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Color me, please: How color-emotion pairs affect our perceptions

Russell T. Rogers
Georgia Southern University

Color Me, Please: How Color-Emotion Stimulus Pairs Affect Our Perceptions

An Honors Thesis submitted in partial fulfillment of the requirements for Honors in the Department of Psychology.

By
Tyler Rogers

Under the mentorship of Dr. Shauna Joye

ABSTRACT

Color-emotion pairings are part of everyday experience, and they develop in early childhood. Emotional experiences are typically much stronger when emotional stimuli (e.g., pictures or videos) are paired with sensory stimuli (e.g., sights or sounds). Since the presence of these sensory stimuli seems to heighten the emotional experience of emotion-evoking visual stimuli, it should be the case that such pairings will allow the manipulation of color-emotion pairings through the presence of a color (a visual stimulus) during an emotional situation (such as watching a video). In this study ($N = 44$), we paired both a positive and negative video with the color green. We also measured participants' suggestibility, which served as a covariate. Although results were not significant, our findings suggest that this is a valid line of research. Limitations and suggestions for future research are discussed.

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Dr. Shauna Joye

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Color Me, Please: How Color-Emotion Stimulus Pairs Affect Our Perceptions

At the heart of everyday life is the reality of emotional experiences. Emotional experiences affect memories, actions, and behavior. According to Chen and Dalton (2005), the emotional tone of certain sensory stimuli can affect a person's sensory perception. Further, the intensity of the reaction that individuals feel toward emotional and sensory stimuli is greater when the stimuli are passively, rather than actively, received (Guest et al., 2010). This suggests that the greatest amount of emotional reaction occurs implicitly rather than by the conscious decision of the individual.

Baumgartner, Esslen, and Jäncke (2005) found that emotional experiences rely on the presence of combined stimuli with different modes of reception. For example, emotional experiences are greater when certain stimuli (e.g., pictures of certain objects, videos) are paired with sensory stimuli (e.g., smells, tastes, sights). Sieb (2013) cites previous research stating that emotional responses have a subjective component to them, which varies across individuals. Since emotional reactions have been shown to rely on the combination of sensory perception and subjective experience, it should be possible to intentionally manipulate them. For example, Hemphill (1996) compared the emotional associations of colors that occur in men and women to those that appear in adolescent boys and girls. These associations tended to be more complex in older adults than in younger children, possibly as a result of experience (Hemphill, 1996). For example, Hemphill noticed that both children and adults tended to have positive emotional reactions to all colors, but adults did so to a lesser extent, such that women react more positively toward bright colors and men react more positively toward dark colors. Hemphill also noted that adults gave more sophisticated answers for why they preferred

certain colors (e.g., “I like red because it is a warm color”) than children. For this reason, it was expected that the emotional reactions of the participants to the colors would be moderately strong in the current study, considering that all were adults.

The idea that more social experience results in increasing complexity of color-emotion associations in individuals is not a new idea. For example, Boyatzis and Varghese (1994) found that children begin to develop color-emotion schemas in early childhood. One such schema described by these authors involved children’s early usage of color to express certain emotions, such as red being used to express anger. The authors also noted that “[w]ith increasing age, it is likely that children’s color-emotion schemes become more differentiated and complex” (Boyatzis & Varghese, 1994, p. 84); they give two reasons why this might be: increased social experience and more advanced cognitive development. Furthermore, evidence suggests that an individual’s emotional associations with a color are a result of that individual’s experience with that color, rather than any universal principle (Boyatzis & Varghese, 1994).

Suggestibility may play a role in how well or quickly stimuli are paired. Kotov, Bellman, and Watson (2004) define suggestibility as a personality trait manifested as a tendency to accept messages without a particularly strong pressure to do so. What this implies is that individuals with a stronger propensity for accepting messages may indeed accept color-emotion stimulus pairings more readily than those with a more moderate or mild propensity for accepting messages. Interestingly enough, Nitzan et al. (2015) found that, after being instructed that treatment would take 2-4 weeks to take effect (and without being informed of the onset of side effects), more suggestible patients showed

significantly less improvement in depression symptoms, coupled with more side effects, after being given an antidepressant for two weeks.

The present study intends to manipulate the emotional reactions of individuals by adding to the method of Hemphill (1996), who simply recorded emotional reactions to colors by presenting color cards randomly to participants and asking them to rate their emotional responses to them. By pairing two seemingly unrelated stimuli (a color with a video meant to evoke a certain emotion), the current study aims to investigate whether the presence of emotion (as evoked by the video) can result in manipulation of how individuals feel toward a sensory perception (i.e., a specific color) before and after the video treatment. It is hypothesized that the emotional reaction stimulated by the video would indeed change how individuals felt about the paired color in a manner respective to the emotion evoked. That is, for individuals who were exposed to the color along with a positive emotional experience, the change in emotional reaction to the color was expected to be positive. For those who were exposed to the color along with a negative emotional experience, the change was expected to be negative. It is also expected that individuals who scored higher on a measure of suggestibility would show larger individual effects than less suggestible individuals. Chen and Dalton (2005) indicated that emotion induction (making one feel a desired emotion) is equally successful in men and women; therefore, no gender differences were expected.

Chen and Dalton (2005) noted that participants with high neuroticism and anxiety were selectively biased to affective rather than neutral stimuli and that such participants exhibited behavioral excitation to intensely emotional stimuli. Rogers and Revelle (1998)

also recorded this effect. It is therefore possible that personality traits will play a measurable role in the outcome of the study.

The importance of the current research is twofold. First, the current research gives insight into the nature of the development of stimulus pairing as it relates to emotionality. This has implications regarding the development of phobic behavior, as physical-emotional stimulus pairs often play a large role in such behavior. Second, the current research develops a method by which color-emotion pairs can be investigated in regards to individual suggestibility. Therefore, not only can the process of the development of phobic disorders be further studied using this method, but also the way in which the personality trait of suggestibility plays a role phobic development, if it plays a roll at all.

Method

Participants

All participants ($N = 44$) were undergraduate students at Georgia Southern University, recruited using the SONA research program. Most of the participants completed the study to receive course credit in PSYC 1101 or another psychology course. Fourteen men (31.8%) and 30 women (68.2%) participated in the study, with gender distributions equivalent across conditions. Participants ranged in age from 18 to 46 years old ($M = 20.46$, $SD = 4.59$). No participant data was eliminated based on the age of the participant because of the idea that adults have considerably complex emotional reactions to colors and sufficient cognitive development should be present in all of the participants in the study. The majority of the participants were Caucasian ($n = 27$, 61.4%), a large minority were African-American ($n = 15$, 34.1%), and the remainder were of mixed or other ethnic background ($n = 2$, 4.5%). First-year students were the largest class

represented (*n* = 21, 47.7%), followed by sophomores (*n* = 7, 15.9%) and juniors (*n* = 7, 15.9%). Seniors were represented the least in the study (*n* = 3, 6.8%), and class data were missing for some participants (*n* = 6, 13.6%). Of the 33 participants who provided their GPA, the average was 3.20 (*SD* = .62).

Materials

Color Rating Scale (Appendix A). Participants rated their reaction to 10 different colors (blue, green, red, white, pink, gray, yellow, black, brown, and purple) by marking an X on a four-inch line scale varying from "Aversive" on the left to "Attractive" on the right. Data were recorded as millimeters from the left of the line, with higher numbers indicating more attractiveness of the color. Colors were presented in different random orders on the document for both the pre-test and the post-test as well as across participants. This task was created specifically for the current study.

Multidimensional Iowa Suggestibility Scale (MISS, Appendix B). The MISS (Kotov, Bellman, & Watson, 2004) consists of 95 items designed to test general suggestibility on a scale of 1-5. Items are rated based on how accurately the participant believes the item describes him or her, with a rating of "1" being the least accurate and "5" the most accurate. In the current study, we used the 21-item version of the MISS (the Short Suggestibility Scale), which shows high test-retest reliability (*r* = .76), internal consistency (*r*s = .86 - .89), and a strong correlation (*r* = .93) with the 95-item version of the MISS (Kotov, Bellman, & Watson, 2004).

Videos. Participants in the Attractive condition watched a 5-minute video of funny game-show answers, and participants in the Aversive condition watched a 5-minute video of live broadcasts of the events of September 11, 2001. Each video was

posted on a green slide with an equal amount of the green slide showing at the top and bottom of both videos. See Appendix C for screenshots representative of these videos.

Demographics Form (Appendix D). The demographics form included age, ethnicity, gender, class, and GPA of each participant.

Manipulation Check (Appendix E). Participants completed a short manipulation check during which they were asked to describe the purpose of the study, guess the color of the slide on which the video was posted, rate how the distressing the video was on a scale of 1-10, and name their favorite color(s).

Procedure

Participants were randomly assigned to two groups (Attractive and Aversive conditions) and tested individually. Upon entering the lab area, participants were asked to sit at a table. After being read the Informed Consent document, each participant was given the opportunity to agree or disagree to the terms of the study.

Immediately after agreeing to the terms of the study, participants were given the Color Rating Scale and asked to rate their emotional reaction to each of the ten colors. Next, participants sat in front of a television screen, and the lights were turned off in the lab. Participants then watched the video for his or her treatment group. After the video ended, the screen was turned off, the lights were turned back on, and participants were asked to return to their original seat at the table and complete the following: post-test Color Rating Scale, MISS, manipulation check, and demographics form. At the end of the experiment, all participants were debriefed and given the opportunity to ask questions.

Results

Preliminary Analyses

A second two-tailed, independent samples *t*-test was performed to ensure that the treatment videos elicited the target emotion. There was a significant difference in video rating between the Attractive and Aversive conditions; $t(42) = -6.62$, $p < .005$. The difference was such that those in the Attractive condition found their video to be much less aversive on a 1-10 scale ($M = 2.13$, $SD = 1.57$) than did those in the Aversive condition ($M = 6.20$, $SD = 2.48$).

A two-tailed, independent samples *t*-test was performed to analyze differences in total MISS score by condition. MISS scores did not differ across condition, $t(42) = 1.42$, $p = .164$. Individuals in the Attractive condition ($M = 55.46$, $SD = 12.80$) scored similarly to those in the Aversive condition ($M = 50.30$, $SD = 11.00$). Using a 2 x 2 (condition by accuracy) χ^2, we found that those who correctly guessed the purpose of the study did not differ across conditions, $\chi^2(1, N = 44) = 2.60$, $p = .107$. In the Attractive condition, 54.2% guessed correctly and 45.8% did not. In the Aversive condition, 30.0% guessed correctly and 70.0% did not.

Primary Analysis

Data were analyzed using a one-way MANCOVA (Multivariate Analysis of Covariance) with treatment condition as the independent variable, difference scores for each of the 10 colors as dependent variables, and MISS score as a covariate. Because there were 10 dependent variables, significance level was corrected using the Benjamini-Hochberg false discovery rate correction in which α level is reduced by .05 for each *p* score, beginning with the dependent variable of greatest significance (i.e., the lowest *p*

value). Means, standard deviations, test statistics, Benjamini-Hochberg correction, and achieved power can be found in Table 1. The data for mean difference in color across pre- and post-test are arranged in Table 1 by calculated significance in ascending order. None of the ten colors showed significant differences across conditions.

Discussion

Although the results for the target color green were not significant, mean differences across group were consistent with the hypothesis, with those in the Attractive condition showing less of a shift in their ratings of green (M = -.02) than those in the Aversive condition (M = -.10). That is, although both groups' ratings of green decreased, they decreased more for the Aversive condition. However, ratings across 5 of the 10 colors (red, black, brown, blue, and gray) decreased for the Aversive condition while increasing for the Attractive condition, indicating that something in the Aversive condition was manipulating the mood of participants in a negative manner. One possibility is that, given the particularly emotional content of the Aversive video, those whose mood were most manipulated rate higher in traits such as anxiety and neuroticism (Chen & Dalton, 2005).

Perhaps the biggest drawback to this study was the potential for Type II error due to the study's lack of achieved power. An effect caused by the manipulation may actually have existed in the current study, but lack of power may have resulted in the failure to find it. Increasing the sample size substantially would address this issue. With a larger sample size and thus more power, differences in the predicted direction may prove to be significant in future studies.

Another potential drawback to this study is the coloration of the videos themselves. Although the videos were posted on a green slide (of which only small portions of the top and bottom were visible), they still had black backgrounds native to the videos. Also, due to the nature of the video content, many colors were present throughout the 5-minute duration of each video. For example, blue was especially prominent in the Attractive video, and both blue and gray were prominent in the Aversive video. Simple sensory overload could have prevented any particular color from developing any significant effect. There are several potential solutions to this problem. One way to eliminate this issue would be to make the videos gray-scale. Another potential solution is to flash the color very briefly and quickly throughout the duration of the video. This latter idea is based on the findings of Gabrielcik and Fazio (1984), who found that subliminal priming of letters caused participants to overestimate the occurrence of those letters in everyday language. It is also based on the conclusion drawn by Guest et al. (2010) that stimulus-emotion pairings are stronger when received passively as opposed to actively. The fast on and off nature of a flashing color may elicit a larger response given that the flashing would occur beyond the immediate attention of the participants. Finally, the effects of different colors could be examined by tinting the treatment videos respective to each of the ten colors. In this way, the strength of the effect as it exists relative to each color can be further investigated.

Since the color-rating scale was given to participants twice, it is also possible that they were consciously attempting to replicate their previous scores. It is for this reason that I suggest using deception when giving the post-test. For example, the researcher may ask the participant to re-complete the scale by pretending to have misplaced the original

test. This may help reduce the tendency for the participants to try and replicate their original results.

The strength of established color-emotion pairings is another potential problem. According to Field (2006), pairings between conditional and unconditional stimuli occur extremely quickly and are difficult to break. Field (2006) uses this explanation to elaborate upon the difficulty that often occurs in treating phobic disorders, but it is also relevant in the current study. Since certain emotions (unconditional stimuli) are paired with certain colors (conditional stimuli) in early childhood (Boyatzis & Varghese, 1994), it can be inferred that these pairings may simply be difficult to break, just as they are in phobic disorders. If a person has a strong emotional tie to any particular color, it may simply take more than a 5-minute treatment to break that emotional tie. Similarly, Terwogt and Hoeksma (1995) showed that color preference plays the largest identifiable role in color-emotion association. Therefore, any person with particularly strong preference for any specific color may just simply like the color too much to allow environmental factors of such short duration to interfere with that preference. Lengthening the videos and increasing their emotional content may help diminish these complications.

Conclusion and Future Research

Despite the lack of power in the current study, this study does serve as a pilot study for further research because participant reactions to color were manipulated in the predicted direction even if the results were not significant. Future research should focus on producing stronger emotional reactions to colors such that differences can be seen across groups using the strategies noted above.

Some potential changes to the method are also advisable. These include: the use of black-and-white, as opposed to colored, videos; the presence of the target color being less obvious (and perhaps flashed very quickly and briefly throughout the video); and longer, more emotionally driven videos. Other changes that should be applied to the method include measuring the present emotional state of participants and tests for personality. This is consistent with the findings of Chen and Dalton (2005), who noted that people who are higher in certain personality traits are more emotionally excited by extremely emotional stimuli. For these reasons, personality tests and affect measures should be administered prior to treatment in future studies.

Future researchers should build upon the work in the current study to design more robust methods of testing the potential for manipulating individuals' emotional reactions to colors and other sensory stimuli. Again, research in this area is potentially important, as findings may be used to bolster our understanding of everyday interactions with physical stimuli and emotions. It may also, as previously noted, be important in understanding the mechanics involved in the development of phobic behavior.

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Table 1

Descriptive and Inferential Statistics for Pre-Post Color Differences by Condition

	Condition								
	Attractive (n = 24)		Aversive (n = 20)						
Color	M[a]	SD	M	SD	F	p	B-H α level	B-H Sig	Obtained Power
Brown	.22	.73	-.24	.53	4.35	.044	.005	No	.53
Blue	.03	.26	-.14	.43	2.14	.153	.010	No	.30
Gray	.04	.48	-.21	.63	2.04	.163	.015	No	.28
Yellow	-.05	.62	.06	.30	1.34	.255	.020	No	.20
Purple	-.18	.54	-.01	.15	1.18	.284	.025	No	.19
Red	.18	.66	-.05	.40	.85	.362	.030	No	.15
Black	.04	.64	-.09	.39	.34	.566	.035	No	.09
Pink	-.14	.38	-.18	.56	.07	.797	.040	No	.06
Green	-.02	.87	-.10	.72	.02	.900	.045	No	.05
White	-.11	.50	-.11	.41	.01	.932	.050	No	.05

[a] All means are uncorrected.

Note. B-H = Benjamini-Hochberg. The Benjamini-Hochberg false discovery rate correction was used to control for Type II error. Noted in the table are the required B-H p-value (alpha level) and a column to indicate whether the F test was considered significant after applying the B-H correction.

Appendix A

For each item, write the color being presented to you and place an "X," according to your reaction to that color, on the scale corresponding to that color.

1.  Aversive ——— Attractive
2.  Aversive ——— Attractive
3.  Aversive ——— Attractive
4.  Aversive ——— Attractive
5.  Aversive ——— Attractive
6.  Aversive ——— Attractive
7.  Aversive ——— Attractive
8.  Aversive ——— Attractive
9.  Aversive ——— Attractive
10.  Aversive ——— Attractive

Appendix B

MISS Short Suggestibility Scale

1	2	3	4	5
not at all or very slightly	a little	somewhat	quite a bit	a lot

____ I am easily influenced by other people's opinions

____ I can be influenced by a good commercial

____ When someone coughs or sneezes, I usually feel the urge to do the same

____ Imagining a refreshing drink can make me thirsty

____ A good salesperson can really make me want their product

____ I get a lot of good practical advice from magazines or TV

____ If a product is nicely displayed, I usually want to buy it

____ When I see someone shiver, I often feel a chill myself

____ I get my style from certain celebrities

____ When people tell me how they feel, I often notice that I feel the same way

____ When making a decision, I often follow other people's advice

____ Reading descriptions of tasty dishes can make my mouth water

____ I get many good ideas from others

____ I frequently change my opinion after talking with others

____ After I see a commercial for lotion, sometimes my skin feels dry

____ I discovered many of my favorite things through my friends

____ I follow current fashion trends

____ Thinking about something scary can make my heart pound

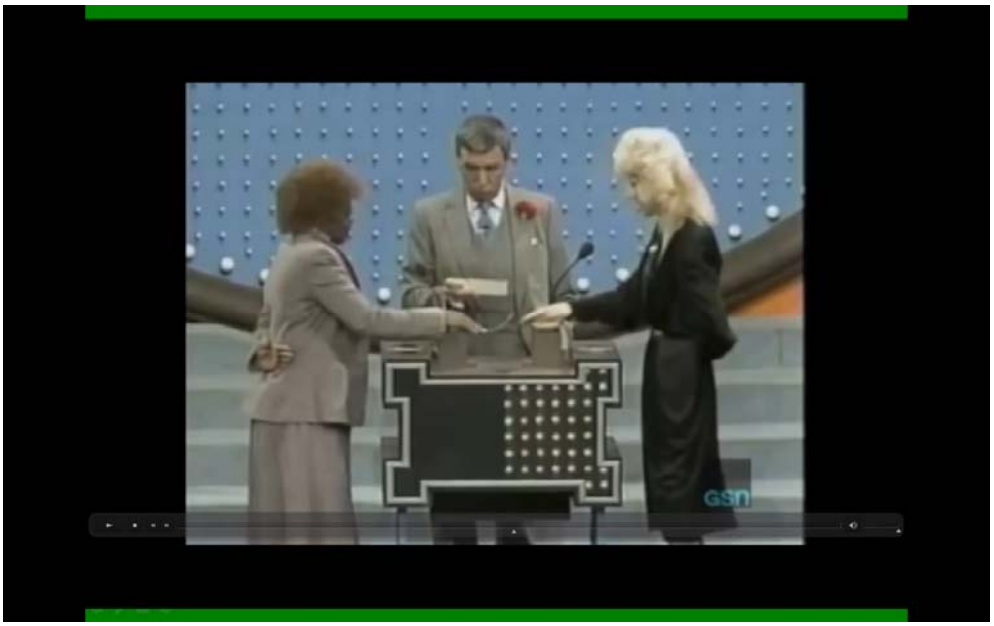
____ I have picked-up many habits from my friends

____ If I am told I don't look well, I start feeling ill

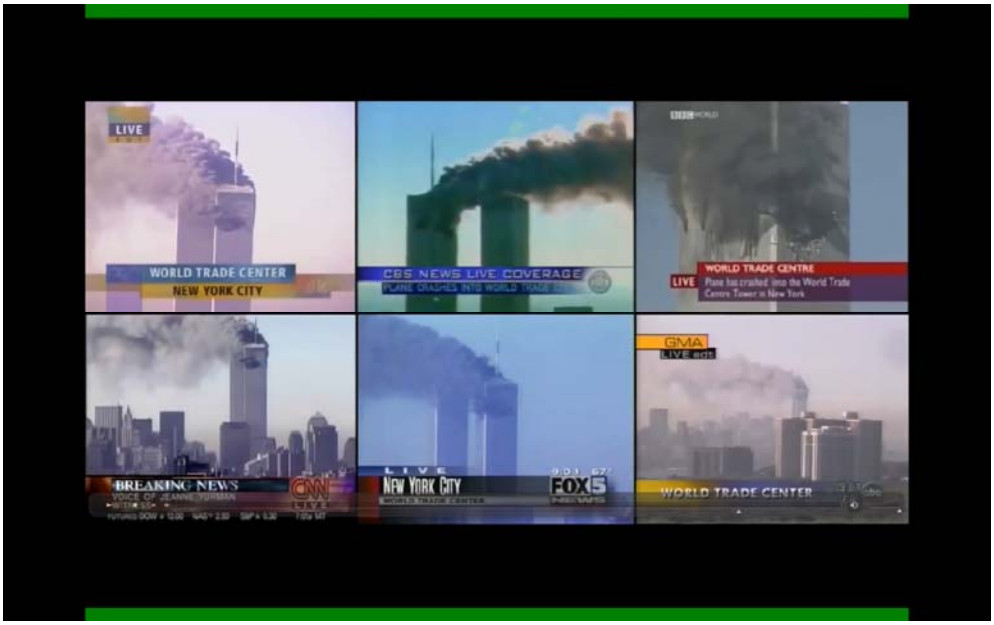
____ It is important for me to fit in

Appendix C

Screenshot of Attractive Condition Video



Screenshot of Aversive Condition Video



Appendix D

Age: _____

Gender *(circle one):* male female other

Ethnicity or Ethnicities:

_____

Year in College *(circle one):* 1st year sophomore junior senior graduate student

Current GPA: _____

Appendix E

Post-Trial Survey

1. In a few short words, describe what you think this study is about:

   _____

   _____

   _____

   _____

2. On a scale of 1-10, with 10 being the most distressing, how distressing was the video that you watched?

   1 2 3 4 5 6 7 8 9 10

3. What is your favorite color? _____

4. What color was the **background** of the video? _____