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Ambient green and creativity

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Abstract

The present research examined an important applied question: whether viewing ambient green (relative to red) on the wall of a workspace would facilitate creativity. A methodologically sound experiment revealed no influence of green on creativity. Care must be taken when interpreting a null result, but these data do not provide support for the presence of a relation between ambient green and creativity. This research also highlights the need for more research in the area of ambient color and psychological functioning, and the need for caution regarding the tendency to move to real-world recommendations before a firm empirical base is established.

Key words: ambient color, green, red, creativity,

Ambient green and creativity

The color green is typically associated with positive meaning such as "go" (in traffic lights), success (given its link to U.S. dollars), and growth, fertility, openness, and calmness (given its link with nature; Adams & Osgood, 1973; Chamberlin, 1968; Clarke & Costall, 2008; Gil & Le Bigot, 2014; Labrecque, Patrick, & Milne, 2013; Moller, Elliot, & Maier, 2009). Theorists have posited that these positive green associations may establish an appetitive motivational state that has positive implications for some aspects of psychological functioning (Goethe, 1810/1967; Goldstein, 1942; Mahnke, 1996). A few empirical studies have provided support for the facilitative influence of green on variables, such as perceived product healthiness, recycling behavior, desire for product discounts, mood, and creativity (Akers et al., 2012; Barone & Winterich, 2016; Lichtenfeld, Elliot, Maier, & Pekun, 2012; Montazeri, Gonzalez, Yoon, & Papalambros, 2012; Schuldt, 2013; Studente, Seppala, & Sadowska, 2016; cf. Müller, 2014). However, the existing research is sparse and has methodological limitations (e.g., poor color control, low statistical power, lack of experimenter blindness to condition); as such, it is best to consider this research preliminary (see Elliot, 2015).

Similarly, applied research examining if ambient color (i.e., color that is not linked to the task at hand) influences individuals' psychological functioning such as stress, mood, and task performance (Ainsworth, Simpson, & Cassell, 1993; Dijkstra, Pietrse, & Pruyn, 2008; Kwallek, Lewis, Lin-Hsiao, & Woodson, 1996; Kwallek, Soon, Woodson, & Alexander, 2005; Pierce & Weinland, 1934; Rosenstein, 1985; Stone, 2001; Stone & English, 2001; Tofle, Schwartz, Yoon, & Max-Royale, 2004) also suffers from the aforementioned methodological limitations, and the empirical yield from this research is mixed and difficult to interpret. One study has examined the influence of ambient colors, specifically, red and blue, on creativity (Küller, Mikellides, & Janssens, 2009); this study found no effect for color (although the experimenter was not blind to color condition). Research has yet to examine the influence of ambient green on creativity, and the present research investigated this applied

question while seeking to attend to the aforementioned methodological limitations. Specifically, this study tested whether ambient green presented in form of green wallpaper on the wall of a workspace influences the creativity of those working in front of the colored stimulus. Based on the premise that green is associated with growth, fertility, openness, and calmness, and on the fact that these associations are presumed to establish an appetitive motivational state, which has been found to facilitate creativity (Isen, Daubman, & Nowicki, 1987; Lichtenfeld et al., 2012; Nijstad, De Dreu, Rietzschel, & Baas, 2010), an ambient green-creativity relation seemed to be a promising possibility to test.

Creativity is consensually defined as the generation of ideas or products that are both novel and of value (Amabile, 1983; Sternberg & Lubart, 1996). Performance on creativity tasks may be distinguished in terms of quantity and quality (De Dreu, Baas, & Nijstad, 2008; Hirt, Levine, McDonald, Melton, & Martin, 1997). Quantity reflects the number of ideas generated, regardless of their creativity, which is also referred to as fluency, whereas quality reflects the uniqueness of the ideas generated, that is, creativity per se (Friedman & Förster, 2002). Research has shown that appetitive cues in performance contexts foster creativity without necessarily influencing fluency (Friedman & Förster, 2002; Roskes, De Dreu, & Nijstad, 2012); thus if green has a positive effect, it is expected to be on creativity per se, not fluency.

Method

Participants. A total of 128 (23 male, 104 female, 1 unidentified) undergraduate students in Germany participated in the experiment. This sample size afforded .80 power to detect a medium effect size ($d = .50$) at $p < .05$ (two tailed). All data were collected before any analyses were conducted, and all data exclusions, manipulations, and variables analyzed are reported. Individuals received a nominal monetary payment in return for participation in the experiment. Participation was restricted to individuals who did not report any color-deficiency. The mean age of participants was 23.39 years old with a range from 19 to 49.

Creativity measure. The Alternative Uses task was used to assess individuals' creativity potential (Guilford, 1967). In this task, participants were asked to list as many creative uses for a brick as they could think of. They were told to avoid mundane solutions or solutions that are virtually impossible.

Data coding. To objectively assess the creativity of the uses of a brick generated by participants, two independent scorers were asked to rate the creativity of the 229 different uses that participants generated on a 5-point scale ("How creative is this response?") anchored at 1 (not at all creative) and 5 (very creative). The aggregated scores across raters were used as the indicator of creative potential. In addition, a measure of fluency (i.e., the total number of responses) was calculated by simply summing the number of responses. Creativity ratings were averaged across all ideas that an individual generated to correct for possible differences in fluency (for a similar rating procedure, see Baas, De Dreu, & Nijstad, 2011). Interrater agreement was excellent based on the criteria explicated by Cicchetti and Sparrow (1981; intraclass correlation, ICC[1] > .73).

Design and Procedure. Participants were randomly assigned to one of two between-subjects conditions: the green condition or the red condition. Red was chosen as a control color because it is the opposite of green in several well-established color models (Fairchild, 2013).

Creative fluency and creative flexibility served as the dependent measures. Sex and age effects have occasionally been found in the color literature (see Baer, 2008; Ma, 2009), thus sex and age differences were tested in preliminary analyses and these variables were omitted from final analyses when they were non-significant (see Judd & Kenny, 1981).

Participants were tested individually by an experimenter blind to participants' condition and the experimental hypothesis. At the beginning of the experiment, the experimenter told participants that they were going to work on a task for which they had to generate as many ideas as possible. To minimize any threat or pressure that participants might

experience, the experimenter sought to create a relaxing atmosphere with no mention of creativity, testing, or performance.

After this short introduction, participants were provided with the experimental materials. The manipulation was a green or red wall hanging placed immediately in front of the desk at which the participant sat during task engagement. The wall hanging (3.08 feet x 3.08 feet) was designed to simulate wall paint; actual paint could not be used because the colors needed to be changed for each session as a function of random assignment to experimental condition. The colors were created by a professional print company hired for the purpose of equating the red and green on lightness and chroma. The colors in the manipulation were selected using the International Commission on Illumination LCh color model. This model defines color space in terms of three parameters: lightness, chroma, and hue (Fairchild, 2013). A spectrophotometer was used to select the chromatic colors, which were equated on lightness and chroma (green: LCh[47.61, 42.34, 147.64], red: LCh[47.58, 42.33, 26.58]); equated here means functionally equivalent (within 1.0 unit; Stokes, Fairchild, & Berns, 1992).

The experimenter remained blind to color condition by testing the participant behind a partition and having another experimenter randomly select and place a color on the wall before each session. Participants were exposed to the color during the entire session. The experimenter instructed participants to generate as many uncommon uses for a brick as they could think of, which is a commonly used task in the creativity literature. When 2 minutes had elapsed (time was monitored surreptitiously with a stopwatch to avoid evoking evaluative pressure), the experimenter told participants to turn the page and answer a brief questionnaire containing demographic items, a color-deficiency item, and a question regarding the purpose of the experiment. The purpose guess was designed as a check to make sure the experimental hypotheses were not obvious to participants (in which case they may either provide a response to seek to assist the experimenter or react against the experimenter by providing an

antagonistic response); a correct guess was defined as stating something about color, something about creativity, and something about the direction of an effect. At the end of the experiment, participants were debriefed, thanked, and dismissed.

Results

Preliminary analyses revealed no sex or age effects on creativity or the number of responses generated (Fs < 1.30, ps > .25). Therefore, sex or age were not included in the final analyses.

An independent-samples t test was used to examine the effect of color condition (red vs. green) on fluency. The analysis did not reveal an effect of color, $t(126) = .45$, p = .66; those in the green condition ($M = 5.78$, SD = 2.51) generated an equivalent number of ideas as those in the red condition ($M = 5.97$, $SD = 2.25$). An independent-samples t test (color condition: green vs. red) also did not reveal an effect of color on creativity, $t(126) = 1.24$, p = .22; those in the green condition ($M = 2.58$, SD =.35) produced ideas that did not differ in creativity from those in the red condition ($M = 2.65$, $SD = .34$).

In the purpose guess question at the end of the experiment, no participant correctly guessed the purpose. However, seven participants mentioned the words color and creativity (but not direction of an effect). Excluding these participants from the analyses did not change the results; for fluency: $t(119) = .09$, p = .93 and for creativity: $t(119) = 1.34$, p = .18[1].

Discussion

The results of the present research revealed no effect of ambient green relative to red on creativity. It is, of course, important to be cautious when interpreting null results. There are many reasons that null findings may be obtained that have little to do with the actual presence or absence of an effect. For example, individuals may participate in the experiment at the end

[1] Given our directional hypothesis, some might desire that we use one-tailed tests. However, one-tailed tests are not optimal for reasons articulated in Fields (2012) and Ruxton and Neuhäuser (2010). Nevertheless, if one applies one-tailed tests in the data analyses, the results and conclusions remain the same (all ps > .45).

of a semester when distraction is high and motivation is low, participants may be so wary of deception in the experiment that they do not fully engage during the session, or experimenters may do a poor job of running the protocol implacably or with minimal variation. In addition, in color research the color stimuli are often poorly controlled, experiments are frequently underpowered, and designs sometimes fail to attend to basic issues such as experimenter blindness. However, this experiment was conducted with carefully controlled color stimuli, with at least adequate statistical power, and with attention to experimenter blindness. Accordingly, although it goes without saying that any experiment, including the present one, must be interpreted with caution and in probabilistic terms, the present data do not provide support for a relation between ambient green and creativity.

From an applied perspective, the present research is consistent with the possibility that painting an office carrel or school wall green may have little influence on the creative output of workers and students. Statements about and recommendations regarding ambient color effects abound on the web and are present to some degree in the scientific literature (e.g., Pelligrini & Schauss, 1980; Schauss, 1979). However, there is no research using carefully controlled color stimuli and sound experimental methodology that has shown a consistent effect of ambient color on psychological functioning. As such, patience and prudence is called for regarding statements about the facilitating or debilitating influence of ambient color in real-world contexts.

Importantly, the present findings do not rule out the possibility of ambient color effects in general. This study investigated color in one precise setting, with one set of color properties, with one type of creativity measure, and within one cultural and demographic context. Given the strong applied interest in such effects, it is sensible to continue to explore possibilities. One possibility is to present the color green in the context of a picture of nature. This would make the link to growth and fertility particularly salient, and this may be what is necessary for an ambient green effect to emerge on creativity. Another possibility is to

explore the influence of ambient blue on creativity. Blue is commonly considered a relaxing color given its associations with the sky and water, and this relaxation may facilitate creative thinking and output (Mehta & Zhu, 1999). If so, the ambient, expansive presentation of blue on a wall may be a close enough match to a clear blue sky that it evokes relaxation and facilitates creativity accordingly.

The present research has limitations that should be noted. First, although the sample size was adequate to detect a medium effect size, it was not adequate to detect a smaller effect. Subsequent research in this area would do well to use a small or small-to-medium effect size in power estimates. Second, only a single item was used to measure creative potential. Future studies would do well to include several different indicators of creative potential. Third, the colored "wall" that was used was small relative to the entire room, and may not have blended well (i.e., naturally) into the overall ambience of the room. Fourth, the extent to which participants actually viewed the colored wall was neither measured nor controlled for, and this may have produced considerable variation across participants. Finally, individual differences in stimulus screening (i.e., sensitivity to environmental stimuli), which has been shown to moderate an ambient color effect in prior research (Dijkstra, Pieterse, & Pruyn, 2008), was not controlled or tested for. Subsequent research would do well to examine possible moderation by this variable.

Future work is needed to determine the generalizability of this null result, and such work is encouraged due to the widespread relevance of such research to school and work environments.

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