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Color's Effect on Test Anxiety

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Test anxiety can affect test results and skew the instructor's perception of how well the student is learning. Studies have been conducted showing that color can influence a person's mood and behavior. Warm colors, like red, orange and yellow, made the customers leave early, while cool colors, green and blue, led the customer to stay and consider purchase (Bellizzi, Crowley, & Hasty 1983). Little research has been done on applications of color as an anxiety reducer in an academic setting. This study sought to determine whether or not color could affect test anxiety by bringing it to the optimal level of arousal. A highly arousing state was achieved by using red. A low arousal state was achieved by using green. If color has an effect on test anxiety, then those in the red or green color condition would have different scores on the comprehensive test than those in the white condition. Color had a significant effect on test performance for individuals with high test anxiety. Participants with high test anxiety in the green color condition did significantly better than those in the red and white condition.

There has been growing concern regarding practical applications of inducing mood with color (Bellizzi, Crowley, & Hasty 1983; Coryell, 2003; Dijkstra, Pieterse, Pruyn, 2008; Murray & Deabler, 1957; Valdez & Mehrabian, 1994). Although research has studied the effects of color on mood in a clinical and health care environment (Coryell, 2003; Dijkstra, et al., 2008), little research has been done on applications of color as an anxiety reducer in an academic setting. Across all educational levels high test-anxiety can skew the teacher's perception of the student's understanding.

Test anxiety is defined as feelings of dread, helplessness and inadequacy resulting in poor test performance (Holroyd, Westbrook, Michael & Badhorn, 1978). Individuals with test anxiety also attempt to avoid or escape the test situation. Test anxiety causes cognitive, emotional, and somatic responses. Both cognitive and physiological arousal occurs in those with high test-anxiety.

It is thought that this arousal causes a delayed reaction in highly anxious individuals (Rockett, 1956). Arousal is induced by feelings of anxiety or vice versa.

Studies show that color can induce a wide spectrum of moods (Murray & Deabler, 1957; Wells 1910). These studies suggest that some colors produce the same affective responses across groups. Such as the color red attracts attention and induces arousal (Bellizzi et al. 1983). Green, on the other hand, has a soothing effect and comforts. Murray & Deabler's (1957) study also shows that some colors are also uniformly preferred and disliked, despite the mood they induced. Dijkstra, Pieterse, Pruyn (2008) found that green induced feelings of comfort, tenderness, calmness and serenity. While red induced excitement, distress and upset. Murray & Deabler's also suggest that our responses to color are learned rather than a response people are born with (1957). Factors such as socioeconomic status and region of birth can





change one's perception of the color. However, this same study, found red produced a feeling of stimulation and excitement across groups. Even though the groups had different socioeconomic status, gender, and region of birth. Green and blue had similar results across groups in inducing feelings of comfort and had a soothing effect. This study found that colors produce similar moods regardless of individual differences and individual liking of the color. Other studies have also discussed how individual differences change people's perceptions of color.

In clinical application, color was used to promote recovery and health (Coryell, 2003; Dijkstra et al., 2008). Coryell found that color has practical applications in a therapy room. Color was matched to a mood and used to induce the desired mood. Research shows that participants with a high stimulus screening ability, the ability to screen out less important stimuli and consequently be less aroused by stimuli, were no more stressed by the green room than the orange room (Dijkstra et al., 2008). Low screeners, participants who are easily aroused by stimuli, were more stressed in the white room than the orange room. Stimulus-screening ability is an individual difference that may change how mood is influenced by color. By finding a uniform effect on the groups with difference stimulus-screening ability, it provides evidence that some consistent colors effects can interact with individual differences, such as stimulus screening ability.

Current studies have focused on the practical applications of color as a mood inducer (Bellizzi et al. 1983; Dijkstra et al., 2008). Bellizzi et al. found that color can physically attract shoppers to a display (1983). Their study suggests that color can automatically produce certain emotional responses and obtain attention. Warm colors such as red and orange were viewed as negative, tense, and bright. Cool colors like

blue and green were rated positively, relaxed and well liked. The warm colors made the customers leave early, while cool colors led the customer to stay and consider purchase. These effects are thought to happen because they stimulate they motivate people to act in a certain way.

Motivation is driven by the basic need for arousal (Levine, 1966). Organisms strive to maintain an optimal level of arousal. The optimal arousal theory states that there is one point along a bell curve that satisfies the optimal arousal (Walters, Apter J. & Svebak, 1982). At one end of the curve is boredom, low arousal, and at the other is anxiety, high arousal. Those with an optimal level of arousal are going to perform well on tasks because they will be neither bored nor anxious.

When that optimal level is passed and the person is too aroused it results in anxiety. When it occurs in an academic or testing setting, it is called test anxiety (Rockett, 1956). Since test anxiety is dependant on the situation, it is considered a type of state anxiety. State anxiety occurs when displeasure and arousal are high (Valdez and Mehrabian, 1994). Their study found that higher state-anxiety scores were associated with red and yellow. This is consistent with other studies that found warm colors, like red and yellow, are more arousing and blue and green (Dijkstra et al. 2008; Jacob and Suess, 1975). Warm colors are also rated less pleasant than blue and green (Valdez and Mehrabian, 1994; Bellizzi et al., 1983). According to these studies, warm colors are more likely than cool colors to produce anxiety because they are less pleasant and more arousing.

The level of arousal may be impacted by color (Jacob and Suess, 1975; Valdez and Mehrabian, 1994; Jacob and Suess's (1975) study, cited by Dijkstra et al. (2008), found warm colors produce higher feelings of arousal. Dijkstra et al. (2008) supported this



finding. Participants who were high screeners were no more aroused when the hospital room was orange than when it was white. They speculated that this occurred because they were able to screen out unimportant stimuli. Conversely, low stimulus screeners were more aroused by the orange room than the white room.

Based on these studies (Walters, Apter J. & Svebak, 1982; Valdez and Mehrabian, 1994; Dijkstra et al. 2008) A highly arousing state can be achieved by using red (Dijkstra et al. 2008; Jacob and Suess, 1975). A non-arousal state can be achieved by using green (Dijkstra et al. 2008; Jacob and Suess, 1975; Bellizzi et al., 1983). I expect test anxiety and color to have a crossover interaction. Those with low test anxiety in an environment that is not arousing, green, are going to perform poorly because they will be at the low end of the arousal curve. The same is true for those high test anxiety and in highly stimulating environment color, red, only they will perform poorly due to being too anxious. People with high test anxiety in a non-arousing environment, green, should reach the optimal level because the two variables will even each other out. The green will create a calming effect, lowering arousal and anxiety. The reverse, low test anxiety and in a highly arousing state, red, will produce the effect of raising arousal to the optimal level.

Method

Participants

A total of 58 participants were in the study. There were six groups with eight to ten participants in each group. Participants were students taking psychology courses at Minnesota State University Moorhead. Since the participants signed up for a time slot, it will be a sample of convenience. The sign-up sheet specified that students with color

blindness or know English as a second language could not apply. They signed up on the psychology research board across from the psychology department. The study was labeled "Reading Comprehension and College" informally. They received extra credit in a psychology class for participating, if allowed by the professor.

Materials

A Westside Test Anxiety Scale was used (see Appendix A). It consists of ten items that assessed test anxiety on a Likert Scale. Scores range from one to five. A higher score indicates higher test anxiety. It took participants around three minutes to finish.

An article titled "The Enigma of the Echidna" by Doug Stewart (see Appendix B) was read by participants. Eight multiple choice comprehension questions based on the article (see Appendix C) was given after they read. The article took about ten minutes to read. The article and the questions are at a tenth grade reading level. The test and questions was printed on red, green, or white paper, depending on the color condition they were randomly assigned to. The test took about ten minutes to compete.

A tablecloth in white, red or green was used to match the color condition.

Procedure

When the participant entered the room, the experimenter already had a table cloth over the table. Participants were given a consent form explaining the experiment. After they signed the form, they were given the Westside Test Anxiety Scale. Upon completing the scale, they read the article. The color was determined by random assignment. The experimenter then explained that the test they were about to take accesses not only their reading ability, but also their ability to do well



in college. They were given the article to read. After they read the article, they were given eight test questions. The article and the question were the same color as the tablecloth. For example, if the article and questions were red, the table cloth will also be red. Once they finish the test, it was be collected. In order to successfully remove deception, participants were then debriefed and informed that the test does not assess likelihood to succeed. A form further explaining the experiment and people to contact if they have any questions was given. They then received a blue card and thanked for their participation. The last 13 participants were assigned color conditions after they were screen for text anxiety to equal the groups out.

Results

Participants in the white condition served as a control. Those in the white group with low anxiety ($M= 4.36$, $S.D= 1.5$) and those in the high anxiety group ($M= 3.00$, $S.D= 1.7$) were compared to those in the other groups. The scores for those with low anxiety in the red group ($M= 4.33$, $S.D= 1.8$) and the high anxiety group ($M= 4.25$, $S.D= 1.0$) were different than the white group. The green group was different than the white group with low anxiety at $M= 5.3$, $S.D= 1.3$ and high anxiety at $M= 5.5$, $S.D= 1.6$. An ANOVA was used to analyze what these results mean.

A two-way ANOVA was calculated with test scores as the dependent variable to assess color and test anxiety on test performance. Test anxiety (high or low) and color condition (white, red, or green) were between-subjects variables. There was no significant interaction between the level of test anxiety and color condition, $F(2, 52) = 1.44$, $P = .246$. Simple main effects analysis showed that color had a significantly impact on number correct ($P = .004$) but anxiety had no significant effect ($P = .336$). There was a

significant effect on color in the high anxiety group, $F(2, 25) = 6.132$, $p = .008$, $\eta^2 = .358$. Color does have a significant effect on test performance for those with high test anxiety.

Discussion

According to past studies, the level of arousal may be impacted by color (Jacob and Suess. 1975; Valdez and Mehrabian. 1994; Jacob and Suess's (1975) study, cited by Dijkstra et al. (2008), found warm colors produce higher feelings of arousal. Dijkstra et al. (2008) supported this finding. Participants who were high screeners were no more aroused when the hospital room was orange than when it was white. They speculated that this occurred because they were able to screen out unimportant stimuli. Conversely, low stimulus screeners were more aroused by the orange room than the white room. Although research has studied the effects of color on mood in a clinical and health care environment (Coryell, 2003; Dijkstra, et al., 2008), little research has been done on applications of color as an anxiety reducer in an academic setting. Across all educational levels high test-anxiety can skew the teacher's perception of the student's understanding. This study sought to discover color's effect on test anxiety and, consequently, test performance.

According to this study, color does have a significant effect on test performance for those with high test anxiety. Color does have an effect on high anxiety, but not low anxiety. Scores were significantly higher for those with high anxiety in the green group than the red and white groups. This study found similar results to other studies. Those in the green group with high anxiety did do better than those in the white or red group. Therefore, green produced effects that lower the participant's arousal level. However, test



anxiety did not have an effect on test performance. There was no significant effect between high and low test anxiety groups. Also conflicting with past research, red did not significantly affect those with low test anxiety. Red did not produce an arousing effect in those with low test anxiety.

Conflicting findings could be explained by the studies limitations. The sample sizes in the groups were small. (8-10 participants per a group instead of 30 per a group.) Since the groups weren't large enough, the rule of large numbers wasn't in effect. The participants were only college level psychology students, thus it is not a representative sample. Also, the test was only eight questions long. Most test students' take will be more than eight questions long in an academic setting. Many in the red condition expressed a dislike for the red. A few voiced that the black print on red paper on a red tablecloth was hard on the eyes. Perhaps the intensity of the red attributed to the conflicting results. However, the study did find similar results to past studies across color conditions. The law of large numbers does apply to those groups since each color group had about twenty participants. Also the color conditions were identical, except in color. Therefore, the difference in scores was due to color.

The academic applications for this study are great. This study provided data that suggests color can be used in classrooms to affect test scores for those with test anxiety. More importantly, this data suggest using green paper for students with high anxiety could improve scores. The test would then be valid gauging the student's knowledge on the subject without anxiety confounding the results. However, data does not suggest any changes for those with low test anxiety, due to no significant differences. Also, it is unknown if the paper without the table cloth underneath would be a strong enough environmental

factor and produce the same results as this study.

The results of this study suggest future research look at the relationship among test anxiety, color's intensity as an environmental factor and test performance. Further research could change just the color of the paper, without a tablecloth. This would increase understanding on the topic of academic performance, anxiety, and color. Most research has been done with color on a large scale. Rooms were painted the color or the store was completely one color. No research has been done to examine changing the center focus of the study, i.e. changing just the paper's color or the item on sale's color. By just changing the anxiety scale, article, and test to the color condition, one would discover the impact of color in a more applicable fashion. This research should aim to determine whether changing color on a small scale would produce the same results as changing color on a larger scale. Further research could also seek to determine how strong color as an environmental factor would need to be to produce an effect.

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Table 1
Table of Means and Standard Deviation among color conditions and test anxiety

	Low	High
White	M= 4.36 S.D= 1.5	M= 3.00 S.D= 1.7
Red	M= 4.33 S.D= 1.8	M= 4.25 S.D= 1.0
Green	M= 5.3 S.D= 1.3	M= 5.5 S.D=1.6

Figure 1

Figure of number correct on test across color conditions.

