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# The Color Impression of Light

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## Abstract

The purpose of this study is to find a kind of lighting and color configuration appropriate for meeting room. The testing through measuring subjective impressions of lighting and color is to prove that the configuration giving impression of (1) spaciousness, (2) relaxation, and (6) privacy using bipolar semantic differential scale. There were 48 participants from student of Interior Design, ISI Yogyakarta distributed in 8 groups that contain of 6 persons. Two rooms with 12 lighting and color configuration were used for testing. The result shows that the configuration gives strong impression on spaciousness and relaxation except impression of privacy.

**Keywords:** Impression, setting of lighting, color

## Introduction

Lights and colors are the integral parts of our environment, without lights, we cannot see colors. A color that was produced from the pigment is different from colors produced by the light. Flynn et. al. said that the color produced from the light is determined by the color temperature and color rendering index, whereas the light/color temperature is measured in Kelvin degrees while to indicate the ability from the light to render the color can be seen from the color rendering index [1]. The difference of color spectrum owned by the

light sources cause the color visual which is received by the eyes also becomes different when it falls on the surface of a colored object. As stated by Weale et.al. that a light color which falls to the colored surface will give different visual effects [2]. Some observations show that the color temperature can be influenced to the subjective interpretation of brightness intensity.

Colors shown in a room is related to the mood or impression just like the warmth feeling or the he calmness and can be used

to coolness, to stimulate the activity of its user. The warm color is often associated with the color of fire and the sun that is shown by the yellow color to orange and red-orange to red-purple. Weale et. al. said that the cool color is identically with the color of snow, ice, water and its reflection to the daylight that is shown by the color of purple to blue and blue-green to yellow-green. While the color of yellow-green and red-purple both can be the warm colors or cool colors. The research conducted by Stone and English found that the room color influences the mood and work performance [3]. Besides that, the composition from some colors that was applied to the working room has also proven to influence the working to be stressful [4]. A stressful condition that was experienced by someone who works in a disharmonic room composition with dominated by the red color is tended to be higher than those who work in a harmonic monochromatic blue color. While the color of a neutral color (white) tends to be received more and does not disturb compare to red and blue colors. This shows that red color tend to increase the stressful on working, while the blue color tends to be more calm and monotonous. Despite there are some contradictions between some researches on the psychological effects of color on its users but in general, warm and cool color groups have the psychological influence on its users. As

stated by Stone and English that the color in a workspace do not influence to the satisfaction and the performance of its user but the data shows that the cool colors (blue, green, and purple) influence the calmness while the warm colors (red, orange, and yellow) energize the atmosphere.

Moreover, the lighting quality is also determined by the setting of lighting, which is also called the lighting mode. Flynn et. al. also said that the lighting mode can be used as a clue in creating a lighting condition, which is suitable for any activities of working or non-working. The lighting dimension influences to the impression that according to Flynn divided into three modes, which are: bright - dim (dimension 1), uniform - non uniform (dimension 2), and overhead - peripheral (dimension 3). While the impression to the light itself according to Flynn is divided into: (1) Impression of Visual Clarity, or the impression to a lighting environment which shows the architecture forms, human, and the details that can be seen brightly and real. (2) Impression of Spaciousness is an impression to the lighting environment, which shows the size of the architectural space around the individual. (3) Impression of Relaxation is the impression to the lighting environment, which shows the functions that, is wanted to support comfort in doing the activities. (4) Impression of Privacy is the impression to the lighting environment, which shows a spatial

necessity that is wanted to do the human's activities. (5) Impression of Pleasantness is the impression to the lighting environment that shows the happiness, which is wanted by human to support their activities. With some comparisons, the impressions used as the study object were impression of spaciousness, relaxation, and privacy.

The objective of this research is to explain how the system in lighting for a meeting room that uses the lamps with the same color rendering index that is fluorescent/TL, but different in its color temperature, which are warm white (yellow) 3000 °K and white 4000 °K, combined with the overhead setting system, peripheral and both combination and the different wall colors (green and orange) that influence to the impression of its users.

#### Material and Method

The subject of this research consists of 48 students of Interior Design Study Program, Faculty of Visual Arts, Indonesia Institute of Arts Yogyakarta, with the criteria that they have been taught about interior design, in



Figure 1. Experiment Room

semester 3rd to 8th. The subject of this research is divided into 4 groups, each contains of 12 people. Each group only judges 3 conditions. To avoid the bias, every group is divided to 2 smaller groups with 6 people each.

This experiment uses the room size of 6X3 m (18m<sup>2</sup>), that is divided into two rooms (9m<sup>2</sup> each) with green and orange-colored wall, with the lighting of overhead fluorescent and peripheral fluorescent. The kinds of furniture and the types of furniture and layout setting both of rooms are the same. The comfort of the room is set by using the same air circulation system (one fan).

The lighting setting is distinguished become two groups that is the group of room's color which is green (represents the cool color) and orange color (represents the warm color) and the group of the light/color temperature that is cool white and the warm white color. The light sources using the same fluorescent lamps. The lamps' placement is divided into two groups, which are an overhead (in the middle of the room, on the plafond) and peripheral (surrounding room adhered to the meeting of top part of the wall and plafond).

#### Result and Discussion

From the average judgment to the impression with a various scales between 1-7 showed that the configuration of the light setting and the colors are able to give the different impression for the subject. The

spaciousness impression that shown by the settings 3, 8, 5 and 10 showed that the rooms' impression feels bigger, wider, broader, long and horizontal, while the settings 2, 6, 7, 4, 2, 9, and 7 showed the impression of spaciousness become smaller, full, narrow, short and vertical.

The relaxation impression that is showed by the settings 1, 7, 4, and 2 influence the comfort of its users became more relax, while the settings 2, 3, 5, 6, 7, 8, 9, and 10, are the opposite, giving the impression of tension for its users.

The Settings of 2, 4, and 7 gave the impression of coolness to the room, the opposite of settings 1, 3, 5, 6, 8, 9, and 10 that gave the warm impression to the room. The privacy impression, which described a public impression, was shown by the settings 2, 3, 7, 8, and 10, while the settings of 1, 2, 3, 4, 7, and 9 gave more private impression to its users. Data analysis of the measurement's result used the General Linier Model from SPSS, which is Univariate Analysis of Variance (ANOVA) with the significance level 0.05 – confidence intervals 95%. This ANOVA is used to test the differences between independent variable (setting, lamps, and colors) with dependent variable (impression) so the significance of those variables was known.

### 1. Impression of Spaciousness

According Flynn, the impression of spaciousness can be formed by creating the

lighting setting with the mode of peripheral-bright-uniform whereas the impression that caught by the room's users is bigger while the mode of overhead-dim-non uniform gives the impression the smaller room. Based on that theory to produce a big and wide room impression so the lamp lighting intensity has to be a high intensity of brightness and the uniformity lighting. This research shows that the combination of lighting setting of peripheral-overhead fluorescent warm white/white have influence to the impression of spaciousness.

This can be proved by the analysis of variance  $F=0.002$  which shows a significant score. The lighting setting combination gives the significant influence to the impression ( $F=0.000$ ). The setting of peripheral-overhead that has a higher intensity of lighting (195-220 lux) is in fact producing the uniformity lighting thus it gives the impression of the room becomes bigger and wider compare to the setting of peripheral-overhead, which has the higher lighting intensity (195-220 lux). The warm white color also influence to the impression of

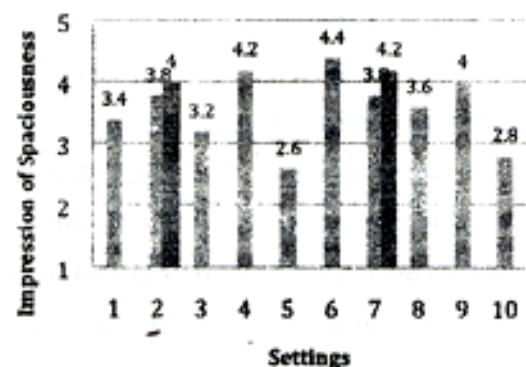


Figure 2. Graphic of Impression of Spaciousness

spaciousness, the warm white-color tends to have the impression of wider compare to the white color.

This also happens to the wall color, the green color configuration and orange are combined with the peripheral-overhead lighting which in fact has a significant influence to the impression of spaciousness ( $F=0.002$ ). This can be seen on the settings 1, 3, 8, 5, and 10 with green colored wall and 2, 6, 7, 4, 2, 9, and 7 with orange colored wall (Figure 2). The analysis result shows that setting composition of the green colored wall-peripheral-overhead fluorescent warm white with a high intensity tends to give the impression of spaciousness-big/wide compare to the setting composition of orange-overhead fluorescent white with the low light intensity which gives a small/narrow impression.

## 2. Impression of Relaxation

Some researches mentioned about the colors that give the impression of warm (red, orange, yellow) give the arousal feeling compare to the cool colors (violet, blue, green) which is related to the feeling of calm. The red color increases the stimulation and the excitation so it influences to the emotion and response from its users, while the colors of blue and green is more related to the feeling of calmness and relax [5][6]. According to Flynn, the relaxation is the impression to the environment of lighting, which shows the desired functions to support the

comfort in doing the activities. This comfort can be produced by making the setting configuration of peripheral-dim-non uniform to get the relax impression and overhead-bright-uniform to get the pressing impression. The light color of white-visually cool with the peripheral setting tends to create a relax atmosphere compare to the light color of visually warm with an overhead setting.

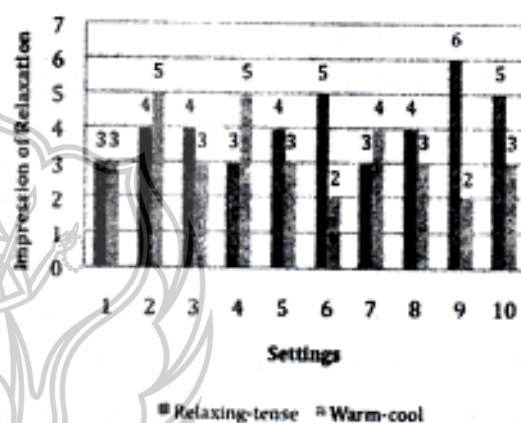


Figure 3. Graphic of Impression of Relaxation

This experiment can be seen by the comfort (relaxing-tense) shows that the difference of the wall colors give the impression of relaxing tense to its users ( $F=0.000$ ). The green color is more giving the impression of cool-relax and at the opposite, the color of orange is more giving the stimulation for its users. While the interaction between the wall color variable with the lighting setting do not give a significant influence ( $F=0.172$ ). It means that the green color if is composed with a peripheral setting or overhead cannot give the more relax impression compare to the orange color which is composed with a peripheral or overhead setting cannot give

the pressing impression to the room compare to the colors of green-peripheral-overhead (Figure 3).

However with this result shows the different impression seen through the atmosphere aspect (warm-cool), this indication can be seen from the interaction between the wall color variable and the significant lighting setting ( $F=0.027$ ). The green colored wall tends to give a cool impression, on the opposite, the orange color is giving the warm impression ( $F=0.000$ ). This is in accordance with Xia, et.al who stated that the using of an overhead lighting setting in general at the offices often create the uncomfortable feeling because of dazzled caused by the direct light to the eyes of its users [7].

The differences of the warm white color and the white color to the relaxation impression cannot be proved because of the effect of color temperature warm white (3000°K) and white (4000°K) cannot give the direct impression to its users but it can give the long-term negative effect and depends on the emotion and the cognitive of its users [8]. This statement is supported by the research conducted by Veitch et.al [9][10], that the light which is produced by the fluorescent full spectrum and cool white cannot give the effect to the performance and the mood of its users.

### 3. Impression of Privacy

The factor of privacy subjective is related to the intimate room spatial while the meeting

room with strongly related to the public space, the privacy factor is sure useless. Flynn indicates that the privacy is the impression to the lighting environment, which shows the spatial necessity that is wanted in human activities. The setting of peripheral-dim-non uniform give the impression of private space and overhead-bright-uniform setting gives the impression of a public space.

This research result shows the interaction between the wall color variable and the lighting setting do not significantly influence the privacy impression than a meeting room ( $F=0.6$ ). This condition can be meant that whether the green colored room or the orange colored room is cannot give the image that those rooms can be a private or public room. Also with the setting of an overhead lighting does not give a public impression and the opposite, a peripheral does not give a private impression.

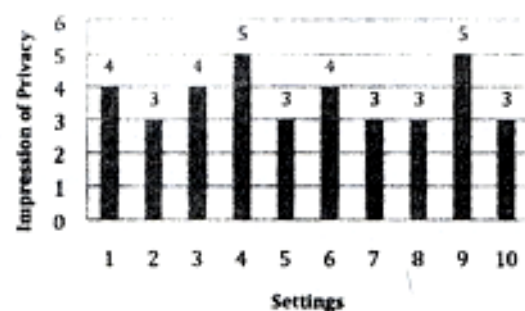


Figure 4. Graphic of Impression of Privacy

The findings from this research show that the configuration of the warm color (orange) and the cool color (green) that composed with the lighting setting peripheral-overhead-fluorescent warm white-white is

more influence to the impression of spaciousness. Whereas the setting of green colored wall-peripheral-overhead fluorescent warm white with a high light intensity tends to give the impression of spaciousness of big/wide compare to the setting compositions of orange-overhead fluorescent white with low light intensity that is more giving the impression of small/narrow. The relaxation impression that tends to be influenced by the wall color, whereas the green color gives the relax impression, while the orange color is in its opposite, more stimulate. However, if the relaxation impression is related to the atmosphere of a

room so the color setting of orange-peripheral is in fact indicate the created atmosphere, which has the impression of visually warmer compare to the green colored-overhead setting. The differences between the light sources of fluorescent white or fluorescent warm white do not give any effects to the relaxation impression. The tested configuration on this experiment does not give an influence to the privacy impression. Thus, it can be said that the public space image or a privacy space image cannot be created only by the configuration of the colors of green-peripheral-overhead or orange-peripheral-overhead.

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