

AFFECTIVE EVALUATION FOR MATERIAL PERCEPTION OF BEAD-COATED RESIN SURFACES USING VISUAL AND TACTILE SENSATIONS: SELECTION OF EVALUATION ITEMS FOCUSING ON COLOR EFFECTS

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ABSTRACT

Kansei/affective values are attracting attention as a new evaluation axis of commercial value. We performed affective evaluation experiments on the tactile material perception of bead-coated resin surfaces and found that physical attributes change affective evaluations. However, few studies have focused on color in surface-material perception research using visual and tactile sensations. We assume that the hues in the three elements of color should change the appearance of materials and affect their affective evaluations. This study, which systematically researched the affective evaluations of surface-material perceptions using visual and tactile sensations, introduces our experimental results to reduce the number of adjective pairs for affective evaluations.

1. INTRODUCTION

Kansei/affective values continue to attract attention as a new evaluation axis of commercial value. Conventionally, the values of industrial products have been constituted by function, reliability, and cost in Japan manufacturing (Ministry of Economy, Trade and Industry JAPAN, 2010). The Japanese Ministry of Economy, Trade and Industry (METI) is striving for new manufacturing by adding to these affective values. METI argues that it is important not only to offer new functions and competitive prices but also to create new values to strengthen Japan's industrial competitiveness.

We performed affective evaluation experiments on the tactile material perception of bead-coated resin surfaces with different surface textures generated by such different physical attributes as resin materials, bead diameters, and bead densities (Ohkura, et al., 2015). We found that affective evaluations are changed by physical attributes. However, few studies have focused on color in surface-material perception research using visual and tactile sensations. We assumed that the hues in the three

elements of color change the appearance of materials and affect their affective evaluation.

This study systematically researched the affective evaluations of surface-material perception using visual and tactile sensations. We chose the number of adjective pairs from previous research to clarify the relations among surface-material perceptions with different colors and adjectives pairs. This article introduces our experimental results to reduce the excessive number of adjective pairs for affective evaluations.

2. EXPERIMENT

2.1 Experimental Setup

We prepared four images of colored cylinders (Fig. 1). The white cylinder is the standard, and the others are comparison targets. We employed three comparison targets. As indicated in Fig. 2, we presented images to compare a standard cylinder with cylinders of the comparison target. The background is an achromatic color with a brightness of 8 based on the Munsell color system. The experimental conditions are shown in Fig. 3 and Table 1. We chose 61 adjective pairs from previous research on visual and tactile sensations (Ohkura, et al., 2015), (Inoue & Kobayashi, 1985), (Suzuki & Gyoba, 2002), (Soeta et al., 2015). Table 2 lists the adjective pairs used for our affective evaluation experiment for which we used a 7-point Likert scale. We also included impossible to evaluate as an option for all the evaluations using the adjective pairs.

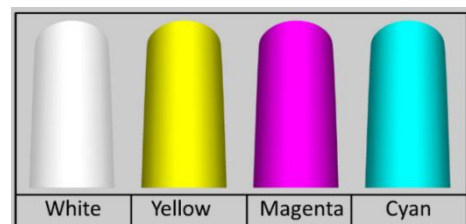


Fig. 1 Image of colored cylinders.

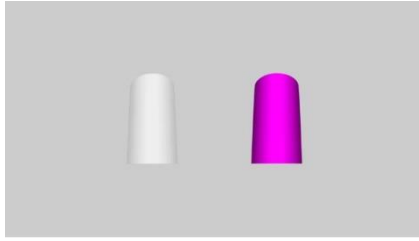


Fig. 2 Presented image.

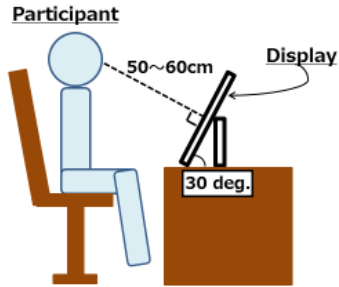


Fig. 3 Experimental set up.

Table 1 Experimental conditions.

Display size	22 inches wide
LCD display angle	30 deg.
Distance between eye and LCD display	50~60 cm
Illumination intensity	0.21 lx

2.2 Experimental Procedure

Our experimental procedures were as follows:

1. Participants watched background images of the display for 15 seconds.
2. They were presented images of the standard and comparison cylinders. The standard cylinder was always on the left of the comparison cylinder.
3. They orally evaluated their comparative impressions of the two presented cylinders for adjective pairs in Japanese on a 7-point Likert scale from -3 (strongly agree) to +3 (strongly agree).
4. They repeated the affective evaluations 123 times in total, 3 x 61, to complete the pair comparison of all the colored cylinders with the standard sample. We randomly presented the order of the comparison cylinders to cancel order effects.

3. EXPERIMENTAL RESULTS

We performed our experiments with six Japanese males with normal color vision in their 20's. Our correlation analysis results show correlations between all adjective pairs excluding "wild" and "artificial".

We performed hierarchical clustering analyses with Ward's method, a complete linkage method, and a centroid method of distance metrics to confirm the robustness of the analytical results (Ward, 1963). The adjectives were divided into 13 groups by Ward's method and the centroid method and 11 groups by the complete linkage method. Based on these results of hierarchical clustering analyses, we classified the

adjective pairs into groups based on the following conditions:

- The adjective pairs were categorized into identical groups regardless of metrics.
- Other adjective pairs

Table 3 shows the final grouping with 11 groups and the others. From the results of these analyses, we selected adjective pairs based on one of the following conditions:

- Weakly correlated with most other adjective pairs
- Strongly positively correlated with many other adjective pairs in each group

Finally, we selected the 21 adjective pairs shown in Table 3.

4. CONCLUSION

We continue to systematically research the affective evaluations of surface-material perception using visual and tactile sensations. We experimentally reduced the number of adjective pairs for affective evaluations for subsequent experiments to clarify color effects and selected 21 adjective pairs from our experiment results. Future work will select colors for affective evaluations and experiment with them on the surface-material perception of colored bead-coated resin using visual and tactile sensations.

ACKNOWLEDGMENTS

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Table 2 Adjective pairs.

Number	Adjective pairs	Number	Adjective pairs
1	Comfortable – Uncomfortable	32	Active – Passive
2	Favorite – Hated	33	Quiet – Noisy
3	Interesting – Boring	34	Cheerful – Dismal
4	Chic – Ordinary	35	Heavy – Light
5	Artificial – Natural	36	Beautiful – Ugly
6	Masculine – Feminine	37	Lively – Sluggish
7	Hot – Cold	38	Good – Bad
8	Simple – Gaudy	39	Kind – Unkind
9	Exciting – Boring	40	Intense – Calm
10	Cute – Ugly	41	Fun – Painful
11	Dry – Sticky	42	Flashy – Sober
12	Smooth – Rough	43	Sharp – Dull
13	Relaxed – Anxious	44	Stabile – Unbalanced
14	Smooth – Prickly	45	Dynamic – Static
15	Mild – Severe	46	Rational – Irrational
16	Wild – Tame	47	Round – Square
17	Healthy – Sick	48	Clear – Obscure
18	Secure – Insecure	49	Full – Empty
19	Damp – Desiccated	50	Healing – Non-healing
20	Youthful – Aged	51	Pleasant – Unpleasant
21	Juicy – Dry	52	Gentle – Scary
22	Unique – Common	53	Clean – Unclean
23	Conspicuous – Inconspicuous	54	Refreshing – Unrefreshing
24	Cool – Old-fashioned	55	Delicious – Terrible
25	Clean – Dirty	56	Pure – Impure
26	Delicious – Disgusting	57	Powerful – Impotent
27	Resilient – Slack	58	Expensive – Cheap
28	Light – Dark	59	Fashionable – Somber
29	Moist – Dry	60	Fine in the touch – Coarse in the touch
30	Soft – Hard	61	Rare – Common
31	Warm – Cool		



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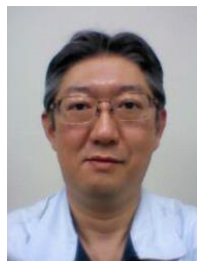
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Table 3 Groups of adjective pairs (boldface shows finally selected adjective pairs).

Group1	Group2	Group3	Group4
Clean – Unclean	Healthy – Sick	Kind – Unkind	Favorite - Hated
Pure – Impure	Refreshing – Unrefreshing	Round – Square	Healing - Non-healing
Comfortable - Uncomfortable	Relaxed – Anxious	Stabile – Unbalanced	Cool - Old-fashioned
Simple – Gaudy	Quiet – Noisy	Secure – Insecure	Youthful – Aged
Masculine – Feminine	Rational – Irrational	Gentle – Scary	
Resilient – Slack		Pleasant – Unpleasant	
Beautiful – Ugly		Mild – Severe	
Delicious – Disgusting			
Fine in the touch – Coarse in the touch			
Dry – Sticky			
Group5	Group6	Group7	Group8
Smooth – Prickly	Full - Empty	Damp - Desiccated	Light - Dark
Soft – Hard	Fashionable – Somber	Juicy - Withered	
Fun – Painful	Interesting - Boring	Moist - Dry	
Clean – Dirty	Chic - Ordinary		
Good – Bad			
Smooth – Rough			
Group9	Group10	Group11	The others
Hot – Cold	Cheerful – Dismal	Conspicuous - Inconspicuous	Sharp – Dull
Warm – Cool	Lively – Sluggish	Flashy – Sober	Cute – Ugly
	Exciting – Boring	Unique - Common	Expensive – Cheap
	Active – Passive	Clear – Obscure	Delicious – Terrible
	Intense – Calm	Rare – Common	Wild – Tame
	Powerful – Impotent		Artificial - Natural
	Dynamic – Static		Heavy – Light



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