

Construction of Recognized Visual Space of Illumination

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As entering a room you immediately understand how the room is illuminated, brightly or dimly and yellowishly or bluishly. The situation is expressed as follows; your visual system constructs, in your brain, some representation for the light filling the space called a recognized visual space of illumination, RVSI. The construction is presumably done by looking at illuminated objects, which are called initial visual information, IVI, and then color appearance of any objects in the room is determined by that constructed RVSI. Based on this theory, the apparent color is largely affected by what we see as IVI, not directly but by way of the illumination recognition. There have been few researchers who study color perception from the view of the space recognition. In the present research, construction mechanism of RVSI was studied through psychophysical experiments where the IVI was manipulated systematically, and several applications were mentioned.

In the first half of the thesis, a spotlight was given in addition to a main ceiling light in experiments. An observer couldn't notice the spotlight without any IVI in the spotlight area. By inserting objects as IVI into the spotlight, we had the observer notice the spotlight. The color appearance of a small test patch in the spotlight was assessed as a measure of the degree of construction of RVSI, by the color naming or the color matching methods. Several important properties of IVI were revealed as follows, First, in the case of scattered objects as IVI, the more objects are presented in the spotlight, the more strongly the RVSI is constructed. Second, a miniature room enclosing a space physically was much more effective as IVI than scattered objects. Third, the gradual change in color appearance of the test patch associating with the IVI insertion, suggests a gradual shift from one RVSI to another. Next, the effectiveness for RVSI construction was investigated for individual walls of the miniature such as sidewalls, a back wall, a floor, and for their combinations. The back wall was the most effective, and the floor followed. Some applications for illumination design were suggested. For instance in a show window, if an attractive or eccentric color appearance is desired as a stage effect, no objects other than an item for display should be put in the spotlight to avoid RVSI construction. On the other hands, if customers must get an exact color appearance with high fidelity, an item should be illuminated together with other objects, more desirably within enclosing walls, to help RVSI construction.

In the other half of the thesis, 2D pictures such as a large photograph and black-and-white patterns were employed as experimental stimuli. Two observing conditions were compared: a picture was observed as a 2D object hung on a wall together with other objects in the experimental room, or a picture was presented exclusively through a view-restricting box. The apparent color on a picture changed across the two conditions. It suggests that when only a picture is given exclusively we feel a 3D space in the picture and that the visual system can construct its RVSI even on the 2D image. It was confirmed possible to control color appearance on 2D pictures by manipulating two RVSIs for the picture and for the environment.