrast, it is considered that the use of a uniform color for the entire image is preferable for natural images.

**Table 1.** Correlation coefficients between densities and preference of the color (\*p-value<.05)

Genre	r
Simple modern	-0.546*
Natural	0.485*
Japanese modern	-0.674*

Color can have different meanings and impressions depending on the function of the room (living room, dining room, kitchen, bedroom, etc.). The interior photographs used in this study are generally consistent with a living room, although there are minor differences. However, the furniture in each photo may differ (e.g., with or without bookshelves). Color-changing items also vary from photo to photo. While this may have influenced the subjects' color choices, the variety of living room types and items covered allows for a general discussion.

#### 4 CONCLUSION

In this study, we investigated the effect of changing the color of one item in a room to another color used in the room. The results showed that colors used as accents tended to give a more favorable impression in the case of modern styles such as simple modern and Japanese modern, while colors that were close to the overall color tone tended to give a more favorable impression in the case of natural styles. In the future, it is necessary to increase the number of subjects and conduct experiments with more age groups. Furthermore, it is necessary to conduct more detailed studies by increasing the number of colors to be changed, targeting other genres such as Scandinavian style.

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