

Study on Evaluation of Kawaii Colors Using Visual Analog Scale

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Abstract. In the 21st century, the Kansei values of industrial products are considered very important. Kawaii is one of the important Kansei values for future interactive systems and industrial products. However, since only few studies have focused on kawaii attribute, we systematically analyze the kawaii interfaces themselves, that is, the kawaii feelings caused by such attributes as shapes, colors, and materials. In previous experiments, we obtained interesting tendencies about kawaii attributes. For example, if an object has more brightness and more saturation, more participants chose it as most kawaii for every hue. The most commonly chosen hue was purple for both men and women. However, since we have not studied intermediate hues based on the Muncell Color System, we systematically experimented on the color elements to clarify the tendencies of kawaii colors. The experimental results clarified the tendencies of kawaii colors for each color element, such as hue, saturation, and brightness.

Keywords: kawaii, color, hue, saturation, brightness, vas, Kansei, virtual object.

1 Introduction

In the advanced information society of the 21st century with its communication infra-structure of computers and networks, software must be enhanced that utilizes this digital content. Among such content, Japanese kawaii characters including Hello Kitty and Pokemon have become popular all over the world, suggesting that the power of Japanese cuteness can be attained worldwide [1]. Kawaii is one of the important Kansei values for future interactive systems and industrial products. However, since few studies have focused on the kawaii attributes of the interfaces of interactive systems or other artificial products, we systematically analyze the kawaii interfaces themselves: kawaii caused by such interface attributes as shapes, colors, textures, and materials. Our aim is to clarify features of kawaii interface from the research results. We previously performed experiments and obtained interesting knowledge about kawaii attributes [2,3,4,5,6]. Our experiment concentrated on such color elements as hue, saturation, and brightness. We employed five basic hues based on the Muncell Color System (MCS). For each hue, we selected three connected

values of saturation and of brightness. Thus, the total number of kawaii color candidates was 45. As an object's brightness and saturation increased, more participants chose it as most kawaii for every hue. The most commonly chosen hue was purple for both men and women. However, since we have not studied intermediate hues based on MCS, we addressed this problem in a new experiment. This paper describes the experimental results.

2 Experimental Set-Up

We showed the virtual objects on a 46-inch 2D/3D compatible LCD monitor from Hyundai on which participants watched stereoscopically with polarized glasses. For the kawaii shapes of objects, a torus was employed based on the results of our previous studies [2]. To select the candidates of kawaii colors, we used MCS. Color has three elements: hue, saturation, and brightness. We employed five basic hues (R, Y, G, B, and P) and five intermediate hues (YR, GY, BG, PB, and RP) based on MCS. For each hue, the following four colors were selected:

- #1 is white, which has the highest brightness and the lowest saturation.
- #2 has higher brightness and lower saturation than the base color.
- #3 is a base color with high brightness and high saturation.
- #4 is pure color, which has lower brightness than the base color and the highest saturation.

These colors for each hue were selected (Fig. 1). Because #1 for each hue is the same color, the total number of kawaii color candidates was 31. The background color was gray.

3 Evaluation

We used the Visual Analog Scale (VAS) to evaluate the kawaii degrees. For the evaluation of pain severity and relief, the method commonly used is the VAS [7]. Subjects arbitrarily marked 200-mm segments. The left side line doesn't seem kawaii, but the right side line does. The length from the left side to the mark put on segments by subjects is converted into scores from 0 to 100.

4 Experimental Methods

First, the color blindness of the participants was tested with the Ishihara color test. Next, they were shown four colors of the same hue and simultaneously evaluated the kawaii degrees of the four colors with VAS. This evaluation was repeated for each hue.

The ten hues were shown randomly. An example of the presented set of objects is shown in Fig. 2.

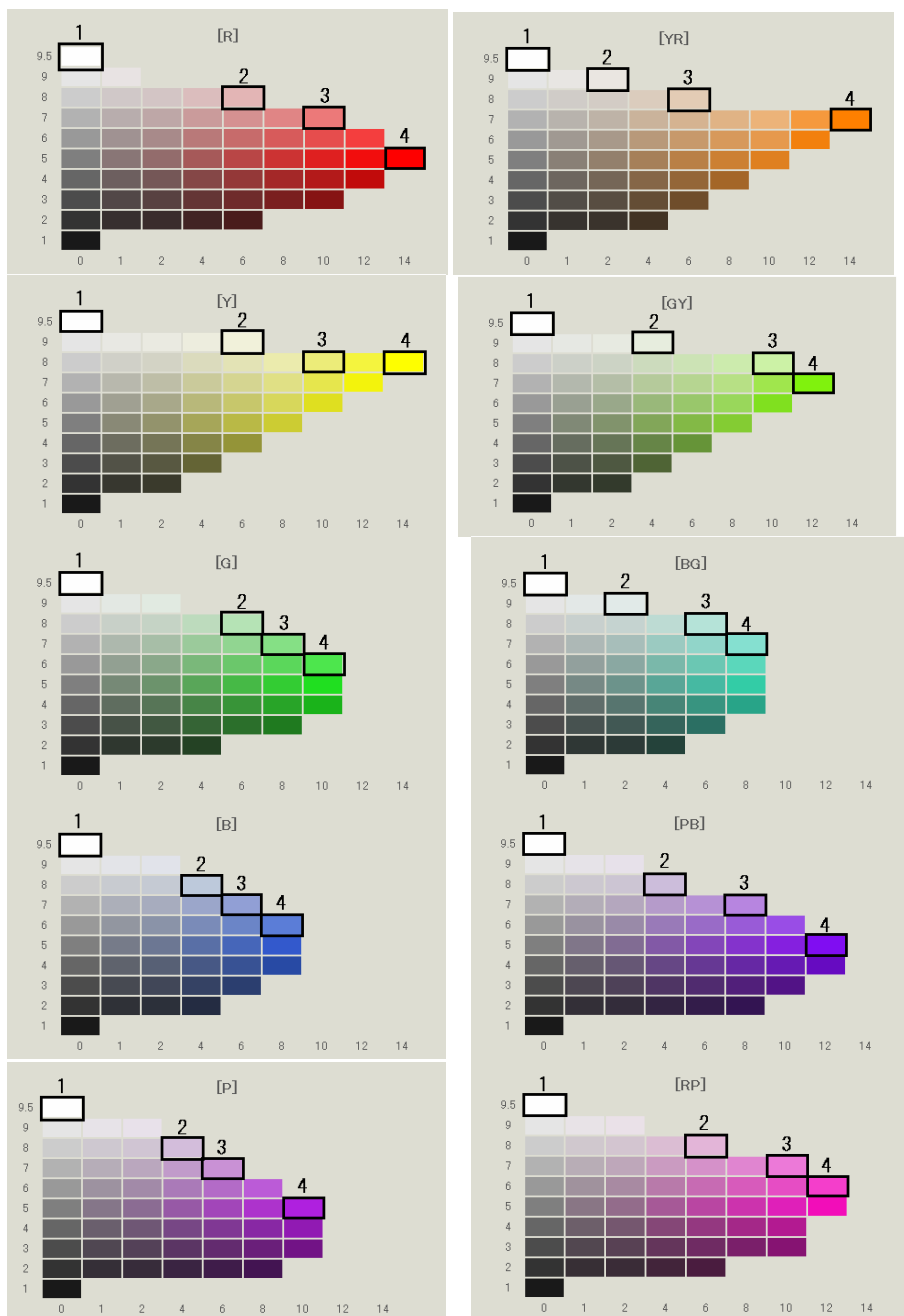


Fig. 1. Selected colors for each hue

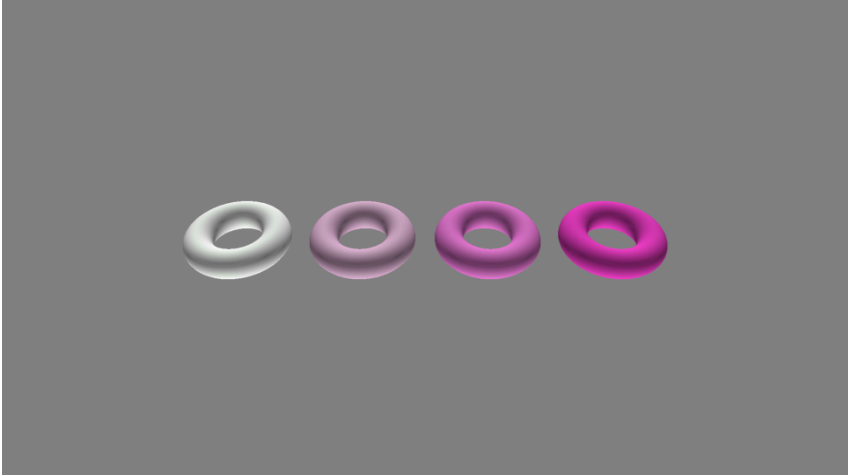


Fig. 2. Example of a set of objects

5 Experimental Results

The experiments were conducted with ten female and ten male students in their 20s with normal or normally-corrected eyesight.

The scores of the kawaii degrees were normalized on a basis of the score of white.

Fig. 3 shows an example of the results by gender. The vertical axis shows the average of the scores of kawaii degrees with the pair of brightness and saturation shown in the horizontal axis. The error bars indicate the standard deviations.

Table 1 shows the results of the analysis of variance with three elements: hue, brightness/saturation, and gender.

The following were obtained from Fig. 3:

- Colors BG#4, YR#4, and G#3 were evaluated high by males.
- Colors YR#4, RP#3, GY#3, and BG#4 were evaluated high by females.
- Color #2 of each hue was evaluated low by both genders.

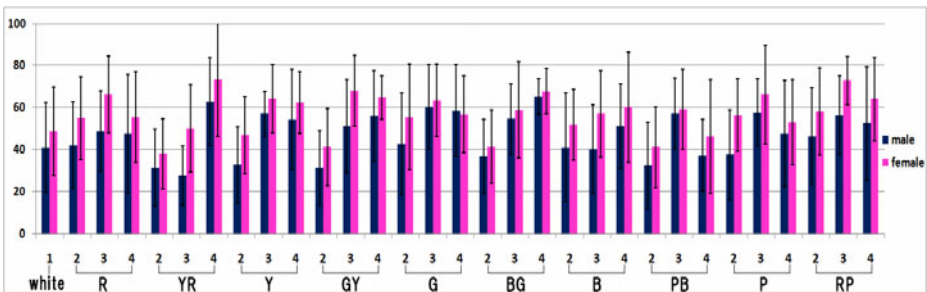


Fig. 3. Averages of kawaii degrees of each color

Table 1. Results of 3-factor analysis of variance

Factor	Sum of squared deviation	DOF	Mean square	F-value	P-value
Gender	10745.628	1	10745.628	24.168	.000 **
Hue	7949.559	9	883.284	1.987	.039 *
Brightness/Saturation	25439.626	2	12719.813	28.608	.000 **
Gender x Hue	1724.541	9	191.616	.431	.919
Gender x Brightness/Saturation	607.910	2	303.955	.684	.505
Hue x Brightness/Saturation	20509.722	18	1139.429	2.563	.000 **
Gender x Hue x Brightness/Saturation	2107.244	18	117.069	.263	.999
Error	248103.813	558	444.630		
Total	317188.043	617			

The following were obtained from Table 1:

- The main effects of gender, hue, and brightness/saturation are significant.
- The interaction effect between hue and brightness/saturation is significant.

6 Discussion

The results obtained from Fig. 3 show the following:

- Color G#3 was evaluated high by males.
- Colors RP#3 and GY#3 were evaluated high by females.
- Colors YR#4 and BG#4 were evaluated high by both genders.
- Colors with intermediate hues based on MCS got relatively high scores.

The analysis of variance results show that the scores of the kawaii degrees for colors differ by gender, hue, and brightness/saturation. The interaction effect between hue and brightness/saturation is significant, and the combinations of hue and brightness/saturation are important for evaluations of the kawaii degrees of colors.

7 Conclusion

In this study, we focused on the kawaii color of virtual objects to apply to future interactive systems and industrial products and obtained the following findings:

- The scores of the kawaii degrees for colors differ by gender, hue, and brightness.
- The combinations of hue and brightness/saturation are important for evaluations of the kawaii degrees of colors.
- Pure yellow red and pure blue green are evaluated high by both genders and are felt to be kawaii.

References

1. Belson, K., Bremner, B.: Hello Kitty: The Remarkable Story of Sanrio and the Billion Dollar Feline Phenomenon. John Wiley & Sons, Chichester (2004)
2. Murai, S., et al.: Systematic study for “kawaii” products (Third report) -Comparison of “Kawaii” between 2D and 3D-. In: Proceedings of VRSJ 2008 (2008) (in Japanese)
3. Ohkura, M., Aoto, T.: Systematic study for “kawaii” products. In: Proceedings of KEE 2007 (2007)
4. Ohkura, M., Aoto, T.: Systematic study for “kawaii” products. In: Proceedings of the Workshop on Designing Cute Interactive Media at DIS 2008, pp. 11–14 (2008), <http://www.cutemedia.org/Proceedings>
5. Ohkura, M., et al.: Systematic study for “kawaii” products (Second report) -Comparison of “Kawaii” colors and shapes-. In: Proceedings of SICE 2008 (2008)
6. Ohkura, M., et al.: Study on Kawaii Colors of Virtual Objects. In: CHI 2009, Boston, MA, USA, April 4-9 (2009)
7. Bird, S.B., Dickson, E.W.: Clinically significant changes in pain along the Visual Analog Scale. *Annals of Emergency Medicine* 38(6), 639–643 (2001)