The Effects of Coloring on Anxiety, Mood, and Perseverance

Judy Eaton & Christine Tieber

brief report

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Abstract

This study tested whether the structure of a coloring task has an effect on anxiety, mood, and perseverance. Eighty-five undergraduate students were randomly assigned to 1 of 2 coloring conditions: free choice, where they could color an image using any colors they wanted, and forced choice, where they were instructed to copy the colors of a precolored image. Anxiety and mood were measured before and after coloring; in addition, perseverance was measured after coloring. Results showed positive effects of coloring, with greater anxiety reduction and evidence of higher perseverance in the free-choice group compared to the forced-choice group. This suggests that well-being might be facilitated by a coloring task that balances structure and engagement.

Coloring books have been marketed widely to adults and many claims have been made as to the positive effects of coloring on well-being; however, there has been little empirical investigation of these claims. Coloring is an activity that promotes concentration and engagement but does not require excessive skill or focus (Curry & Kasser, 2005). This is especially true of the type of coloring marketed toward adults, which tends to be highly detailed, often (but not always) abstract, and requires more time commitment than a traditional children's coloring book. It has been proposed that coloring can be beneficial to well-being because it provides enough structure so that users are not overwhelmed by too many decisions (e.g., what to draw) but is intricate enough to promote engagement and a state of mindfulness (Carsley, Heath, & Fajnerova, 2015; Curry & Kasser, 2005). Mindfulness has been linked with a reduction in anxiety (for a review, see Khoury et al., 2013) and increased self-regulation (Brown & Ryan, 2003).

The literature on the positive effects of coloring is small, but the findings suggest that coloring can reduce anxiety. Studies on coloring typically take the form of a pre–

post design, where a measure of anxiety is given both before and after the coloring task. The tasks are varied, but often include coloring a predrawn mandala (Curry & Kasser, 2005; van der Vennet & Serice, 2012) or some other predrawn image, drawing on a blank page, or creating another type of art (e.g., sculpture, painting). In one of the first studies on coloring and anxiety, Curry and Kasser (2005) induced anxiety in participants by having them briefly write about a time when they felt fearful, and then gave them the opportunity to either color a mandala design or a plaid geometric pattern or to color on a blank page. Self-reported anxiety was significantly reduced in both the mandala and plaid conditions, but not in the blank page condition. More recent replication studies have found a reduction in anxiety in the predrawn mandala condition only (van der Vennet & Serice, 2012), or a reduction in anxiety in all three conditions (C. R. Drake, Searight, & Olson-Pupek, 2014). Other studies in which coloring was included as an experimental condition have generally found that coloring results in decreased anxiety (Carsley et al., 2015; Sandmire, Gorham, Rankin, & Grimm, 2012; Sandmire et al., 2016). A small amount of research also suggests that coloring and drawing can positively affect mood (Babouchkina & Robbins, 2015; J. E. Drake, Coleman, & Winner, 2011; Smolarski, Leone, & Robbins, 2015).

It seems clear from the foregoing that coloring can reduce anxiety, but whether there is a difference in the effectiveness of different types of coloring is less certain. Given the differences between the effectiveness of coloring a predrawn mandala compared to drawing on a blank page found by both Curry and Kasser (2005) and van der Vennet and Serice (2012), it could be that the difference is related to the degree of structure provided in the task. The mandala provides more structure than the free drawing task, but not so much structure that it increases anxiety. Coloring and drawing, although they differ in structure, are also different in other ways (e.g., the degree of creativity involved, the need for a certain skill level or sense of efficacy), and thus are not directly comparable. We set out to provide a more robust test of whether the degree of structure in a coloring task affects its effectiveness in decreasing anxiety by varying the level of structure within the same task.

In this study we used a pre–post design, whereby participants were assessed on their state mood and anxiety both before and after coloring a design for 30 min. There

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were two experimental conditions: All participants were given an abstract, detailed image to color (similar in complexity and design to a predrawn mandala but typical of images found in adult coloring books), but those in the free-choice condition were given free choice as to what colors to use and those in the forced-choice condition were instructed to copy the colors of a preexisting image. Free choice of color was intended to provide enough flexibility to promote engagement and enough structure so as not to evoke anxiety. The forced choice of color was intended to provide so much structure that engagement might be inhibited. We predicted that anxiety would be lower and that mood would be more positive and less negative in the free-choice condition compared to the forced-choice condition.

We also included a measure of perseverance to assess whether the coloring manipulation would result in behavioral changes. Given evidence that mindfulness can have an effect on self-regulatory behavior (Brown & Ryan, 2003), we predicted that participants would persevere longer in the free-choice condition than in the forced-choice condition.

Method

Participants

Participants were 85 undergraduate students (71 women, 13 men, 1 unspecified) enrolled in an introductory psychology course at a small Canadian university. They received a small amount of course credit for their participation. Participants ranged in age from 18 to 44, with an average age of 20.11 years ($SD = 4.06$).

Measures

Mood. The Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) was used to measure mood. It consists of 10 items measuring positive affect (e.g., interested, excited) and 10 measuring negative affect (e.g., upset, distressed) for which participants are asked to rate the extent to which they currently feel that way on a 7-point Likert scale. Internal reliability (Cronbach's alpha) was .89 for both the pre- and posttests for the positive items and negative items.

State Anxiety. A 6-item short form of the state scale of the Spielberger State–Trait Anxiety Inventory (Marteau & Bekker, 1992) was used to measure state anxiety. Participants were asked to rate the extent to which they currently felt calm, tense, upset, relaxed, content, and worried on a 7-point Likert scale. The positively valenced items were reverse-scored. Internal reliability (Cronbach's alpha) was .91 for the pretest and .89 for the posttest.

Perseverance. Perseverance was assessed through the length of time participants spent on an impossible anagram task. They were provided with a description and example of an anagram (PERAP = PAPER), and then given the following instructions: "On the following pages are a series of anagrams. Please do your best to solve them, but if you have tried and can't figure one of them out, you can move on to the next one." The software recorded the time participants spent on each anagram. The first three anagrams (ONSW = SNOW or OWNS; RCTODO = DOCTOR; LSEPE = SLEEP) were relatively easy to solve to get participants engaged in the task. The remaining three anagrams (HCTIRIU, ANDMETAPR, and TBRABO) had no solutions (i.e., they were impossible), and the length of time participants tried to solve them was intended to assess perseverance.

Procedure

Participants were tested in groups ranging from one to three in a small lab containing three desks arranged side-by-side, separated by dividers. Each desk contained a computer monitor, keyboard and mouse, and a tray of 20 Crayola® Super Tips colored markers. After providing informed consent, participants were asked to put away cell phones and other items that might distract them.

Because participants were tested in small groups, it was not possible to assign individual participants to one of the two experimental conditions, out of concern that they would notice that another participant had a color guide and they did not (or vice versa). For this reason, testing sessions were randomly assigned to conditions instead of individual participants, through the results of a coin toss.

The study took place in four parts (see Figure 1). In the first part, participants completed the measures of mood and state anxiety on the computer. Qualtrics data collection software was used to present the questions. In the second part, the experimenter waited until all participants had completed the scales, and then gave each participant a line drawing of an abstract design on an 8.5- × 11-in. piece of white paper (taken from Mucklow & Porter, 2014, p. 131). In the free-choice condition, participants were simply instructed to color the image using the markers provided; in the forced-choice condition participants were given an additional copy of the image that was already colored and were instructed to color their image as close as possible to the one provided.

After 30 min, participants were asked to put aside their coloring and complete the remainder of the study on the computer. The third part included four questions assessing how long they felt they had been coloring, how satisfied they were with their finished product, whether they wished they had been given more time to color, and the extent to which they felt they had used their creativity in the coloring task, followed by the same measures of mood and state anxiety presented at the beginning of the study. After this, participants completed the fourth part of the study, the anagram perseverance task. Finally, participants answered questions about their age and gender and were debriefed and thanked for their participation.

Results

Manipulation Check

A visual examination of the colored images showed that all participants colored at least part of the image, and that all
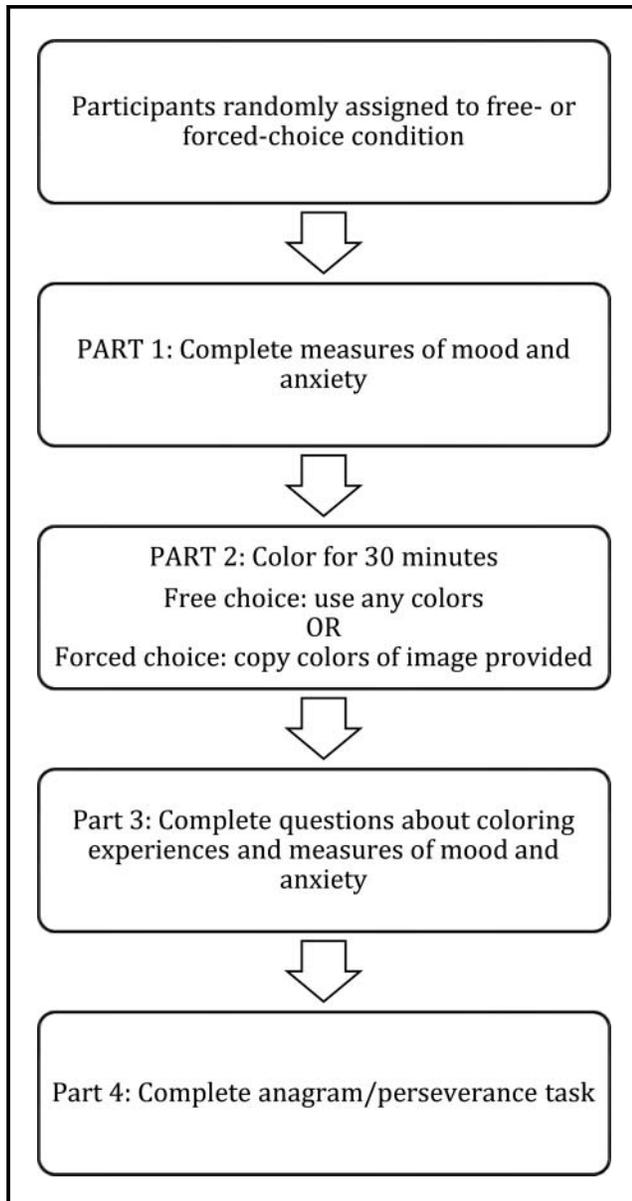
Figure 1. Experimental Procedure

participants in the forced-choice condition made an effort to copy the colors of the image provided to them. Thus, the manipulation of choice in the use of colors was successful.

Overall, participants underestimated the length of time that they had been coloring ($M = 23.86$ min, $SD = 7.28$ min). The average level of satisfaction with the finished product for the entire sample was 4.82 ($SD = 1.54$) and average desire for more time to color was $M = 4.96$ ($SD = 2.13$); both of these factors were measured on 7-point Likert scales. There were no significant differences between those in the free-choice condition and those in the forced-choice condition for any of these three questions (all $ps > .05$). Overall, this suggests that all participants, regardless of whether they had freedom of color choice, found the coloring task to be relatively engaging and enjoyable.

There was a significant difference in the degree to which they felt they had used their creativity: Reported use of creativity was higher when they had free choice of colors ($M = 5.63$, $SD = 1.11$) compared to when they did not ($M = 3.33$, $SD = 1.72$), $t(83) = 7.318$, $p = .000$.

Anxiety and Mood

To determine whether there was a difference in anxiety and mood between the free-choice and forced-choice conditions, mixed analyses of variance were conducted with time (pre- and postcoloring) as the within-subjects factor and choice (free choice and forced choice) as the between-subjects factor.

Analyses for anxiety revealed a significant main effect of time, $F(1, 83) = 9.295$, $p = .003$, $\eta^2_p = .10$, whereby anxiety was significantly lower after coloring ($M = 2.39$, $SD = 1.15$) than before ($M = 2.73$, $SD = 1.19$). There was a marginally significant Time × Choice interaction, $F(1, 83) = 3.744$, $p = .056$, $\eta^2_p = .04$. An examination of the two groups indicated that the decrease in anxiety after coloring was greater in magnitude in the free-choice group (0.55) than in the forced-choice group (0.12; see Table 1).

Positive and negative mood were analyzed separately. For positive mood, results revealed a significant main effect of time on mood, whereby positive mood was lower after coloring than before, $F(1, 83) = 10.936$, $p = .001$, $\eta^2_p = .12$. Although the interaction was not significant, $F(1, 83) = 3.496$, $p = .07$, $\eta^2_p = .04$, an examination of the means of the two groups indicated that the decrease in positive mood was larger in magnitude in the forced-choice group (0.38) than in the free-choice group (0.10; see Table 1). For negative mood, results revealed a significant effect of time on mood, whereby negative mood was lower after coloring than before, $F(1, 83) = 20.282$, $p = .000$, $\eta^2_p = .20$. There was no interaction between time and condition; both

Table 1. Descriptive Statistics for Anxiety and Mood Before and After Coloring in Free- and Forced-Choice Conditions

| | Free Choice | | | | | Forced Choice | | | | |
| | T1 | | T2 | | | T1 | | T2 | | |
Variable	M	SD	M	SD	T1 – T2	M	SD	M	SD	T1 – T2
Anxiety	2.88	1.26	2.33	1.25	0.55	2.58	1.12	2.46	1.05	0.12
Positive mood	4.77	0.82	4.67	1.05	0.10	4.81	0.95	4.43	0.98	0.38
Negative mood	2.56	1.04	2.20	0.95	0.36	2.32	1.07	2.04	1.00	0.28

groups reported decreased negative mood after coloring (free-choice, 0.36; forced-choice, 0.28; see Table 1).

Perseverance

An independent samples t test was used to determine whether there was a difference in perseverance between the free- and forced-choice groups, with the total amount of time (in milliseconds) spent on the three impossible anagrams as the dependent variable. The results of this analysis were not significant, $t(83) = 1.68$, $p = .10$. In examining the length of time spent on each of the three impossible anagrams, however, an interesting pattern became apparent. For the first anagram (HCTIRIU), both groups spent a relatively equal amount of time attempting to solve it (free-choice $M = 90.65$, $SD = 56.32$; forced choice $M = 88.85$, $SD = 69.73$). For the second anagram (ANDMETAPR), the free-choice group spent significantly longer on it ($M = 101.86$, $SD = 82.49$) compared to the forced-choice group ($M = 64.99$, $SD = 34.91$). The free-choice group also spent longer working on the third anagram (TBRABO; $M = 65.05$, $SD = 49.53$) compared to the forced-choice group ($M = 55.63$, $SD = 31.87$). It could be that both groups were confused about the first anagram and thus moved on to the next one after a similar amount of time, but that the free-choice group, once they realized the task would be challenging (i.e., by the time they got to the second anagram), persevered more. To test this, the t test was rerun using only the second and third anagrams. There was a significant difference between the two groups, $t(83) = 2.43$, $p = .017$, whereby those in the free-choice group spent longer working on the anagrams ($M = 166.92$, $SD = 108.36$) than those in the forced-choice group ($M = 120.62$, $SD = 59.87$). The post hoc nature of this analysis means that these results should be interpreted with caution, but they do suggest that free choice in coloring might result in increased perseverance.

Discussion

Our findings showed that 30 min of coloring resulted in lower negative mood and lower anxiety, especially when participants were allowed free choice of colors. This provides preliminary empirical support for the use of coloring by adults to improve mood and relieve anxiety. There is also some initial evidence that free choice in coloring had behavioral implications: Participants persevered longer on an impossible task when they had been given free choice in coloring.

Although our findings suggest that coloring in general is effective at decreasing negative mood and anxiety, the fact that those in the free-choice condition reported a marginally greater decrease in anxiety than those in the forced-choice condition also indicates that the degree of structure in the task is important. Hinz (2009) suggested that a low level of structure in an expressive therapy task is associated with more affective responses, whereas a high level of structure is associated with more cognitive responses. Although both coloring tasks were highly structured, the forced-

choice condition, in which participants had to match colors with an existing image, was more cognitively demanding than the free-choice condition. It could be that higher levels of structure that require greater, or possibly too much, cognitive engagement are less conducive to facilitating positive outcomes. Future research should more fully explore this possibility.

Another reason for the differences between the two groups might be that choosing which colors to use involves a certain amount of creative decision making. Coloring is clearly not the same as art therapy; it does not provide the same potential for understanding the internal experiences associated with the creation of art nor, on its own, does it help participants better understand their internal experiences (Carolan & Betts, 2015). However, given the demonstrated positive effects of art therapy (Slayton, D'Archer, & Kaplan, 2010), it could be that coloring with choice is somewhat closer to creating a work of art than simply copying colors. Indeed, participants rated the degree to which they felt they had used their creativity to a higher degree when they had free choice of colors compared to when they did not.

There are some limitations of the study that should be addressed in future research. The sample consisted of mostly female undergraduate students; hence, the results are not necessarily generalizable to males or nonstudents. Also, the repeated-measures design makes it difficult to ascertain whether the changes in mood and anxiety resulted from coloring or simply the passage of time, or from demand characteristics. However, the difference in magnitude of these changes for the two experimental conditions suggests that at least some of the changes were the result of the type of coloring.

The results of this study demonstrate that traditional, nondirective coloring for a relatively short amount of time can reduce anxiety, and might increase perseverance on difficult tasks. The practical uses of this are clear. Offering coloring opportunities to those struggling with anxiety (e.g., students during stressful times such as before exams) might not only help reduce anxiety, but it could actually help them engage in more proactive behaviors (e.g., studying), especially when used as a supplement to professional therapeutic services (Carolan & Betts, 2015). Given that coloring is an inexpensive, accessible method of anxiety reduction that requires no outside intervention or special skills (provided one has the fine motor skills necessary to hold a pencil, crayon, or marker), these findings are encouraging, and add to the growing literature on the benefits of coloring as a form of self-care.

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