

brief report

The Impact of Anxious and Calm Emotional States on Color Usage in Pre-drawn Mandalas

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Abstract

The purpose of this single-subject experiment was to test whether a link exists between emotional state and color usage in a common art therapy technique. The researchers hypothesized that when coloring a pre-drawn mandala, participants would choose warm colors when they were anxious and cool colors when they were calm. The non-random sample consisted of 64 undergraduate and graduate students who were assigned to one of three evenly distributed groups. For each group, a different mood (anxious, calm, or neutral) was induced through a brief writing exercise. The researchers calculated the percentage of the total area of each mandala that was colored with warm colors and compared the results for each group. The researchers found no statistical differences in the color choices of participants who were feeling anxious, calm, or neutral when coloring a pre-drawn mandala. Color usage may have more to do with color preferences and memories that are associated with colors than current emotional state.

Introduction

Although people may have different reasons for choosing particular colors when producing a piece of art, we still know very little about how emotional or psychological states affect that choice. Research has identified a relationship between emotional state and color, in that warm colors may provoke active feelings, such as anger and tension, and cool colors may provoke sedate feelings, such as sadness and fatigue (Levy, 1980, 1984). In the study described herein, we attempted to take this observation further and to examine whether emotional state influences a person's choice of warm or cool colors when using a common art therapy technique.

Color affects everything from workplace productivity to consumer trends to voting behavior (see, e.g., Kuller,

Ballal, Laike, Mikellides, & Tonello, 2006). In Valdez and Mehrabian's (1994) study, participants reported a greater degree of anxiety or arousal when viewing red and yellow hues as compared with viewing blue and green hues. In their study of college students, Kaya and Epps (2004) found that blue or green colors elicited more feelings of being relaxed, happy, or calm. They also found that participants more often reported feeling negative emotions such as anger or annoyance when viewing red or orange than participants who viewed green and blue.

Because anxiety often accompanies depression (Morrison, 1995), the link between emotion and color usage has diagnostic and therapeutic value. Research that examines the differences in artwork produced by individuals who feel anxious versus the artwork of participants who feel calm may help art therapists treat patients who are experiencing anxiety-related problems. Color choice is one of the elements of standardized art-based assessment, such as the Formal Elements Art Therapy Scale (FEATS; Gantt & Tabone, 1998) that rates the prominence of color and color fit of a given artwork, among other elements. The Diagnostic Drawing Series (Cohen, Hammer, & Singer, 1988) considers monochrome color and multiple color usage in its rating system. The Mandala Assessment Research Institute Card Test involves selecting from preprinted color cards to evaluate a client's current emotional state. Although Kellogg (1992) observed that colors chosen by clients seemed to reflect emotional content, she elaborated a theory of color that was related to developmental stages rather than specific emotions.

Bell and Robbins (2007) examined whether the process of drawing or painting can produce positive feelings or improved mood. Although these researchers found that a decrease in negative mood was correlated with the production of art, they did not investigate color choice and mood. Other researchers have induced changes in mood by using writing exercises (Curry & Kasser, 2005; Lumley & Provenzano, 2003; Marlo & Wagner, 1999; Pennebaker, 1997; Pennebaker & Seagal, 1999; Smyth, Hockemeyer, & Tulloch, 2008; Soliday, Garofalo, & Rogers, 2004). In Pennebaker's (1997) study, participants reported feeling better after writing about negative experiences. Marlo and

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Wagner (1999) compared moods induced by positive, negative, or neutral writing exercises, and found that members of the negative and neutral groups experienced increased negative moods, whereas members of the positive group experienced a slight decrease in negative mood.

Curry and Kasser (2005) used a writing exercise to induce a mood prior to evaluating the effectiveness of mandala drawing to reduce anxiety. The researchers administered the pre- and post State Anxiety Inventory (SAI) portion of the State-Trait Anxiety Inventory (Spielberger, 1983) to evaluate mood changes among participants who colored a mandala, a plaid design, or a free-form picture. Mandalas and plaid designs were found to be equally effective for reducing anxiety, whereas free-form coloring did not reduce the level of anxiety back to baseline. Serice, van der Venet, and Norwood (2007) replicated the Curry and Kasser study, using similar writing exercises to induce an anxious mood, and found that coloring a mandala reduced anxiety to a greater degree than either free-form coloring or coloring a plaid design.

The purpose of the current study was to test the relationship between emotional state and color usage when coloring a mandala after inducing a mood through a writing exercise. Widely utilized in many art therapy settings, mandalas can be pre-drawn and designed in such a way that they can be mathematically manipulated, which makes them ideal for experimentation. The primary research hypothesis for the study was: There is a difference in the color choices of participants producing art, and these color choices can be predicted based on whether the participants are anxious or calm. In particular, when coloring a pre-drawn mandala, participants will choose warm colors when they are anxious and cool colors when they are calm. The null hypothesis was that there is no difference in the color choices (i.e., warm colors vs. cool colors) of anxious participants and calm participants when they are coloring mandalas.

Method

Participants

The participants for this single-subject experimental study were a nonrandom sample of convenience consisting of 64 undergraduate and graduate students (51 women and 13 men) enrolled at a university in the U.S. Southwest. The participants' ages ranged from 20 to 56 years, with a median age of 26 years. The majority of the participants were recruited from a social science and humanities department that historically has had a large female enrollment. As a result, 79% of the participants were women and 21% were men. The majority of the participants was Caucasian (61%), and a minority was Hispanic (22%), Asian (8%), African American (5%), and Native American (2%), and 3% classified their race as "Other." Sixty-seven percent had earned the equivalent of an associate's degree at the time of participation and 33% had earned a bachelor's degree or higher.

The participants were volunteers who met with the researchers on a designated Research Participants' Day on campus. The first author assigned the 64 participants to

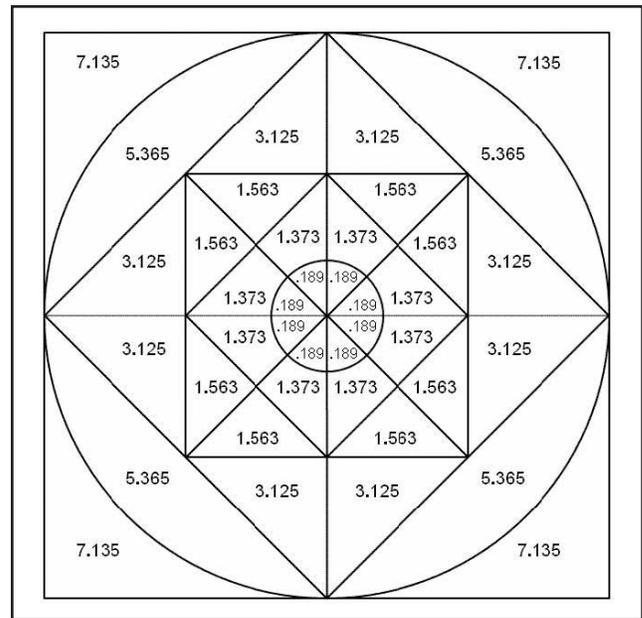


Figure 1

one of three evenly distributed, non-randomized groups: Anxious ($n = 22$), Calm ($n = 21$), or Neutral ($n = 21$). Each group was defined by the writing assignment administered to induce a particular mood. The participants were not given any financial compensation but received credit toward the required research participation component in their statistics or psychology coursework.

Procedure

Participants were asked to sign informed consent forms and also released their artwork to the researchers for use as data. Following the completion of a demographic questionnaire, the participants rated their baseline mood (Time 1) using the 20-item State Anxiety Inventory (SAI; Spielberger, 1983). Examples of the items are "I feel nervous" or "I feel calm." Participants rated their current mood on a 4-point scale ranging from "not at all" to "very much so."

Following the baseline measure, the next step was to induce the desired mood for each group. Participants wrote for 4 minutes about a particular scenario that contained specific emotional content. Those in the Anxious group were asked to write about a time when they felt anxious; those in the Calm group were asked to write about a time when they felt calm and relaxed. Neutral group members wrote about the room in which the experiment took place, which was presumed to be a neutral experience (Pennebaker & Seagal, 1999). After 4 minutes, the participants completed the SAI (Time 2) to measure whether their anxiety had increased, decreased, or remained constant.

Immediately after the Time 2 measure, participants were directed to completely color in a pre-drawn mandala (Figure 1, with numbers removed) using six sharpened colored pencils (red-orange, orange, yellow, green, navy blue, and blueberry) that were presented in rainbow order for control purposes. Warm colors are defined as being in the

560–750 nm range of the visible spectrum and cool colors are in the 400–560 nm range (Skoog, 1985). A pencil sharpener also was available in case it was needed during the 45-minute procedure. No further instructions were given to the participants.

If a participant did not complete the coloring, but stated that he or she was finished, the researcher pointed out the incomplete portions and asked the participant to finish. For participants who refused to finish, their artwork and other data were not included in the statistical analysis. The mandala had to be completely filled in to be usable for the mathematical calculation.

Instrumentation and Analysis

Based on our decision to replicate the research protocol by Curry and Kasser, (2005), we assumed that a 4-minute writing exercise would induce changes in participants' moods. Mood change was measured with the state-anxiety (SAI) portion of Spielberger's (1983) State-Trait Anxiety Inventory (STAI). The alpha coefficient for the reliability of the SAI has been reported to be high ($r = 0.93$; Bowling, 2001). The STAI has been successfully used to differentiate between stressful and calm states, and it has been shown to be valid when tested against other anxiety scales. Because the validity is higher for state-anxiety than trait-anxiety, the SAI was chosen as the measurement tool for this study, due to the fact that moment-to-moment anxiety was of greater interest to us than trait-anxiety.

The mandala, which we refer to as the Kersten mandala, was first suggested by the second author and then designed by the first author in cooperation with an engineer. It consists of a circle within a square that encloses concentric squares and another circle. The inner shapes are divided into sections by lines that connect the corners of the squares. Although any size of the mandala can be used for replication studies, in this study each mandala was 7" x 7" on a sheet of 8.5" x 11" white copy paper. The Kersten mandala functions as a geometric problem to be solved and allows a rater to reliably calculate the percentage amount of warm versus cool colors used.

The mandalas were analyzed in the following manner. Each section that was filled with either a warm or cool color was assigned a percentage value of the mandala's total area, as depicted in Figure 1. For example, if a warm color filled the upper left hand quadrant, it was given a value of 7.134 meaning that this section represented 7.134% of the mandala's total area. The percentage of warm colors and cool colors when added together totaled 100%. Because the percentage of warm color usage is inversely proportional to the percentage of cool color usage, only the warm colors were analyzed to test the hypothesis.

The procedure did not allow for mixing warm and cool colors. Mandalas with sections that contained a mixture of warm and cool colors were not used for calculating results. The data included the SAI at Time 1 and Time 2 for all three groups and the percentage of warm color usage in the mandalas colored after Time 2 for all three groups. The alpha level of .05 was used for all statistical tests.

Table 1 SAI Anxiety Levels at T₁ and T₂

Group	<i>n</i>	Time 1		Time 2	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Calm	18	36	13	32	10
Neutral	20	37	12	37	12
Anxious	21	34	8	41	11

Paired sample *t* tests were used to compare the state-anxiety mean score for members of each group at Time 1 and Time 2. An independent sample *t* test evaluated the differences in SAI levels between paired groups (Calm vs. Neutral, Neutral vs. Anxious, and Calm vs. Anxious). The first author calculated the initial results and the second author checked three sample calculations from each group for accuracy. There was 100% agreement between the two raters in the assignment of warm and cool colors based on the definitions above.

We expected that the mood states of the three groups as measured by the SAI at Time 2 would be different due to the writing directive to induce mood. These differences would then provide a basis of comparison for the differences in the color choices in each of the three groups.

Results

Quantitative Results

From a total of 64 volunteers, 59 completed all procedures for the experiment. Five participants were excluded either because of unanswered survey items or because they used both warm and cool colors in a single section of their mandalas or they drew original designs inside the geometric shapes.

Table 1 summarizes the descriptive statistical results of the baseline anxiety level at Time 1 (T₁) and induced anxiety level at Time 2 (T₂) for each group. Table 2 summarizes the independent sample *t* test for equality of means. Results show no statistical differences for T₁ between the Calm and Neutral groups ($p = .84$), Anxious and Neutral groups ($p = .31$), and the Calm and Anxious groups ($p = .46$). At T₂, there was no statistical difference for the anxiety levels between the Calm and Neutral groups ($p = .12$), or between the Anxious and Neutral groups ($p = .34$). However, a statistically significant difference was found between the Calm and Anxious groups ($p = .01$).

In order to ascertain whether the writing task induced a mood change among the participants, as assumed, a paired sample *t* test was conducted that compared baseline anxiety level to induced anxiety level for the three groups (Table 3). The Calm group's mean score at T₁ was 36 ($SD = 13$) and dropped to 32 ($SD = 10$) at T₂. A statistically significant difference was found in the Calm group ($p = .02$) between baseline anxiety level and induced anxiety level. The Neutral group's mean score at T₁ was 37 ($SD = 12$), and 37 ($SD = 12$) at T₂. As expected, there was no difference between T₁ and T₂ anxiety levels for the Neutral

Table 2 Independent Sample T-test for Equality of Means for SAI Anxiety Levels at T₁ and T₂

Group Pair	df	Time 1				Time 2			
		t	p	95% CI		t	p	95% CI	
				LL	UL			LL	UL
Calm and Neutral	36	-0.2	.84	-9.2	7.5	-1.6	.12	-12.9	1.5
Neutral and Anxious	39	1.0	.31	-3.2	9.8	-1.0	.34	-10.5	3.7
Calm and Anxious	37	0.7	.46	-4.3	9.3	-2.7	.01*	-15.9	-2.4

Note: CI = confidence interval; *df* = degrees of freedom; *LL* = lower limit, *UL* = upper limit.
* $p < .05$, two-tailed, equal variances assumed.

group ($p = .86$). The Anxious group's mean score at T₁ was 34 ($SD = 8$), and elevated to 41 ($SD = 11$) at T₂. A statistically significant difference was found for the Anxious group ($p = .00$) from T₁ to T₂. These results show that the writing task indeed reduced or increased anxiety depending on which writing task was assigned.

Table 4 summarizes the results of the analysis of the percentage of warm color usage for the three groups in their mandalas, and Table 5 shows the results of the independent sample *t* test that compares the percentage of warm color used at T₂. There were no significant differences in warm color usage between the Calm and Neutral groups ($p = .34$), the Anxious and Neutral groups ($p = .38$), or the Anxious and Calm groups ($p = .09$). Thus, the null hypothesis cannot be rejected. Based on the warm color usage results, we concluded that there was also no statistical difference between cool color usages of the three groups at T₂. Anxious and calm emotional states do not appear to influence color choice when coloring the Kersten mandala.

Field Observations

Although the aim was to test for differences between the groups, qualitative differences were evident that may shed light on the quantitative data. Participants in the Calm group were far more likely than those in the other groups to alter the pre-drawn Kersten mandala by drawing their own designs on the mandala, creating patterns and shapes, and mixing colors. Participants in the Neutral group were less inclined than those in the Calm group to alter their designs but did so more often than participants in the Anxious group. Calm group members were also more inclined to color with lighter pressure and to color inside the lines. Participants in the Anxious group, by contrast, colored more intensely (i.e., with greater saturation) and colored within the lines less often. Anxious group members were more likely than any other group members to re-sharpen their colored pencils repeatedly while coloring their mandalas.

Another observation related to requests for different colors. Some participants asked for either black or pink pencils. One participant commented that she was very happy to have her favorite colors available and described how her color usage reflected her cultural heritage.

Table 3 Paired Sample T-test Results for SAI Anxiety Levels between T₁ and T₂

Group	t	df	p	95% CI	
				LL	UL
Calm	2.7	17	.02*	1.0	8.2
Neutral	-0.2	19	.86	-3.1	2.6
Anxious	-4.8	20	.00*	-10.1	-3.9

* $p < .05$, two-tailed.

Table 4 Percentage of Warm Color Usage at T₂

Group	Percentage Area of Warm Color Usage		
	n	M	SD
Calm	18	52.7%	18.1%
Neutral	20	47.5%	15.0%
Anxious	21	43.2%	15.6 %

Table 5 Independent Sample T-test Results Comparing the Percentage of Warm Color Usage at T₂

Group Pair	t	df	p	95% CI	
				LL	UL
Calm and Neutral	-1.0	36	.34	-16.1	5.7
Neutral and Anxious	0.0	39	.38	-5.4	13.9
Calm and Anxious	1.8	37	.09	-1.5	20.4

* $p < .05$, two-tailed.

Although the majority of the participants were Caucasian, minority groups were well represented (collectively representing 39% of the participants) and differing language needs for some participants were observed. For example, one Hispanic participant stated that she wished she could have written in her native language, as she felt more emotionally connected to it than English. It appears that the use of English as a second language may have caused difficulty for another participant who wrote only three sentences during the 4-minute activity.

Discussion

We sought to test whether emotional state influences color choice when coloring a pre-drawn mandala. The findings suggest that there were no significant differences in the amount of warm or cool color used when an anxious, calm, or neutral state was induced. We found no statistical difference in the percentage of warm color used between the Calm and Neutral groups, between the Anxious and Neutral groups, or between the Calm and Anxious groups. Therefore, we cannot reject the null hypothesis. There was no difference between the color choices of anxious participants and those of calm participants when they were coloring a pre-drawn mandala.

The failure to reject the null hypothesis may be due to the variability of induced anxiety regardless of the group. Such variability may be explained by the fact that some participants in the Calm group began with very high SAI scores at T_1 ($M = 36$, $SD = 13$, Range = 20 to 66) as compared to the Neutral group ($M = 37$, $SD = 12$, Range = 22 to 60) and the Anxious Group ($M = 34$, $SD = 8$, Range = 20 to 54). Despite the fact that these initially anxious Calm group members did calm down after the writing task, some maintained higher SAI scores at T_2 ($M = 32$, $SD = 10$, Range = 20 to 49) compared to those in the Anxious group at T_2 ($M = 41$, $SD = 11$, Range = 22 to 58). This variability in anxiety levels between the three groups at T_2 was surprising considering the fact that there was no statistical difference in anxiety levels between the groups at T_1 (see Table 2). However, their SAI score ranges overlapped at T_2 . In addition, the variability could be explained by the observation that some participants stopped writing prematurely; these individuals may not have experienced the full effects of the writing task to induce the mood.

Another factor not taken into account is the role of culture, both in emotional language and in acceptable color choices. For example, a participant of Asian heritage who wrote only three sentences during the 4-minute writing task had a score change of two points in the opposite direction of what was expected (i.e., she wrote about an anxious memory and grew calmer at T_2). Had participants been prompted to write in the language in which they felt most comfortable, their SAI scores might have reflected larger changes from T_1 to T_2 , as might their color use.

In addition, cultures vary greatly in how their members use color to express meaning. Park and Guerin (2002), for example, found that a palette comprised of neutral hues, light value, and a simple, cool appearance was most favored by Japanese participants and least favored by participants of English heritage. The same study found that a palette of warm hues, middle value, and clear yet subtle hues of red, blue, green, and yellow was most preferred in the United States and least preferred in Korea. Cultural color preferences may have played a significant role in the results of our study as well. Future studies need to consider cultural implications when assessing color utilization in artwork.

There were three methodological problems that should be addressed if the study is replicated. Participants should be instructed to write for the entire four minutes of

the writing task because those who stopped writing prematurely may not have experienced the full effects of the task. Secondly, some participants had difficulty with the directions for the coloring task, resulting in unusable data. It needs to be made clear that participants should not alter the design, mix colors, or use more than one color in any mandala section. The directive could be more specific to state, "Use the colors provided and do not mix the colors."

It is also possible that a limited color selection may have altered some participants' emotional states. Not having the choice of desired colors may have caused an increase in frustration or disappointment, which in turn may have affected the participants' art products.

A nonrandom sample of convenience design was used to recruit undergraduate and graduate participants and most of the participants were women and Caucasian. Consequently, caution should be executed when generalizing these results to other populations.

The results also raise several new questions. Color usage may have more to do with color preferences and associated memories than with current emotional state. Kaya and Epps (2004) suggested that "color preferences are associated with whether a color elicits positive or negative feelings" (p. 396). Indeed, several participants requested other colors because the ones that were offered were not what they wanted to use. It is possible that participants may use more or less of their favorite colors depending on their emotional state; thus, future research should include a question on the demographic survey about the participant's most and least favorite colors.

Wright and McIntyre (1982) found that patients who were hospitalized for depression showed marked differences from a control group with respect to use of color. Future research may indicate that if presented with a wider selection of colors, groups with differing emotional states may use differing amounts of vibrant colors, keep within limited color schemes (e.g., only using shades of red), or restrict their number of color choices. An interesting research question would be to ask whether emotional state restricts the range of colors used.

Finally, it is important to note that art-based assessments such as the Formal Elements Art Therapy Scale or the Diagnostic Drawing Series (Cohen et al., 1988) can be utilized to evaluate color usage in artwork. Some of the qualitative data in this study (e.g., line quality, perseveration, and implied energy) lend themselves to interpretation using the Formal Elements Art Therapy Scale. The color scales in the Diagnostic Drawing Series could also be utilized to further differentiate between warm and cool color usage when coloring a mandala.

Conclusion

A number of conclusions can be drawn from this study, which tested whether a link exists between emotional state and color usage in a common art therapy directive. We found that the writing task as described by Curry and Kasser (2005) successfully induced anxious, calm, and neutral moods in participants prior to the mandala-coloring

task. We also found the Kersten mandala to be very useful in determining the proportions of warm and cool colors that the participants used due to its mathematical design.

We hypothesized that participants would choose warm colors when they were anxious and cool colors when they were calm. We found no statistical differences in color choices for participants who were feeling anxious, calm, or neutral when coloring the Kersten mandala. Members of the Anxious group, in fact, used more cool colors than members of the Calm group. That we found no statistical differences seems to contradict the observation by Kellogg (1992) that color choice might reflect emotional content and Wright and McIntyre's (1982) finding that the color choices of depressed patients were markedly different from those of a control group. Color choice may have more to do with color preferences and associated memories than current emotional state.

Although this study showed that a common art therapy directive such as a mandala can be used systematically to examine art expression, it also illustrates the limitation of deducing an emotional state based solely on one aspect of an artwork. Linking color with a particular emotion grossly simplifies the complex act of making a piece of art as well as the motivation for making it. The Kersten mandala, nonetheless, may be useful in future studies that investigate emotional states combined with other research tools to explore complex motivations for making certain art expressions.

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