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Relationship of Color to Fear Reactions

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Abstract

Color is often used in everyday life to designate danger or caution. Warning signs, alarms, and hazard labels all use colors of red, yellow, or orange to indicate danger. This study was designed to determine if the so-called danger colors have an unconscious influence on people's fear emotions. Using a within-subjects design, the experiment participant is presented with a series of questions about how much fear they would experience in certain situations. Each block of questions has a screen background color from one of three groups: danger colors (red, orange, yellow), harmless colors (blue, green, purple), and the control group (white). My hypothesis is that danger colors will cause higher fear responses and harmless colors will cause lower fear responses than the control color of white.

Relationship of Color to Fear Reactions

Color is used in everyday life to indicate hazards or danger. Danger colors (red, orange, yellow) are associated with warning and danger signs or symbols. Through regular association of danger colors with warning signs and apparatus, humans may develop a cognitive connection between the danger colors and fear emotions. The danger colors may cause a greater fear response than harmless colors (blue, green, purple) or plain white.

Current cognitive psychology research has shown a relationship between color and unconscious processing of the color. Sinclair, Soldat, and Mark (2002) found that external color cues affected processing strategy and performance on exams. Students were given an exam printed on either red or blue paper. Those with blue paper performed better than those with red.

If color could have this effect on test performance, it could likely have an effect on fear emotions also. In this experiment, I test my hypothesis that danger colors cause a higher fear response than harmless and white colors.

Method

Participants

For some basic sample data, two of my sisters completed the experiment. In an actual run of the experiment, a large number of participants would need to be used in order to eliminate individual differences in fear levels and phobias. The participants would be randomly selected from a diverse sample.

Hupka, Zaleski, Otto, et al. (1997), studied the emotional connotation of various colors across several different countries. They found that the emotional content of colors varied by

culture. Therefore, in my experiment it is important to select participants from the same cultural background, or to control for the cultural factor.

Apparatus

The equipment used is a computer and the E-Prime program. The monitor needs to be able to correctly display a range of colors (an analog projector may distort colors). Input from the user is gathered via the keyboard, using mainly the number keys from 1 through 7 (the number keys above the letters, not the keys on the number pad).

Procedure

I designed experiments for both a between-subjects design and a within-subjects design. I chose to run the within-subjects design because it would allow me to collect more data with a small number of participants.

In the between-subjects design, each subject would be assigned into one of the three groups based on his/her subject number. They would then respond to 15 questions, which would each have a color from the color group that they were assigned to (danger, harmless, or control).

In the within-subjects design (the one I tested with), each subject goes through all three color conditions, with 5 questions in each condition block (ex, 5 questions in harmless condition, then 5 in danger, and then 5 in control) for a total of 15 questions. The order that the conditions are presented is randomly selected to control for order effects. The questions that are selected for each group are also randomly ordered.

For each question (an example question is: How fearful would you be if you spilled acid on your hand?), the participant is asked to respond with a level of fear from 1 to 7 where 1 is the lowest and 7 is the highest.

Data is logged on the keyed response to each question and the color condition that the response was in.

The questions are grouped into blocks (ie, each color condition is presented independently and not intermingled) so that any carryover or mood effect is preserved. Seeing a sequence of danger colors in a row may help to create the fearful mood that we're testing for (and likewise with the harmless and control groups).

Randomization of the questions is important because it insures that each condition is equally likely to get any of the questions, and therefore, by the law of large numbers, each condition will have roughly equivalent questions in terms of the level of fear they induce.

Results

There are two possible outcomes of the experiment: if my hypothesis holds true, then the danger color condition has a higher mean fear level than the harmless and control conditions (and the harmless condition would be expected to have a lower average than the control condition) (see Figure 1). If my hypothesis is contradicted, then the danger color condition would have the lowest fear level while the harmless condition would have the highest (see Figure 2). Another possible scenario is for the three conditions to have no statistically significant difference, indicating no effect.

In the two test trials I ran, the mean response for the danger group was 5.7, which was slightly higher than the 5.5 mean for the control group. It was significantly higher than the 3.7 for the harmless group (see Figure 3).

Using simulated data for the supporting case of my hypothesis, the danger group was 5.90, harmless was 4.05, and the control was 4.45. The case contradicting the hypothesis had a 4.00 for the danger condition, 5.90 for harmless, and 5.00 for the control. However, the data simulator was not able to do the ANOVA analysis for the data (it said "Error in get(ctr)(levels(x), contrasts = contrasts").

Discussion

The data in support of my hypothesis would likely be significant enough to support a main effect on the fear levels for the danger color condition. The mean response for the danger condition was significantly higher than the other two conditions. After an ANOVA analysis, the data would most likely show a high F value and low p value ($p<.05$ or $<.01$), indicating that the danger condition is significantly higher. This would lead us to conclude that color can have a significant effect on fear responses.

In the case contradicting the hypothesis, the danger condition is significantly lower than the other two conditions, and the harmless condition is high. This data would indicate a tendency for danger colors to cause lower fear levels.

Alternatively, if the mean values for each of the conditions were close, the analysis could show no statistical difference between the conditions, in which case we would conclude there was no evidence for an effect on fear responses because of color.

References

Sinclair, R., Soldat, A., & Mark, M. (2002). Affective cues and processing strategy: Color-coded examination forms influence performance. *Handbook for teaching introductory psychology: Vol. 3*, 104-106.

Hupka, R., Zaleski, Z., Otto, J., et al. The colors of anger, envy, fear, and jealousy: A cross-cultural study. *Journal of Cross-Cultural Psychology Vol 28(2)*, Mar 1997, 156-171.

Figure Captions

Figure 1. Graph of average responses in the case that my hypothesis holds true, indicating that danger colors produce higher fear levels.

Figure 2. Graph of average responses in the case that my hypothesis is wrong and danger colors lead to lower fear levels than harmless colors.

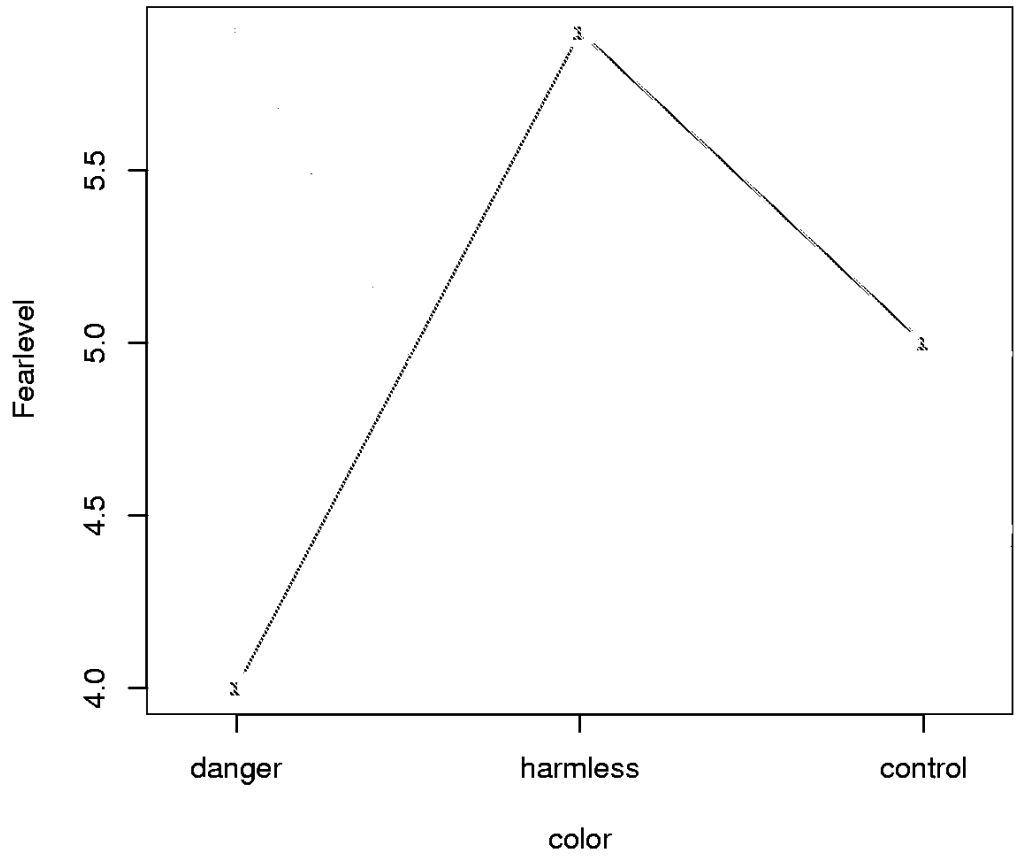

Figure 3. Data for the two sample trials.

	Danger	Harmless	Control
Mean response (1-7)	5.70	3.70	5.50