MEANINGFUL POSITION OF AN OBJECT IN A SPACE TO CONSTRUCT A RECOGNIZED VISUAL SPACE OF ILLUMINATION RVSI

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ABSTRACT

When a subject looked at a uniform white board placed in a test room from a subject room through a large window the window appeared a mere black sheet if the former was illuminated very low while the latter was illuminated high. If an object was placed just in front of the white board the board immediately appeared a white board. This indicates that the object worked as the initial visual information IVI for the subject to construct a recognized visual space of illumination RVSI for the test room. If, however, the object was gradually separated from the surface of the board the power of the object as the initial visual information decreased and the whiteness decreased. In this paper the power of an object as the initial visual information was investigated as a function of the distance of the object from the white board. A subject judged the amount of whiteness of the board by the elementary color naming. It gradually decreased from 80 % down to 10 % or less when the object was changed from 0 cm to 86 cm.

INTRODUCTION

The concept of recognized visual space of illumination RVSI was introduced to explain the color appearance of objects and lights [1, 2]. A subject adapts to the illumination of a space where an object is placed. The state is expressed as the subject constructs an RVSI for the space and perceives the color of object in relation to the RVSI. By using two rooms technique composing of a subject room and a test room connected by a window limited in its size it was clearly shown that the color appearance of a test patch placed in the test room changed radically whether the patch was perceived in the subject room or in the test room [3]. To construct the RVSI of the test room it was necessary for the subject to be able to see objects in the test room. The objects are called the initial visual information IVI for the RVSI. When IVI was increased the RVSI became more complete [4]. If there is no IVI in a space a subject should not be able to construct an RVSI. Even if there is an object in a space its ability to work as an IVI for the space should be different depending on its position relative to the RVSI. The ability is investigated in relation to the position in this paper.

PRINCIPLE AND APPARATUS

Figure 1 shows a scheme of apparatus drawn in a scale. It was composed of a subject room and a test room of the depth 210 cm and 90 cm, respectively, and the rooms were illuminated by fluorescent lamps of the daylight type Ls and Lt. There was a window of the size 30 cm high and 40 cm wide opened on the separating wall of the rooms. Inside of the subject room was pasted by a white wall paper. At the back wall of the test room a white board WB of the size 61 cm high and 91 cm wide was placed. A subject looked at the white board from the distance 180 cm from the window subtending 10°×13°arc of visual angle. When there was no object in the test room, in other word there was no IVI, and the test room was not illuminated by Lt but the subject room brightly by Ls, the window appeared to be pasted by a black paper. There was no space perception for the test room. The space perception only took place when there were placed some objects in the room such as flowers as shown by IVI in Fig. 1. Once the space perception took place in the subject the white board appeared as a white board. The white appearance was the result of constructing the RVSI for the test room in the subject. But the construction should be different depending on the distance of the IVI from the white board. In the present paper the whiteness was judged by the elementary color naming method as a function of the distance.

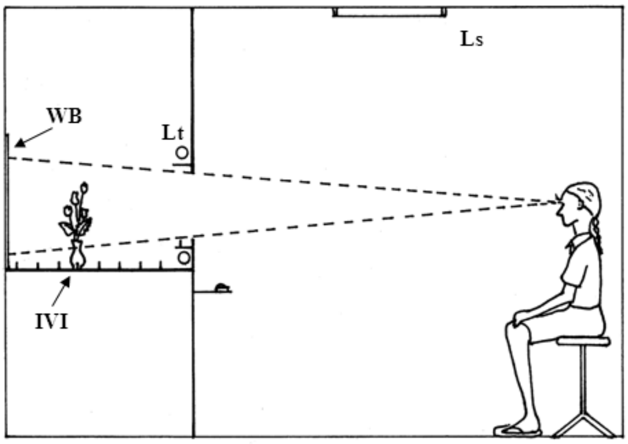

Figure 1 Scheme of apparatus.

The object to work as IVI is shown in Fig. 2. It was composed of artificial flowers of some colors, deep red, white, green, and deep green. The flowers were arranged to a white vase and the total height was 45 cm. The frame of Fig. 2 shows the window and subjects could see only flowers and an upper portion of the vase in the window. To locate the position of the vase marks were drawn on the table in the test room as 0, 1, 2, , , 7, each interval being 10 cm apart. The position 0 was at the distance 5 cm from the white board and thus the position 7 was 75 cm apart from the white board. There was additional position 8, which was not on the table but on a cover over the lower lamp, which was 86 cm from the white board.
At each position of 9 positions of IVI a subject judged the whiteness and the blackness of the white board around the flowers by the elementary color naming method. Five repetitions were made at different time or day.
The horizontal plane illuminance of the subject room was kept constant at 757 lx when measured on the front shelf as illustrated in Fig. 1. The horizontal plane illuminance of the test room was set at either of four levels, 10, 20, 40, and 80 lx when measured on the table in the test room closest to the white board. The illuminance was changed by a light controller connected to the two

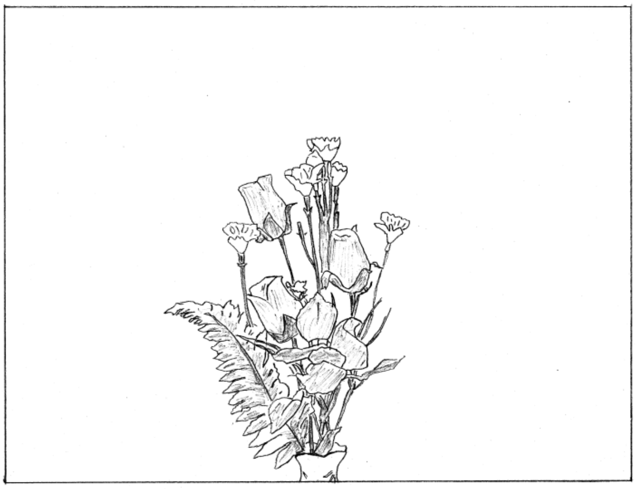

Figure 2 Flowers as initial visual information IVI.

fluorescent lamps. The measurement was conducted while the subject room was lit at 757 lx. Ten lx of the test room was provided when the two lamps were off.

Five subjects participated in the experiment, CP, MI, PS, RT, and SM, who were all normal in color vision when tested by 100 hue test.

RESULTS

Results of the subject CP are shown at the upper section of Fig. 3. The abscissa gives the distance from the white board in cm and the ordinate the whiteness amount in percentage. Four curves correspond to the test room illuminance, circles to 10, squares to 20, triangle to 40, and diamonds to 80 lx. The whiteness without IVI or flowers in the test room is shown by the respective symbols on the left ordinate. When the IVI was closest to the white board the whiteness amount was a little over 80 % regardless the illuminance level implying the subject constructed the RVSI for the test room and judged the white board as white. When the IVI separated from the board the whiteness decreased and the decrease was most rapid with 10 lx. When the distance was 86 cm the board appeared almost black to imply that the IVI did not help to construct the RVSI for the test room at all. When there is no IVI in the test room the whiteness became almost zero. The window appeared very black in spite of the fact that the subject was looking at the white board. The subject judged the board by the luminance of the board and not by the lightness of the board. When the illuminance became higher in the test room the effect of IVI decreased but the RVSI was constructed to a certain extent by the illumination itself and the whiteness did not go down to zero even at 86 cm.

There were some individual differences and the averages of five subjects were taken, which are shown in the lower section of Fig. 3. The decrease of whiteness continues for increasing distance of IVI from the white board. In other words the effect of IVI to construct the RVSI or the space perception for the test room gradually decreased for more distant IVI from the test surface.

It was argued that an RVSI could be constructed even for a uniform plane by which the simultaneous lightness contrast takes place1). The present investigation showed that a space perception over a uniform plane constructed by IVI decreases when the IVI separates from the plane.

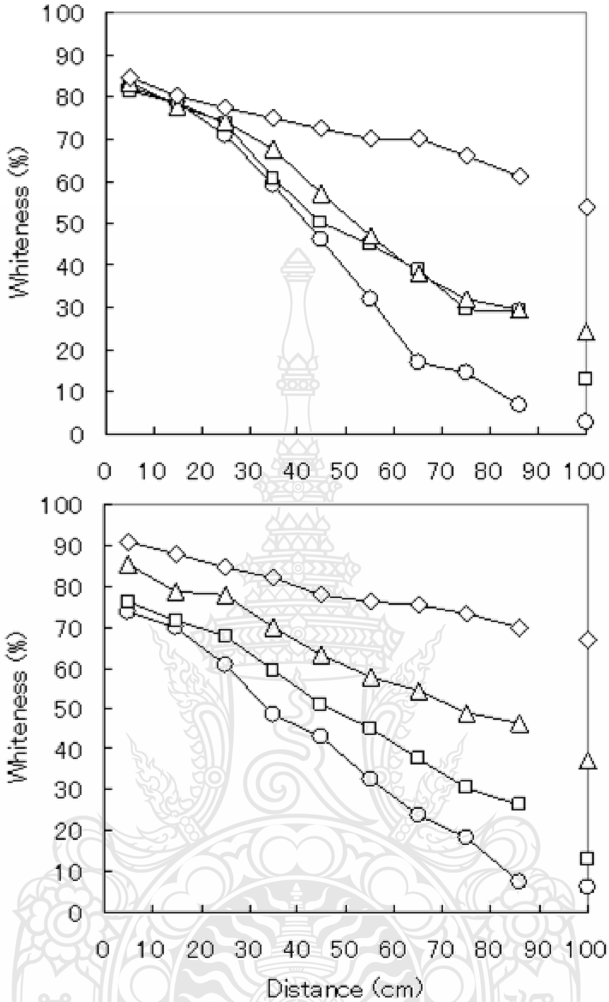

Figure 3 Whiteness amount as a function of the distance of IVI from the white board. Upper, results from subject CP; lower, averaged results of five subjects. Symbols indicate the luminance level of the test room, circles, 10 lx; squares, 20 lx; triangles, 40 lx; dimonds, 80 lx.

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