

## Preferred color of a plant control room for aged operators

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# Preferred color of a plant control room for aged operators

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## Abstract

Recent manufacturing facilities have become large and rationalized. In order to achieve rationalization, the facilities must be manipulated via a remote and centralized control room. These control rooms, where operators remain during the entire work shift, are usually required to be not only in efficient working condition but also in pleasant living condition. This report presents the result of an experiment which was carried out for various aged subjects who were requested to state which hue in the attributes of color were preferred for the control room. The result presents a cool color is preferred for young operators, and for aged operators, the tendency is to prefer warmer color in the control room.

## 1. Introduction

This report concerns the color (hue) of a plant control room. The plant in a large manufacturing company recently has rationalized facilities. These facilities have no operators but are controlled by operators in a remote control room. The operators in the control room are under a great deal of stress during their working labours. The visual environment is especially important. The atmosphere in the room must be comfortable and relaxed, but it must also maintain an appropriate tense feeling. In this investigation, the color of the room was investigated under the consideration of the above conditions. From among three attributes of color, the hue was chosen to speculate.

The experiment was executed on a CRT display. Prior to the color experiment, CRT display presentation experiment to determine whether the CRT scenery was equal to the real space feeling, was executed. The subjects were 20 persons, from age 20 to age 50.

The experiment was carried out with three groups: one was 10 subjects, 20 years old, other was 5 subjects of middle age from 30 to 40 years old, and the last one was 5 subjects, 50 years old. All subjects had no defect in their visual ability.

## 2. Comparison between CRT display and real spatial presentation.

### 2.1 Method

Three rooms in the university were chosen respectively: a corridor as a narrow space, a computer room as a space filled with objects, and a lecture room as a wide space. These room photographs were put into a computer by a scanner device and were displayed on a CRT display. The computer is a Macintosh II fx, the CRT display is a 19 inch SuperMac made by Sony Corporation, and the scanner is a Sharp Jx-320. On the other hand, subjects observed the real rooms from the same positions of view as the photograph. The subjects were asked to evaluate their feelings for each scene, according to SD (semantic differential) values. A SD evaluation chart is shown in

chart 1.

The subjects chose the value on the line between two adjectives which were contrary to each other. From the values for each scene, determining criteria were extracted.

**2.2 Results**

The extracted main factors are shown in Chart 2. The atmospheric factor is commonly extracted between the CRT displayed scenery and the real scenery. Other factors were different for each trial. There was a spatial factor, an activity factor, and others. Using the atmospheric factor for the evaluation of the following experiment was effective.

**Chart 1 SD chart: pairs of contrary adjectives**

|             | extreme |   | medial |   | extreme     |
|-------------|---------|---|--------|---|-------------|
|             | 1       | 2 | 3      | 4 | 5           |
| light       |         |   |        |   | heavy       |
| calm        |         |   |        |   | agitated    |
| bright      |         |   |        |   | dark        |
| cool        |         |   |        |   | warm        |
| soft        |         |   |        |   | hard        |
| strange     |         |   |        |   | familiar    |
| old         |         |   |        |   | modern      |
| valuable    |         |   |        |   | worthless   |
| composed    |         |   |        |   | restless    |
| orderly     |         |   |        |   | mess        |
| feminine    |         |   |        |   | manly       |
| eyestrained |         |   |        |   | clear eye   |
| closed      |         |   |        |   | open        |
| strong      |         |   |        |   | weak        |
| dull        |         |   |        |   | stimulate   |
| simple      |         |   |        |   | complex     |
| mature      |         |   |        |   | unripe      |
| gloomy      |         |   |        |   | cheerful    |
| young       |         |   |        |   | aged        |
| active      |         |   |        |   | still       |
| safe        |         |   |        |   | dangerous   |
| oppressive  |         |   |        |   | refreshing  |
| vivid       |         |   |        |   | astringent  |
| empty       |         |   |        |   | full        |
| sharp       |         |   |        |   | somber      |
| narrow      |         |   |        |   | wide        |
| favorable   |         |   |        |   | unfavorable |

**Chart 2 Extracted factors for real space and CRT**

|               |             | 1 st factor | 2 nd factor |
|---------------|-------------|-------------|-------------|
| Corridor      | Real space  | Atmospheric | Spatial     |
|               | CRT display | Atmospheric | Spatial     |
| Lecture room  | Real space  | Activity    | Atmospheric |
|               | CRT display | Spatial     | Atmospheric |
| Computer room | Real space  | Atmospheric | Activity    |
|               | CRT display | Functional  | Atmospheric |

R



Y



G



B



P



Fig. 1 5 samples of experimented scenery changing 5 hues.

### 3. Color experiment

#### 3.1 Method

A typical plant control room picture was incorporated into the computer by the scanner device. Using Macdraw which was provided as Macintosh software, the hue of the room color was changed to 10 hues in turn: red (R), yellowish red (YR), yellow (Y), greenish yellow (GY), green (G), bluish green (BG), blue (B), purplish blue (PB), purple (P), and reddish purple (RP) according to the Munsel chromaticity diagram. In the scenery, a dark brown control panel, was used for all trials, because the panel was used to be determined by the company. Samples of the scenery are shown in Fig. 1. Each scene was displayed on a CRT display, and all subjects mentioned previously were asked to reply to the SD chart (mentioned previously) request.

#### 3.2 Results and discussion

The two largest factors were extrapolated for every segregated age groups. The extrapolated factors are shown in Chart 3.

Chart 3 Extracted factors for three age groups

|                 | 1 st factor | 2 nd factor |
|-----------------|-------------|-------------|
| 20 age of years | Atmospheric | Activity    |
| Middle age      | Activity    | Atmospheric |
| 50 age of years | Atmospheric | Activity    |

In the chart, the atmospheric factors were commonly for all groups again.

These factors correspond with two Cartesian coordinates' axes which are exemplified in Fig.2.

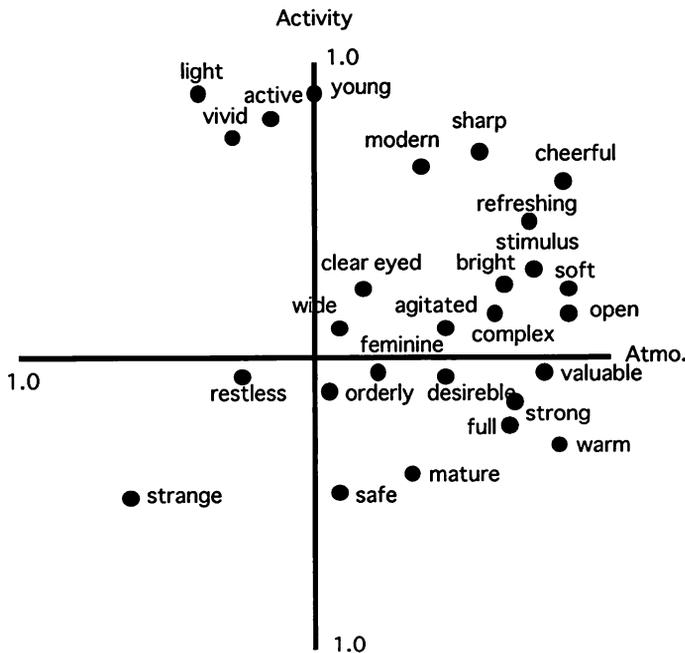


Fig. 2 Coodinates of extracted factors

Subsequently, for each age group, the load of the SD value contributing to the atmospheric factor was calculated. This load is obtained by multiplying the SD value by the coordinates of the atmospheric factor. As shown in Fig.3, the calculated load values are depicted on circle figures. In the figure, radial length shows the load values. For the 20 year old group, the range from YR to BG is the larger load. For the middle aged group, the range from YR to G is the larger load. For the 50 year old group, the range from RP to YR is the larger load. As person ages the tendency of the preferred color shifts from a cool color to a warm color.

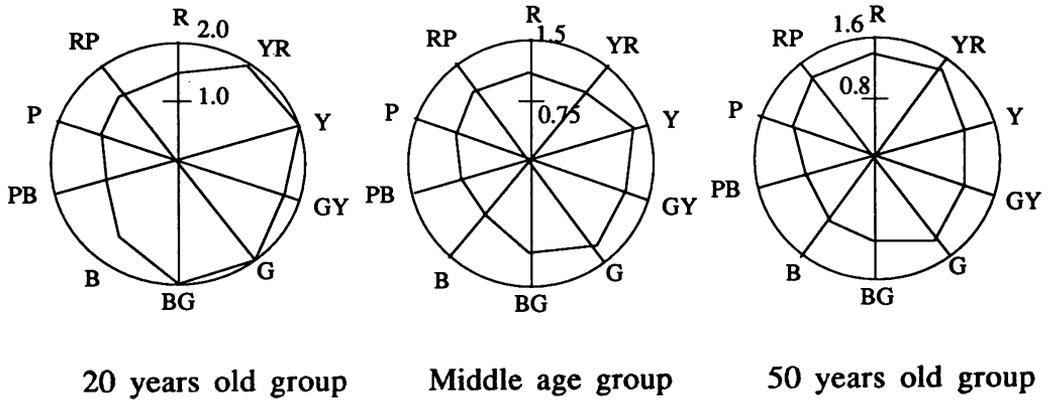


Fig. 3 Load values related to color hue