Chromatic Adaptation is not for Object but for Illumination

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1. Introduction

The concept of recognized visual space of illumination RVSI emphasizes the adaptation to the illumination filling in a space in explaining the perception of color [1]. If so the effect of the chromatic adaptation is much stronger when a subject stays in a room illuminated by a certain color than he just looks at an object of that color. The effect of chromatic adaptation was compared for these two observing situations

2. Experiment

Experimental room was decorated by objects such as flowers and dolls as shown in Fig. 1. The subject room was illuminated by three fluorescent lamps Ls and the test room by two lamps Lt, both of the day light type. T is a test patch of N6 and a subject observed it through a window W of the size 4×4 cm^2 from distance 120 cm or making the window size 2°×2° of visual angle.

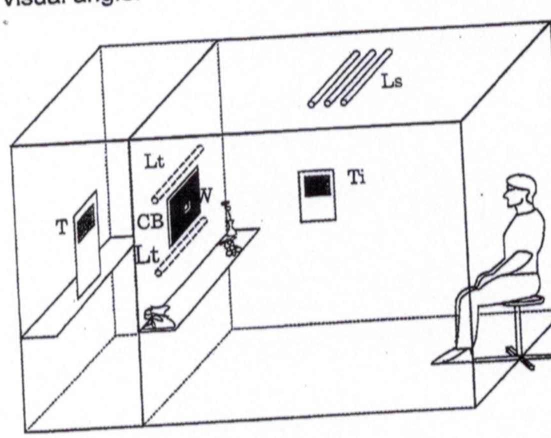

Fig 1 Apparatus composing of two rooms.

Under the illumination condition the lamps Ls were covered by either red or green film and under the object condition a red or green color board CB of the size 52 cm wide and 38 cm high or 24°×18° with a hole of the same size as the window W was placed over the window so that the subject could observe the test patch T as for the illumination condition. The red area in Fig. 1 shows CB. The colored film was taken out for the object condition.

The red colored board was prepared by a laser printer and the green one by an inkjet printer. Their colors were made close to the respective colored lights and the final color specifications are shown on Table 1. The illuminance of the subject room was adjusted so that the luminance on the surface of the colored boards under white light or of the front white wall under colored light became roughly equal as seen in the column L. The illuminance at the adjustment on the shelf of the front wall was listed at the column E.

Table 1 Color specifications of paper board and illumination.

	L*	x	y	L (cd/m^2)	E (lx)
Red paper	42	0.553	0.348	25	682
Red illum	-	0.564	0.354	26	91
Green paper	51	0.274	0.498	24	351
Green illum	-	0.287	0.623	25	85

In the test room the test patch T was illuminated by the bottom Lt at 100 lx of the vertical plane illuminance on the test patch.

Subjects judged the color appearance of the test patch by the elementary color naming method. Four subjects, WN, SN, CP, and MI with normal color vision participated in the experiment and repeated their observation for five times for each condition. In the experiment four other test patches of which colors were slightly different from the test patch of N6 were randomly presented together with the real test patch of N6 to avoid subject's presumption. Judgment was repeated for five times for them also.

To measure the color appearance of the illumination of the subject room the test patch of N6 was put on the wall of the subject room as shown by Ti in Fig 1 and a subject looked at it through the window W from the test room illuminated with two lamps.

3. Results and discussion

The test patch appeared to be pasted on the window W and as an object in the subject room. Its color appearance was the object color mode for all four conditions. The averaged perceived colors from the four subjects are shown in Fig. 2 for four different conditions. Colored bars indicate

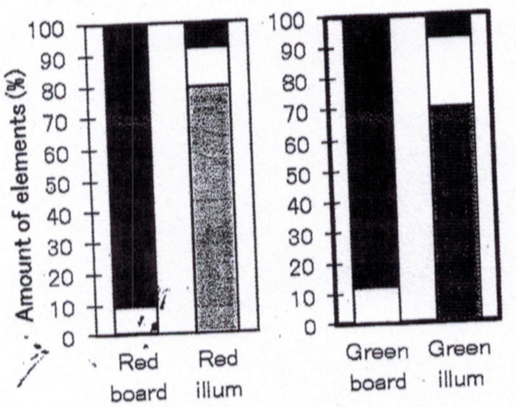

Fig 2 Color appearance of the test patch under different conditions.

the chromaticness, white bars the whiteness, and black bars the blackness, respectively. The chromaticness was zero or almost zero with colored board to imply effectively no chromatic adaptation. It went up to 70 or 80 % with colored illumination and it implies a strong chromatic adaptation.

When the visual system adapts to color, say to red, the recognition axis in the concept of RVSI rotates toward the color and the color appearance of the test patch which remains psychophysically white should appear as opposite color of the adapting color that is green, by which we can know the effect of chromatic adaptation.

The amounts chromaticness and the apparent hues of the test patch are shown in Fig. 3 by a polar diagram based on the opponent-colors theory. Red and green circles indicate the color appearance of the illumination. Red and green squares indicate the apparent hue perceived for

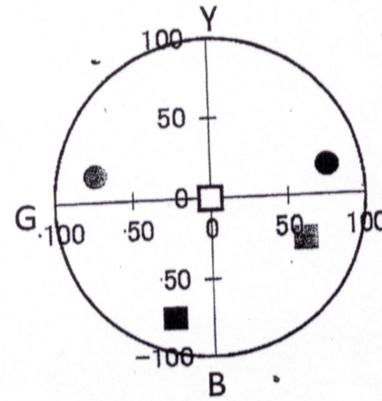

Fig 3 Color appearance plotted on a polar diagram of the opponent-colors concept.

the illumination condition and the white squares for the object condition. Two are almost superposed. It is interesting to note that the apparent color of the test patch for red illumination is not green but greenish blue, not opposite to the red illumination. That is, the chromatic adaptation does not follow the opponent-colors theory. This tendency was also found in previous researches [2, 3].

References

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