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Impression Evaluation between Color Vision Types - Blue Considered Lively by Elderly People –

Yasuyo G. ICHIHARA * Kogakuin University, 1-24-2 Nishi-Shinjuku, Shinjuku-ku, Tokyo 163-8677, Japan*
ichihara@cc.kogakuin.ac.jp

Abstract

Anyone has the original color world.
There is it whether our problem, it are the things that original sense of color is native whether it is an acquired thing. Red is not a color that stands out brightly for dichromatic individuals who have a different sense of color from the majority.
However, they know that the color of passion is red. They also know that the color of sadness is of bluish color.
But these understandings are learned a posteriori. If so, there must be a discrepancy in terms of the impression between the stimulation of letters by the color name and the stimulation by color itself. Impression is also expected to be different between the majority and the minority. This study conducted the impression survey by SD method using stimulations by letters and colors to understand instinctively the color world as seen by individuals with different sensation of color.

Keywords: *Color vision, Impression evaluation, dichromatism, Protan, Deutan*

1. Introduction

We are surrounded by color in our everyday lives, and color is a means by which we obtain information. When color is perceived, we experience a variety of impressions and sentiments concerning that color. For example, Japanese people tend to prefer blues [1], while reds tend to be perceived as passionate [2]. People are also deemed to experience the same response to stimulation by the color or by the name of the color. Kuromaru et al. [3] [4] performed an impression evaluation experiment with color stimuli and color names in which young subjects (20–29 years-of-age) were exposed to color stimuli and color name stimuli, and the difference in their impression was investigated. The results revealed almost no difference in impression between a color stimulus and corresponding color name stimulus for any color other than green. Ichihara et al. [5] [7] also reported a large difference between color stimulus and color name stimulus in an impression evaluation experiment performed with subjects having divergent color perception (deuteranopes). These subjects showed no tendency for the same impression in response to color stimulation and corresponding color name stimulation for blue and pink. Green also tended to yield a similar response to brown and was also positioned close to purple.

The total population of Japan as of October 1, 2017 is 126,710,000, of which people aged 65 years and older account for 27.7% (elderly population rate). The total population of Japan is expected to fall while the elderly population rate is expected to rise [6]. The change in impression of color that will occur associated with this increasingly aged population is unknown.

In light of our aging society, the present study performed an impression evaluation experiment in elderly subjects using color stimulus and word (color name) stimulus in the pursuit of trends. Simultaneously, this study also investigated commonalities and differences in impression between elderly and young subjects.

2. Experimental Method

Evaluation forms were prepared containing stimuli and paired adjectives, and experiments were performed by the SD method in 14 elderly subjects (men and women aged ≥60 years) who passed the Ishihara color test. The method used was identical to that of Kuromaru and Ichihara [3] [4] [5] [7]. Eleven basic colors were used for the color stimulus and color name (word) stimulus. All color block sizes were 3 cm × 3 cm. The Munsell values and color names used are shown in Table 1, and the color stimuli created from the Munsell values are shown in Figure 1.

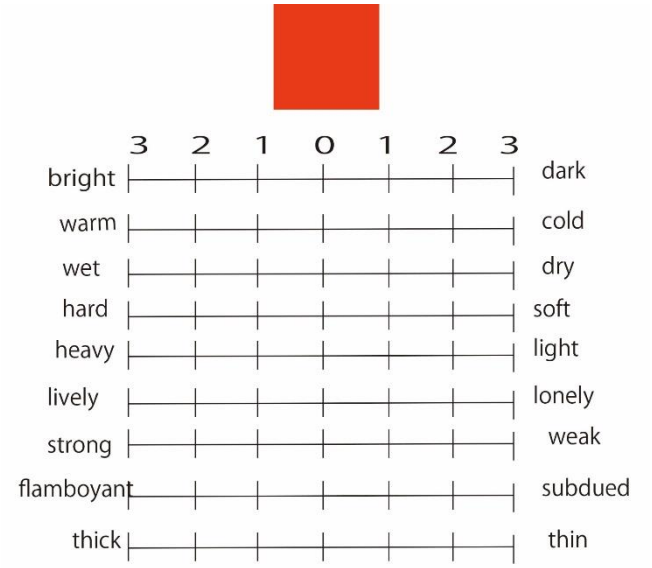

Figure 1. Example of Red stimuli

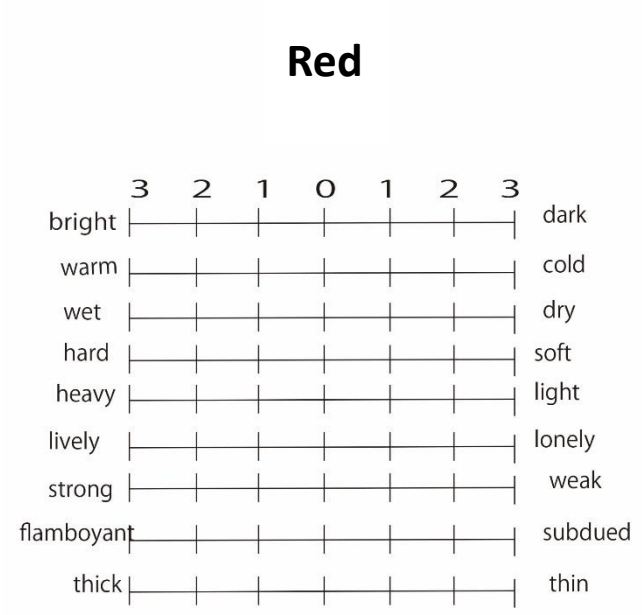

Figure 2 Example of Red word stimuli

Table 1 Stimuli used in experiments

Blue	5B 4/8
Black	N1.0
Red	5R 4/14
White	N9.5
Brown	5YR3.5/4
Yellow	5Y 8/14
Purple	5P 4/10
Pink	5RP8/6
Grey	N5.0
Orange	5YR 7/14
Green	5G 4/10

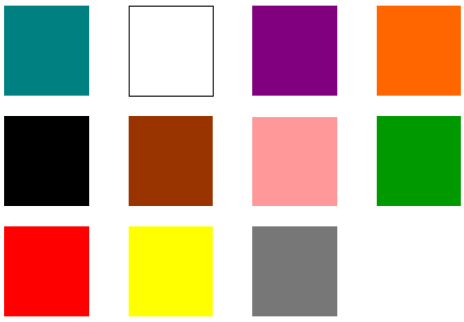
Figure 3 Color stimuli based on Munsell values

A total of 9 paired adjectives were used (Table 2), evaluated on a scale of one to seven. Data was aggregated and factor analysis (principal factor method) was performed using SPSS.

Table 2. Paired adjectives

bright-dark
warm-cold
wet-dry
hard-soft
heavy-light
lively-lonely
strong-weak
flamboyant-subdued
thick-thin

3 Experimental Results

The results of factor analysis of young subjects performed using SPSS are shown in Table 3, and the results for each factor among elderly subjects are shown in Table 4.

All factors yielded a positive value for both young and elderly subjects. Factor 1 adjectives were the same among both young and elderly subjects (lively, warm, flamboyant, bright). Among young subjects, Factor 2 adjectives were thick, strong and heavy, and the only Factor 3 adjective was wet. Among elderly subjects, Factor 2 adjectives were deep and strong, and Factor 3 adjectives were heavy and hard, showing a difference between young and elderly subjects for Factor 2 and Factor 3 adjectives.

Based on results obtained in young subjects, Kuromaru and Ichihara [3] [4] [5] [7]named Factor 1 adjectives “sensory,” Factor 2 adjectives “physical,” and Factor 3 adjectives “dry.”

In the present study, among elderly subjects the Factor 1 adjectives were named “sensory,” Factor 2 adjectives “strength,” and Factor 3 adjectives “potency.”

For young subjects, mean results for color stimuli and color name (word) stimuli are shown in Table 5(a b) and plotted in Figure 4. For elderly subjects, the equivalent results are shown in Table 6(a b) and Figure 5.

Table 3 Factors analysis among young subjects

Paired adjectives		Factor 1	Factor 2	Factor 3
Lively	lonely	0.95	0.13	-0.17
Warm	Cold	0.87	0.06	-0.29
Flamboyant	Subdued	0.82	0.31	0.23
Bright	Dark	0.79	-0.33	-0.07
Deep	Pale	0.01	0.77	0.28
Strong	Weak	0.39	0.68	0.08
Heavy	Light	-0.30	0.61	-0.23
Wet	Dry	-0.17	0.18	0.55
Sum of square loadings after rotation (a)		3.42	2.07	1.02

Table 4 Factor analysis among elderly subjects

Paired adjectives		Factor 1	Factor 2	Factor 3
Bright	Dark	0.83	-0.22	-0.26
Warm	Cold	0.80	-0.02	-0.23
Flamboyant	Subdued	0.80	0.21	-0.14
Lively	Dull	0.79	0.07	-0.07
Thick	Thin	-0.01	0.82	0.18
Strong	Weak	0.09	0.82	0.23
Heavy	Light	-0.23	0.34	0.82
Wet	Dry	-0.21	0.16	0.75
Sum of square loadings after rotation (a)		2.70	1.58	1.47

Table 5 (a) Mean factor scores among young subjects (color stimuli)

	Factor 1	Factor 2	Factor 3
5B 4/8	0.86	0.05	-0.39
N1.0	1.24	-1.45	0.45
5R 4/14	-0.86	-0.61	0.41
N9.5	-0.10	1.52	-0.62
5YR3.5/4	0.86	-0.85	1.07
5Y 8/14	-0.97	0.78	-0.38
5P 4/10	0.33	-0.64	-0.28
5RP8/6	-0.88	0.76	-0.32
N5.0	0.83	0.32	0.46
5YR 7/14	-1.05	0.26	-0.10
5G 4/10	0.29	-0.08	-0.04

Table 5 (b) Mean factor scores among young subjects (color name)

	Factor 1	Factor 2	Factor 3
Blue	0.56	-0.20	-0.55
Black	1.25	-1.21	0.52
Red	-1.10	-0.47	0.08
White	-0.18	1.50	-0.24
Brown	0.77	-0.50	0.53
Yellow	-0.91	0.49	-0.20
Purple	0.23	-0.65	0.27
Pink	-0.94	0.59	-0.43
Grey	0.91	0.18	0.65
Orange	-1.10	0.02	-0.29
Green	-0.20	0.07	0.04

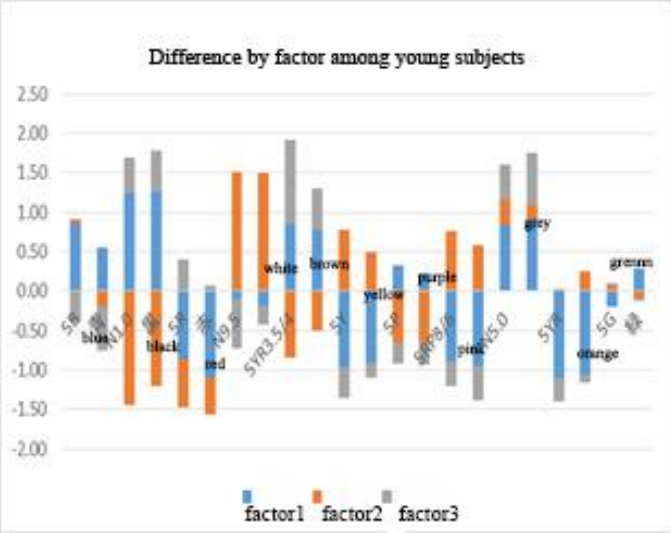

Figure 4 Difference by factor among young subjects

Table 6 (a) Mean factor scores among elderly subjects (color stimuli)

	Factor 1	Factor 2	Factor 3
5B 4/8	0.73	-0.20	0.23
N1.0	1.32	-0.70	-0.95
5R 4/14	-0.81	-0.51	0.02
N9.5	-0.02	1.13	-0.16
5YR3.5/4	0.84	-0.27	-0.36
5Y 8/14	-0.73	0.24	0.67
5P 4/10	0.09	-0.15	-0.27
5RP8/6	-0.21	0.71	0.62
N5.0	1.01	0.36	-0.24
5YR 7/14	-0.63	0.04	0.20
5G 4/10	0.36	-0.21	-0.11

Table 6 (b) Mean factor scores among elderly subjects (color name)

	Factor 1	Factor 2	Factor 3
Blue	-0.04	-0.08	-0.08
Black	1.25	-1.03	-0.09
Red	-1.44	-0.96	-0.28
White	-0.13	0.78	0.18
Brown	0.25	0.03	-0.37
Yellow	-0.87	0.20	0.65
Purple	-0.04	-0.27	-0.21
Pink	-0.69	0.64	0.61
Grey	1.06	0.65	-0.23
Orange	-1.05	-0.26	0.08
Green	-0.25	-0.14	0.10

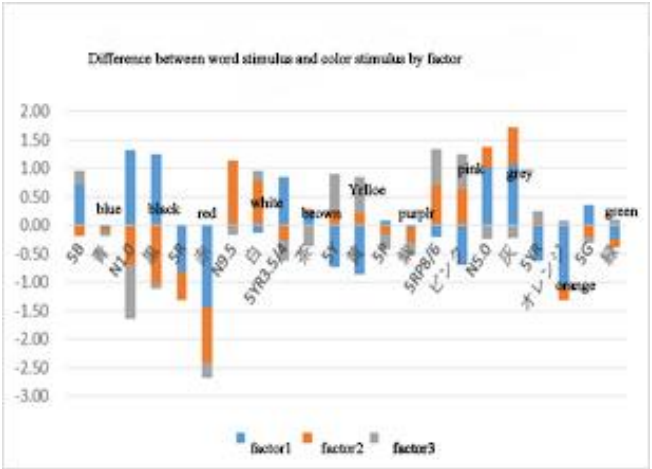

Figure 5 Difference by factor among elderly subjects

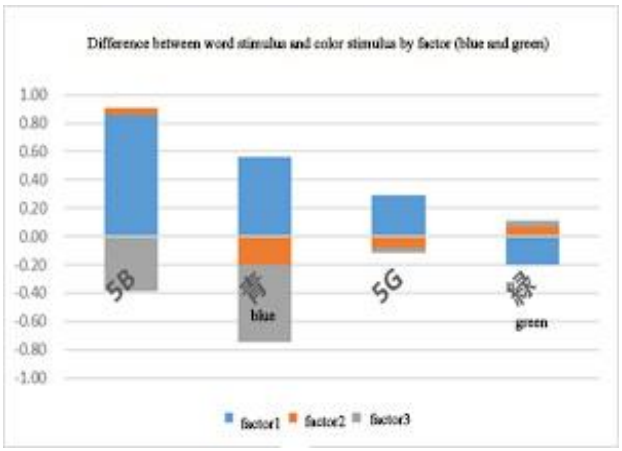

Figure 6 Difference by factor among young subjects (blue and green)

A large difference between word stimulus and color stimulus was observed among both young and elderly subjects for blue and green. An enlarged figure showing the results for these colors is shown for young subjects in Figure 6 and elderly subjects in Figure 7.

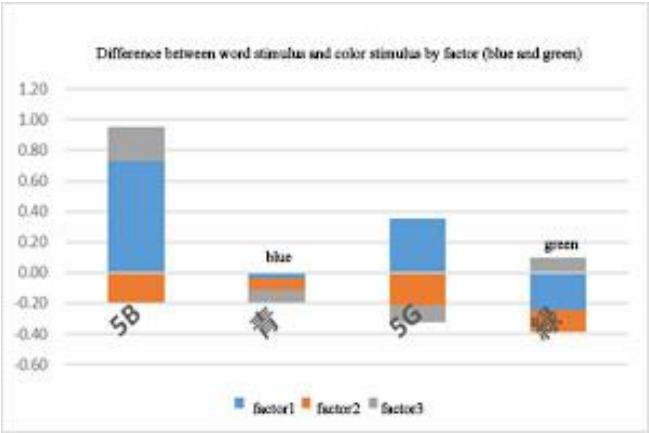

Figure 7 Difference by factor among elderly subjects (blue and green)

Next, dendrogram results for young subjects are shown in Figure 8 and for elderly subjects in Figure 9.

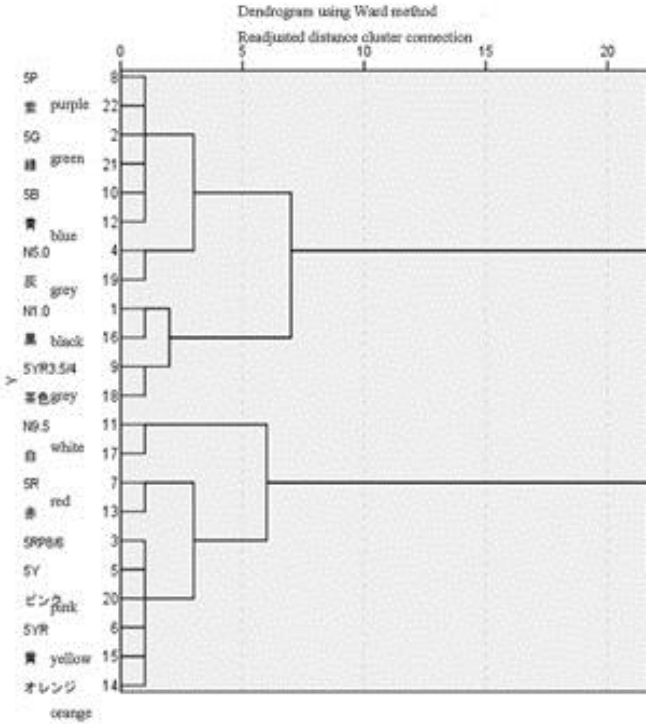

Figure 8 Dendrogram for young subjects

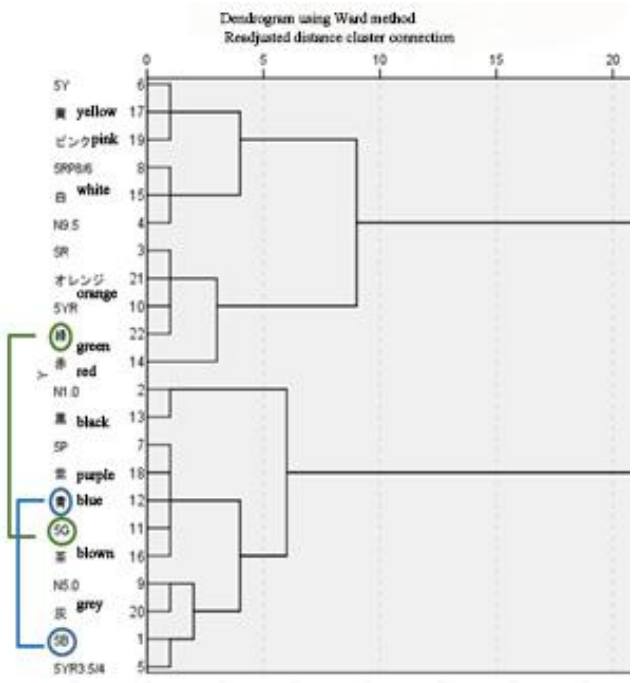

Figure 9 Dendrogram for elderly subjects

4. Discussion

Young subjects tended to have the same impression to color stimulus and corresponding word stimulus for all colors, except for green. The reason the factor loading inverses (changed between positive/negative) for the word green was presumably due to subjects thinking of yellowish green and dark green. No large difference in impression was observed, since the color stimulus and word stimulus for green both belong to the cold color group on the dendrogram.

Elderly subjects tended to have a different impression of color stimulus and corresponding word stimulus for green and glue but exhibited no large difference in impression for other colors. For green, loading was reversed for Factor 1 (sensory) and Factor 3 (potency). As with young subjects, this is presumably due to subjects thinking of "bright green" and "deep, strong green" when given a word stimulus. The dendrogram also shows the green word stimulus is grouped among warm colors, with orange and red.

There are also differences between young subjects and elderly subjects in their impression of blue. Among young subjects, only the loading of Factor 2 was reversed, but among elderly subjects the loading of both Factor 1 and Factor 3 were reversed, and all factors for the word stimulus have negative values. This can be interpreted as young subjects thinking of a deep blue of low brightness, and elderly subjects thinking of a bright blue. The dendrogram also shows the blue word stimulus belongs to the neutral color group of purple and green, but the color stimulus is in the brown group. This trend was not observed in young subjects. In other words, when presented with the blue word stimulus, young subjects intuitively considered blue to be a "dark, dull color," but elderly subjects considered it to be a "bright, lively color." Young subjects were prone to associate the color blue with "sadness," but among elderly subjects, the color blue was associated with "the color of the sky" and "the color of the sea in summer," and elderly subject experienced a lively impression of the blue word stimulus.

5. Conclusion and Future Topics of Study

Impression evaluation of color stimulus and color name stimulus by young and elderly subjects revealed that elderly subjects include the color name stimulus for green in the warm color group that contains orange and red. Also, while young subjects intuitively considered blue to be a "dark, dull color," elderly subjects considered blue to be a "bright, lively color."

A possible future topic of study will be Mansell number 5B which displays a color that appears more turquoise than blue. Impression evaluation must be performed using a variety of different greens and blues. Performing this experiment with a greater number of age groups will also reveal how impression changes with age.

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Author Biography

Yasuyo G. Ichihara received her BS in art and design from the University of Joshibi(1986) and her PhD in Artistic Anatomy from Tokyo national University of fine art and music (1991). Since then she has worked Hosen art college, she is an associate professor in Kogakuin University from 2006 in the in Tokyo. Her reasearch has focused on the color vision deficiency and color universal design. She has done SPIE and IS&T Internet Imaging program committee 2000 -2006.

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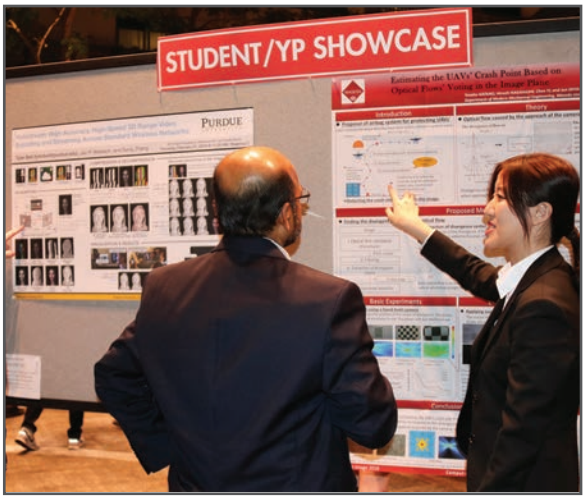

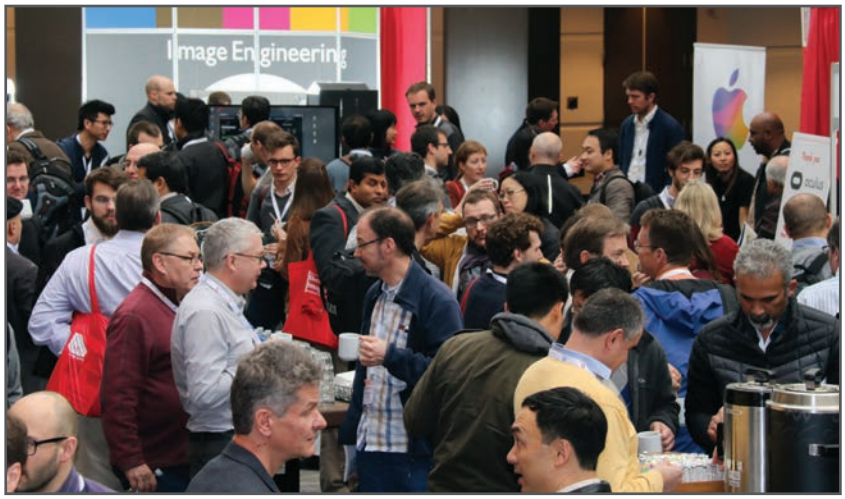

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