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## **THE EFFECTS OF ROOM COLOR ON STRESS PERCEPTION: RED VERSUS GREEN ENVIRONMENTS**

Teresa M. Kutchma; *Faculty mentor Edison Perdomo, Ph.D.*

### **Abstract**

The purpose of the study was to investigate the effects of red versus green room colors on individual perception of stress. Room color was found through previous studies to have specific effects on psychomotor activity and emotional states. Correlations were found between red room color and emotional and physical stimulation, while green was associated with inhibitory effects. Additionally, Goldstein's theory of color perception showed that red has stimulating effects on human behavior. Subjects consisted of 15 female and 15 male college freshmen at Minnesota State University, Mankato. An experimental booth was used for red, green and white room conditions. Subjects were required to wait inside of the booth for five minutes before completing a copy of the stress inventory from the DASS (Depression, Anxiety, and Stress Scale) under each condition. It was found that subjects in red the red room condition had higher stress rating scores compared to green or white room conditions. Consequently, the findings suggest that environment color plays a significant role in stress perception.

## Introduction

Effects of room color on human behavior has been a curiosity among psychologists, educators and employers. Although the role of environment color has a research history, it is one area that has left theorists at times uncertain, particularly when testing the effects of room color on human behavior. Research based on Goldstein's theory of color perception has found that red has stimulating effects on human behavior (Nakshian, 1964). The purpose of the study at hand was to investigate the effects of red versus green room colors on individual perception of stress. Previous research led to the hypothesis that subjects would have higher rating scores on the Depression, Anxiety and Stress Scale (DASS) when tested in the red room condition compared to green or white (control) room conditions (Clara et al and Roemer, 2001). It was also predicted that while there would be significant effects between red and green and red and control room colors, there would also be significant differences between green and control conditions. This study is important to current literature on color studies in that it generalizes the known effects of mood and physical strength to stress perception in a college population. Although past studies have assessed effects of overall mood there is some evidence that the expansive effects of a bright red room may have effects on human stress perception and physiological responses as well. However, limitations are raised in this study. Mainly, it is questionable as to whether or not red had a genuine effect or if the purpose of the study was simply predicted by subjects who, in response, altered their responses accordingly. The results are since the effects of room color may be under-estimated in some situations. Current research suggests that there is a link between color sensitivity and mood disorders (Barrick, Taylor & Correa, 2002). In any case, determining triggers to life stress is important for all individuals and the environment is often overlooked as a trigger to emotional states of being.

## Literature Review

The effects of color on human behavior have mainly been explored by theorists who focused on task performance (Dwyer & Moore, 2002; Etnier, & Hardy, 1997; Hamid, & Newport 1989; Naksian, 1964; Pellegrini et al, 1981; Safadi et all, 1999; Thompson, & Gerhardt 1985).

Previous research has found that the effects of red, yellow, blue and neutral room color on mood increased test scores of males and females when taking the SAT (Rosenstein, 1985). Goldstein and Rosenthal found that subjects' judgment of time tended to be inaccurate under red environment conditions, and more accurate under the green environment when asked to estimate size, length, weight and cutaneous localization. Blue and yellow were also used along with black and white for control. Greater spontaneous outward movement was found for red and yellow conditions compared to green and blue (Naksian, 1964). Goldstein also found that specific effects of red's expansive effects on motor perception correlated with an aroused or excited mood state (1964). Similar findings about room color have held true for motor activity and emotional states in children. Children studies can be more easily validated (and less confounding) than adult studies since adults have more learned environmental responses than young children. Hamid, 1989, found that the effect of pink room color on gross motor activity of children significantly increased physical strength and positive mood when compared to a blue room (Hamid, 1989). Preschool children were tested for gross motor activity and mood. Findings concluded that warm room color (pink) had positive effects on increasing children's physical efficacy and mood. However, pink room effects on prisoner's room color had averse effects on mood and elicited the outbreak of aggressive actions in a prison search room painted pink (Pellegrini, et al, 1981).

Most research found that the effects of red and green were found to be significant compared to similar but insignificant effects of yellow and blue. There is also question as to whether specific hues have effects on psychomotor activities (Hamid, 1989; Naksian, 1964). Goldstein's theory on the effects of environmental color and physical/emotional states has also been explored through the use of red, green, blue, yellow for experimental effects and black and white for control. Results indicated that red significantly affected subjects' judgment of time and psychomotor perception. Red had an expansive effect on motor judgments, while green had contrasting effects. The effects of yellow and blue were less significant, but comparable to those of red vs. green. Red room conditions were also shown to have an exciting and stimulating effect on emotional states. This is why red was hypothesized by Goldstein to induce over-responsiveness to external pressures (Nakshain, 1964).

Room color has been found through previous studies to have specific effects on psychomotor activity and emotional states (Hamid, & Newport 1989; Naksian, 1964; Thompson, & Gerhardt 1985; Pellegrini et al, 1981). Motor tasks involving mental judgment have been found to show inaccurate performance under red room conditions (Naksian, 1964). Hamilton and Newport, 1989, suggests that the effect of a pink room color on gross motor activity of children significantly increased physical strength and positive mood in children when compared to blue room conditions. Arousal differences between color conditions were found to be significantly different for pink versus blue conditions. Specifically, it was found that the children's paintings were more positive when produced under pink conditions. Physical strength was correlated with mood scores and supported the enhancing effects of pink along with the depressing effects of blue (1989). These findings contradicted those found by Ott, 1958, who suggested that pink and orange caused a loss of physical strength while blue had the least effect.

The color pink was also used in a prison study to test the hypothesis that pink has tranquilizing effects on mood (Pellegrini et al, 1981). However, the research found that pink actually had arousing effects on prisoners in a search-room setting. No differences were found in the incident rate for the pre- and post- pink months although the rate of incidents did drop initially after the room was painted hot pink. Incidents of prisoner outbreaks continued to increase double-fold compared to baseline measures taken with pale blue walls (Pellegrini, et al, 1981).

Despite this wide range of research, there is still a level of uncertainty when determining specific roles of color cues on human behavior. Room color effects were found to be only limited when used to diminish violent behaviors of mentally retarded persons (Thompson and Gerhardt, 1985). Thompson and Gerhardt focused on the effects of a color known as “Baker-Miller” pink. The color was meant to have tranquilizing effects as proposed by Pellegrini et al, 1981. Two hypotheses were tested. The first was that there would be observable changes in clients’ behaviors and less hitting, kicking and spitting would occur. The researchers’ second hypothesis was that the time it took participants to achieve a more calm state would be lessened in the pink room condition (1985). It was found that the rate of hitting decreased slightly in the pink room but spitting and yelling was unchanged. The findings were inconclusive for effective treatment use of room settings. However, other research suggests that red and pink affect physical strength, and mood (Hamid, & Newport, 1989; Nakshian, 1964; Pellegrini et al, 1981).

Current research suggests that a physiological reaction takes place when the brain perceives color. A study at the University of South Alabama measured blood pressure and heart rate of undergraduates during a Wingate motor task in three different colored room settings, red-orange, blue-green and white. Increases in systolic blood pressure were found between room

color and time interactions (Etnier & Hardy, 1997). Hatta and colleagues (2002) found no changes in psychological mood or heart rate between a red and blue room. However, response times were longer for the red environment compared to the blue one in task performance trials consisting of figure transformation.

Although current research has had some success in discovering physiological changes in the presence of color stimuli, there is evidence that color sensitivity is affected in individuals with mood disorders. Barrick and colleagues (2002) found support for changes in color sensitivity and patient -self reports of things appearing gray, cloudy, drab, or lacking color. These reports were significantly correlated with depression, however, there is still little evidence to support an increase in color sensitivity during manic episodes. Reasons for this are uncertain, although it is thought that there are changes in color receptor activity rather than changes in the occipital center of the brain.

## **Methods**

### **Procedure**

Subjects included 30 introductory psychology undergraduate students at Minnesota State University, Mankato. All participants were selected based on volunteers who will receive extra course credit for their involvement in the study. Numbers for males and females were equal with an average age of 18 years. All subjects were assessed for color-blindness prior to their session by asking them to identify the color of the swatches.

Each condition was conducted in a cardboard booth approximately 3ft by 2½ft. The booth colors were changed by hanging red, green or white material over the walls of the booth. A

desk was located inside the booth for the writing convenience of the subject. The booth had three walls and an open ceiling to allow florescent lighting to be used.

Subjects were given an informed consent form to read and sign. Subjects were then asked to sit inside of a booth for five minutes before completing stress questions on the DASS and instructed to summon the experimenter when finished. Only the stress scale of the DASS was completed. These questions related to occurrences of stress over the previous week. Questions included “I found it hard to wind down” and “I tended to over-react to situations.” Each subject completed a total of three of the same DASS questionnaires on stress (one for each condition). Between each condition, the color of the fabric in the booth was changed and the subject waited five minutes for the next condition to begin. Changing the fabric setting was done quickly to reduce any effects that may have occurred. The sequence of conditions varied randomly in order to avoid experimental bias associated with the order of color environment arrangement. Experimental conditions consisted of a red booth and a green booth. The control condition consisted of a white background. Participants were immediately debriefed following their trial run in order to avoid any discomfort that might have resulted in participating in the experimental condition. Results were statistically analyzed using the subjects’ raw scores from the DASS. Group comparisons were made between each of the three conditions.

## **Results**

Out of the three hypotheses tested, only comparisons between the red room and control condition yielded significant results with an ANOVA (\* $p < .05$ ). No significant differences were found between red and green respectively ( $p > .05$ ), or between green and control ( $p = .147 > .05$ ). Mean DASS scores can be observed in Table 1.



Table 1

Mean DASS scores per room condition		
Color	M	SD
Red	11.9	7.5
Green	11.1	7.3
Control	9.5	6.6

Although there were no significant differences found for the main hypothesis, of red versus green environments, a general trend can be observed in the direction of significance. Red was shown to have a significant effect on stress ratings. Therefore, expected differences between red and green conditions are inconclusive and can only suggest that green does not effect individual stress ratings as profoundly as red. As seen in Table 2, significant differences were also found with gender comparisons for red ( $*p=.018 > .05$ ) and green ( $*p=.019 < .05$ ) with no significance in the control condition.

Table 2

Mean Gender DASS Scores per Color Condition				
Color	Males	SD	Females	SD
Red	8.7	5.5	15	8.12
Green	8	6.9	14.1	6.5

Significant scores in gender data suggest that males may not be as sensitive to color stimuli compared to females and rate their perceived stress much lower.

## Discussion

Although room color has consistently been shown to have effects on human behavior, the results of this study are inconclusive to differences between red and green. Possible limitations in this study, including a small sample size may have contributed to this observation. A trend toward significance may indicate that the sample size was simply too small for intermediate differences to be observed. However, it can be concluded that while a red room may have powerful effects on stress perception, green may also have minor effects as well. The limited

effects of green found in this study should be examined further, perhaps with a larger sample size before a conclusion can be made. Another limitation could have resulted from cultural or individual differences for color preference. Analysis of variance would have accounted for most individual differences, however, results would be predicted to vary across cultures. For example, red is a favorable color in Japanese culture (Hatta, 2002). For such cultures, it could be predicted that stress rating scores would be lower and possibly insignificant for red room color.

Many color researchers have combined ergonomics with physiological tests to measure heart rate and blood pressure in human performance tasks. Physiological measurement would further implement evidence for room color effects on stress and rule out the possibility that subjects were simply guessing the outcome of the study. During the debriefing, some subjects reported increased heart rate or feelings of tension in the red condition. While many subjects reported that the booth seemed dreary or closed in the green condition, there were no reports of increased heart rate, only feelings of tension. No verbal reports were given in regards to the booth under white conditions. Subjects also reported that the red condition was very bright compared to the green and white conditions. This would explain feelings of increased heart rate for the red condition compared to predictable feelings of tension under green conditions where subjects were more likely to feel closed-in. Where physiological studies could probable correlate red environments with increases in heart rate, and green environments with reports of tension or measures of blood pressure, social psychology studies could take into consideration locus of control (Singg and Whiddon, 2000). For example, it could be predicted that subjects with a high locus of control would have lower DASS scores in a red room condition than a person with low locus of control. Persons with high locus of control could also be expected to have lower measures of heart rate and blood pressure for red room conditions.

While results indicate that there is an effect of room color on stress perception, there is always a certain amount of skepticism in regards to validity. Many color studies have found complex issues. However, most of these studies had complex experimental designs. Color perception is a sensitive area with much to take into consideration. Perhaps color studies could benefit from keeping the experiments simple and concise to prevent experimental bias that has withheld results in the past.

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