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Are Coloring Books Really Just for Kids? Investigating Possible Effects of Specific Pattern Coloring on Conceptual, Physiological and Behavioral Aspects of Anxiety

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Coloring on Conceptual, Physiological and Behavioral Aspects of Anxiety

A Thesis Presented by

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Abstract

This study examined the role of specific pattern coloring, such as coloring books for adults, on conceptual, behavioral and physiological measures of anxiety. Undergraduate female students (n = 8) had ECG electrodes and a respiration belt attached and completed the State Trait Anxiety Inventory (STAI) at five time points; at baseline, after an initial autobiographical anxiety induction, following a passive relaxation condition, after a repeat induction and then after a coloring condition. The participants were randomly split into a control and experimental group; the control group free colored while the experimental group colored in a mandala pattern. Participants had the option of coloring before bed to test the effect of coloring on sleep onset latency. The electrodes and respiration belt measured heart rate and respiratory sinus arrhythmia (RSA) data and MATLAB transformed the raw data to produce heart rate variability (HRV) values. The self-report data indicated that the manipulation did not induce anxiety and that there was no reduction in anxiety after the coloring conditions. Physiological data indicated that the manipulation successfully induced anxiety, however, there was no significant reduction in anxiety. Although the results of this study were not significant, they suggest that with a larger sample size, it would be possible to see an effect of specific pattern coloring on the reduction of anxiety.

Introduction

Overview

Did you know that coloring books are not only meant for kids anymore? Recent headlines have shown that there is a growing trend in coloring books marketed to adults. Coloring books topped Amazon sales list and some books are even targeted to reduce anxiety and stress. Is this growing fad based on simply hype or is there science to support it? My own personal experience has led me to believe that coloring books may actually have an effect on reducing anxiety. This study will investigate whether the act of coloring in a specific pattern can actually reduce anxiety; we will measure anxiety in multiple components, conceptual, physiological and behavioral. We will use self-report questionnaires to measure conceptual components, heart rate variability and respiratory sinus arrhythmia to measure physiological components and we will use sleep onset latency to measure the behavioral component. We believe that specific pattern coloring, such as a coloring book will reduce anxiety significantly compared to free drawing as measured by multiple components of anxiety.

Almost everyone will experience some form of anxiety during his or her lifetime and for some it can become a serious burden. For a large part of the population, anxiety is just an occasional occurrence that arises surrounding particularly important or significant life events. However, trends show that anxiety and stress levels are rising. With more anxiety comes more anxiety related symptoms and one of the most common symptoms of anxiety is a sleep disturbance. It is critical to find ways to treat anxiety in its many forms. Many methods of anxiety treatment require long-term commitment to therapy or a medication regimen. Newer forms of treatment are based on alternatives to therapy and medication and people suffering from anxiety can use them without such an expense of time, energy or money. Literature has

shown that art making, often in the context of art therapy, can function to reduce anxiety and stress levels in varieties of populations. Further research is necessary to explore the exact role that coloring books can play in anxiety reduction.

Anxiety and Stress Epidemiology

In 2001-2003, a replication of the National Comorbidity Survey (NCS-R) was conducted to investigate prevalence, severity, and comorbidity of *DSM-IV* disorders. The goal of the NCS-R was to increase the literature and understanding of DSM-IV disorders. This set of analyses focuses on the 12-month prevalence of anxiety, mood, impulse control, and substance abuse disorders based on the DSM-IV. The sample included 9,282 English speakers in the contiguous United States. The DSM-IV and a fully structured World Health Organization World Mental Health Survey version of the Composite International Diagnostic Interview (WMH-CIDI) were used to diagnose all of the previously listed classes of disorders. Within diagnoses, each case was given a rating of mild, moderate, severe or very severe. The most predominant 12-month disorders were specific phobia, social phobia, and major depressive disorder with rates of 8.7%, 6.8% and 6.7% respectively. Anxiety disorders were the most widespread class, with 18.1% of those surveyed having a diagnosis, and followed by mood disorders with 9.5%. Overall 26.2% of those sampled met 12-month criteria for any DSM-IV disorder; for those with 12-month disorders, over 40% of respondents exhibited comorbidity with other DSM-IV disorders (Kessler, Chiu, Demler, Walters, 2005).

Further analysis was conducted with the NCS-R data to look at lifetime prevalence of the DSM-IV disorders. This study used the same 9,282 participants as the 12-month prevalence analysis as well as the WMH-CIDI. The most prevalent lifetime disorders were major depressive disorder, alcohol abuse, specific phobia and social phobia, with rates of

16.6%, 13.2%, 12.5%, and 12.1% respectively. Similar to the 12-month analysis, anxiety disorders were the most predominate class of disorders followed by impulse control disorders with rates of 28.8% and 24.8% respectively. For anxiety and impulse control disorders, the median age of onset was 11 years of age. The likelihood of exhibiting one disorder in the course of a lifetime was 46.4%, with 45% of people exhibiting 2 or more disorders. It is clear that for many people in the United States, anxiety and other DSM disorders can be part of their lives. Although this study specifically explored clinical DSM level diagnoses, a large portion of the population may deal with anxiety on a more minor, day-to-day level. Understanding the prevalence of anxiety and other disorders aides in the motivation to find novel and efficient methods for treating and mitigating the symptoms of the disorders (Kessler, Berglund, Demler, Jin, Merikangas, Walters, 2005). Although almost everyone experiences anxiety, those in college may be particularly susceptible to stress and anxiety.

Anxiety and other mental disorders are a significant burden for anyone but can be a significant struggle in college, when teenagers may be away from home for the first time. Many college students struggle with anxiety and depression as they transition and for some the situation can get to the point that they attempt suicide. Although there have been studies on mental health in an overall population, there has not been extensive research on risk factors specific to youth and student populations. Increasing the understanding of mental health in a college aged population could have significant effects for many aspects of later life, including substance abuse, academic success, and future employment. A university is a prime setting for supporting mental health because it encompasses a large portion of the student's lives. The goal of the study was to add to the epidemiological literature on mental health, especially depression, anxiety and suicidality among university students. The data was collected using a

web-based survey from students at a large university in the Midwestern United States; a web survey was used because it might be easier for some students to discuss sensitive topics when they don't need to be face-to-face. The survey was conducted using 2,843 undergraduate and graduate students in October-November. The Patient Health Questionnaire (PHQ) was used in order to measure clinical symptoms for depression and anxiety, while questions from the National Comorbidity Survey Replication (NCSR) were used as a measure of suicidality. In addition the survey looked at relationships between mental disorders and many other characteristics. Overall, 15.6% of undergraduates and 13.0% of graduates screened positive for depression or anxiety. The rates for depression, 13.8% for undergraduate and 11.3% for graduates, were higher than the rates of anxiety, 4.2% and 3.8% respectively. Within anxiety disorders, there was a greater rate of generalized anxiety disorder than panic disorder for both undergraduate and graduate students. Only 2.5% of undergraduates and 1.6% of graduate students reported suicidal thoughts in the month prior to the survey. This study adds clinically valid measures of psychiatric disorders to the literature on mental health epidemiological studies. In the midst of day-to-day life, anxiety can crop up for people in many ways and for some it can become debilitating. Having a greater understanding of how anxiety and other disorders affect the population and how many people are affected aides in strengthening the importance of finding cures and treatments to deal with anxiety (Eisenberg, Gollust, Golberstein and Hefner, 2007). Studies such as this help to inform the reasoning for this novel study. Finding everyday and easy methods for dealing with anxiety can make life easier for those struggling with anxiety. Additionally, as time progresses it appears that anxiety and stress rates, in students and overall, are climbing.

Many universities have observed significant increases in yearly visits and overall clients and this trend shows that mental health may be a significant issue for college students. Stress, anxiety, and depression are on the rise in college students and can significantly alter daily life. Homesickness and the college transition have an impact mostly on first-year students but can affect students of other years as well. Academics can suffer as a result of increases in anxiety and depression, but can also be a cause. Understanding the exact causes of anxiety, depression and stress could make it easier to create more specified and effective treatments. The goal of this study was to investigate the prevalence and causes of psychiatric disorders among students. All participants were recruited randomly from classes across varying disciplines. After all exclusions were made, the results were gathered from 374 students. The Depression, Anxiety, and Stress Scale (DASS) was used to assess severity and symptomology. The DASS ranked depression, anxiety and stress as normal, mild, moderate, severe and extremely severe. 11% reported severe or extremely severe symptoms for depression, 15% reported severe or extremely severe anxiety and 11% reported severe or extremely severe stress. The major causes of concern for the students were: academic performance, pressure to succeed, post-graduation plans, financial concerns, quality of sleep, relationships with friends, relationships with family, overall health, body image and self-esteem. When someone suffers from anxiety, the effect on the rest of his or her life can be significant. As more and more evidence appears, it is clear that college is time when many students may experience clinical symptoms (Beiter, Nash, McCrady, Rhoades, Linscomb, Clarahan and Sammut, 2015). This study adds more modern evidence to support the motivation for the study, the need to help mitigate anxiety and stress symptoms and struggles.

More than clinical anxiety, stress is a part of almost everyone's daily lives and stress has not stayed constant over the years.

To some it seems that stress has been a part of everyday life for as long as they can remember and they expect it to remain that way for time to come. That belief may not be accurate because the amount of stress is changing. Dealing with stress can put pressure on the body, leading to increased risk for depression, cardiovascular disease, delayed healing, upper respiratory infections and even death. Comparing stress levels over time has been difficult because not all studies used proportional studies and valid and comparable measures of stress. The study used data from 3 separate surveys, each conducted by professional polling groups. The first study was a telephone study from 1983, and the second and third studies were Internet based studies from 2006 and 2009. All three surveys used the Perceived Stress Scale (PSS); higher levels of stress as measured by the PSS have been associated with higher cortisol, suppressed immune function, greater disease susceptibility and slower wound healing. The survey uses 10 items to assess stress in daily life situations and a higher score indicates greater stress. This study aimed to understand the relation between many demographic factors and stress levels as well as a comparison between stress levels in 2006 and 2009. The 1983 survey was a Harris poll conducted with 2,387 adults in the United States, the 2006 and 2009 surveys were both eNation surveys conducted with 2,000 adults each. For all three surveys, in addition to the PSS, multiple demographic data points were collected, including age, education, race/ethnicity, employment, and income. Overall results show that women report more stress than men, stress decreases with increasing income, education and age. Results also indicate that minorities experience more stress than Whites. Additionally, mean stress levels were compared between the 2006 and 2009 surveys, partially to investigate the effect of the

2008-2009 economic downturn. Between 2006 and 2009, stress levels increased for Whites, those aged 45-64, those with 4-year and advanced degrees and those with full-time employment. It is interesting to note that as people age, stress increases, however this study didn't investigate specific sources of stress but it is likely that as someone ages, the source of stress changes. Stress increased 18% for women and 24% for men between 1983 and 2009, although only the data between 2006 and 2009 could be statistically compared because the 1983 survey was conducted via telephone while the others were via the Internet. This data seems to show a trend that as time has progressed, people are getting more and more stressed (Cohen and Janicki-Deverts, 2012). Data like this shows the increasing importance of finding ways to battle stress in a manner that doesn't. It is clear that anxiety and stress are a widespread part of life for many in America and finding ways to deal with those things could be a vital part of making life just a little bit easier for so many.

Anxiety Based Sleep Disturbances

Sleep disturbances are often co-occurring with and symptoms of many psychopathological conditions and sleep disturbances may also present as risk factors. Sleep difficulties are most commonly tied to depression and anxiety disorders and can be associated with decreased response rates to treatments. Research shows that sleep may not just be a symptom in anxiety and depression but actually a substantial contributing factor. The reasons for sleep disturbances are varied and not the same for every individual, they may be due to lifestyle choices, the environment, or medical and psychiatric conditions. This study was specifically curious about the relation between symptoms of psychopathology and sleep quality and quantity in normally healthy individuals; they hypothesized that those with increased sleep disturbances would score higher on measures of psychopathological

symptomology, especially on scales of Depression, Anxiety, Somatic Complaints and

Paranoia. The subjects of this study were 49 healthy adult men and women, most of who were

Caucasian. All participants reported no significant history of psychiatric or medical conditions.

Participants completed an open-ended questionnaire in regards to sleep habits, including,

trouble falling asleep, trouble staying asleep and the frequency of sleep disturbances. The

Personality Assessment Inventory (PAI) was used as an objective measure of

psychopathological symptomology; the PAI is made up of 344 statements, rated from very

false to very true, broken down into 11 clinical scales. The scales included, Somatic

Complaints, Anxiety, Anxiety Related Disorders, Depression, Mania, Paranoia, Schizophrenia,

Borderline Features, Antisocial Features, Alcohol Problems and Drug Problems. Of the 49

subjects used, 22 reported at least one sleep problem, while the other 27 denied experiencing

difficulty falling or staying asleep. Within the 22 participants reporting problems, the

frequency of complaints ranged from 2-156 times per year, with a median of 52. Of the four

hypothesized scales of interest, there were significant results seen between those who reported

sleep disturbances and those who did not on Depression, Anxiety and Somatic Complaints,

although there was no significant difference on Paranoia. For almost all of the participants

involved, the scores on the PAI indicated that they were within the subclinical range of the

disorders. It is clear that sleep plays a significant role in normal cognitive functioning. This

study was a correlational study so directionality cannot be assumed but there is research

showing that the relationship may go both ways (Tkachenko, Olson, Weber, Preer, Gogel and

Killgore, 2014). Sleep disturbances and trouble falling asleep are common parts of suffering

with anxiety, even if it is not at a clinical level. Determining that coloring can help with

anxiety in regards to a real world symptom such as sleep could prove the usefulness of the

technique in day-to-day treatment of anxiety. Although anxiety has been implicated in sleep

difficulties, there is still more to understand about the exact features of anxiety that have an

effect.

Pre-sleep cognitive activity has been found to play a role in difficulties falling asleep,

but more investigation is necessary. Cognitive activity can be broken down into both thoughts

and images and more and more work has shown how important imagery is in cognitive

activity. The goal of this study was to understand the focus of attention pre-sleep, the content

of cognitive activity prior to sleep and the imagery that accompanies the thoughts. This study

compares these things in both sleep-onset insomniacs as well as healthy controls. The author

hypothesized that for those with insomnia, the pre-sleep cognitive activity would be made up

of worries and concerns and that the associated images would follow the same pattern

compared to healthy controls. The study was conducted with 60 participants, 30 insomniacs

and 30 control subjects. All participants underwent an initial diagnostic interview with a

qualified psychologist and then completed the Sleep Disturbance Questionnaire (SDQ), Beck

Anxiety Inventory (BAI), Beck Depression Inventory (BDI), Penn State Worry Questionnaire

(PSWQ) and the Why Worry and Intolerance of Uncertainty questionnaires. The

questionnaires were followed by a semi-structured interview broken down into 4 sections. The

first section involved the participants estimating overall sleep quality, how often thoughts kept

them awake, and their average sleep onset latency. The second section asked the participants to

rate statements related to the focus of their pre-sleep attention. The third section sought to

classify the content of pre-sleep cognitive activity by rating the extent to which they thought

about certain topics. The fourth and final section investigated imagery and intrusions

associated with pre-sleep cognitive activity. In regards to the questionnaires, those with

insomnia had higher scores on the BAI, PSWQ and the Why worry and Intolerance of Uncertainty questionnaires. As a part of the SDQ, participants rated statements related to cognitive interference and markedly 77% of insomniacs cited one of the three statements related to cognitive interference; the three statements were "My mind keeps turning things over," "I am unable to empty my mind," and "My thinking takes a long time to unwind." Expectedly, insomnias reported lower sleep quality, more cognitive activity interference and increased sleep onset latency. The insomnia group also reported significantly more time spent attending to worries, trying to solve problems and listening to noises. In regards to imagery, the insomniacs reported more distressing imagery compared to controls. These results support the concept that cognitive activity prior to sleep may contribute to the sleep difficulties, especially delayed sleep onset, associated with nonclinical and clinical anxiety (Harvey, 2000). If coloring can help with anxiety by quieting the mind, then coloring prior to sleep may be able to reduce pre-sleep cognitive activity and decrease sleep onset latency.

Art Therapy

It has often been said that art therapy is a useful tool for reducing stress, anxiety and negative moods, but more clarification is needed. Early research showed that art therapy was successful as a tool of stress reduction but the literature did not differentiate between art production and art viewing within art therapy. Additionally, most early art therapy studies did not use truly randomized experimental conditions, so their results need careful consideration when extrapolating to larger populations. Studying the varying effects of active, or art making, versus passive, or art viewing, art therapy can help to elucidate exactly how art therapy functions as a therapeutic agent. It was the authors' hypothesis that participants in the experimental art production group would exhibit a larger reduction in negative mood and

anxiety as compared to those in the art viewing control group. The fifty participants were all adults and those with mood related disorders were excluded. All participants initially wrote a 10-item "to-do" list of their most vital concerns and apprehensions to induce a mild negative mood. Additionally, all participants completed the Profile of Mood States (POMS) and Spielberger's State Trait Anxiety Inventory (STAI), a measure of both state anxiety, which is representative of current anxiety levels, and trait anxiety, which is a measure of penchant to anxiety. Participants were then given random assignment to production or viewing groups. Those in the experimental group had 20 minutes to draw with a variety of materials on white paper while those in the control group had equal time to view and sort images of famous paintings. After completing the tasks, all participants again completed the POMS and STAI, in order to have a measurement post-activity. Overall, those in the production group exhibited greater reduction in POMS, state anxiety, as well as trait anxiety. The greater reduction for the experimental group was significant for all three measures compared to those in the control group. These results indicate that within art therapy, the creation of art may have a greater role than the viewing of art in stress and negative mood reduction. Even though this study was conducted using simply art making as opposed to art therapy within the context of actual art therapy, there was still significance. The findings show that it is important to have a true experimental study to add weight to results, which this study is based on. The findings of this study also tie into the overall hypothesis of this paper because they show the importance of actually making art on stress and anxiety reduction (Bell and Robbins, 2007). Although this initial study showed proof that art making may be more successful than art viewing in stress reduction, further research is necessary to see how art making functions in various circumstances.

A focus on art making activities with an undergraduate college population in regards to anxiety adds another dimension to how art can be used. College is still full of many small stressors and some college events such as finals may produce quite high levels of stress. If art making could reduce stress and anxiety in an undergraduate population, then its implementation could be intensely useful. The authors hypothesized that half an hour of art making would reduce anxiety and stress to a significant degree. In order to measure anxiety and stress, the authors' used the State Trait Anxiety Inventory (STAI). All of the participants were undergraduate students immediately prior to finals week and exclusion criteria included those with documented mental illness and those who were taking drugs that affect the central nervous system. Participants were randomly divided into control and experimental groups and both groups completed a base line STAI prior to any intervention. Control participants sat comfortably in a room while those in the experimental condition were presenting with five art making possibilities, mandala design coloring, free form painting, collage making, clay and drawing and given instructions on how to complete the activity. After half an hour, both groups completed the STAI a second time. After ensuring that the groups were truly random in regard to pre-activity anxiety, results were examined. In regards to state anxiety, the experimental group showed a significant reduction in anxiety as measured by t-tests, while the control group did not exhibit any significant change. Similarly, the experimental group displayed a significant decrease in trait anxiety, while there was no significant decrease for those in the control group. The reduction in trait anxiety was an unexpected result due to the fact that trait anxiety is expected to remain relatively constant over a long period of time but the change may have due to participants not adequately distinguishing between state and trait questions on the STAI. The study did show that only half an hour of art making was sufficient

to cause a significant decrease in stress and anxiety. The authors posited that the success of this intervention may be due to the fact that art making allows for a brief separation from reality. This is important in regard to fact that when college students are stressed, academic performance drops. Therefore, the discovery that short periods of art making are an effective stress relief could have strong implications for students (Sandmire, Gorham, Rankin and Grimm, 2012). The addition of an undergraduate population adds to support for the overall hypothesis because it broadens the examined populations and focuses on the population that will be specifically examined in this study. Art making has been shown to be an efficacious method to reduce stress and anxiety, however most studies don't have results specific to each art making task. Although a college experience may be quite stressful, there are stressors unique to caring for a family member with cancer.

Life can be filled with stressful circumstances but art making may offer a brief respite and can even provide stress reduction. There is research to show that those who act as medical caregivers have to shoulder a large amount of responsibilities and may be vulnerable to increased stress and negative moods, but because of their position as caregiver they may not seek the help they need. The authors' goal was to see if art making in the form of creative arts intervention could reduce stress, lower anxiety and uplift mood in population of caregivers for family members with cancer in both inpatient and outpatient settings. Family caregivers acted as their own control by completing baseline measures of stress, anxiety and mood using the Mini Profile of Mood States (Mini-POMS), Beck Anxiety Inventory (BAI) and The Derogatis Affects Balance Scale (DABS), respectively. Caregivers were then presented with an "ArtKart" equipped with choices of art making activities included watercolor printing, mandala creation and silk painting. After completing an hour of art making, all measures were

repeated. Forty caregivers participated in the study and most of the participants were women and were the spouses of the patients. The results indicated that there was significant reduction in stress between pre and post creative arts intervention. Additionally, anxiety was also diminished by a significant amount, pre and post intervention. Lastly, after the intervention there were significantly more positive emotions compared to negative emotions. Overall, all three measures showed that a short-term artistic intervention had successful and significant effects on stress, anxiety and emotional state. There was not enough data to show the specific effect of each artistic activity but the success of the measures may have varied by activity type. In order to ensure participation and success the authors noted that artistic tasks needed to be accessible even to those with limited artistic abilities. The success of the art making may have been due to the creation of a tangible product to represent a happy moment in the midst of a generally negative time of life. Based upon the data of this study it appears that even short-term artistic activities may be useful for aiding caregivers and that implementation of creative arts interventions may prove useful in many hospital settings (Walsh, Martin and Schmidt, 2004). Tying into the hypothesis, this article indicates that even relatively undirected artistic activity can successfully lower anxiety and stress. Having information on the results by artistic activity would add additional information to the applicability of this study but even without it there is proof that quick artistic tasks may be helpful for those under increased amounts of stress. Although this study focused on those in situations of markedly intense stress and responsibilities, it is important to consider that caregivers may not be under the same type of stress as those experiencing and battling cancer.

Dealing with cancer can come with pain, fatigue, depression, and anxiety and increasing numbers of people are turning to complementary therapies such as art therapy. Art

therapy is used with cancer patients because it aids patients in increasing self-awareness,

coping with symptoms, and adapting to traumatic and stressful experiences. Art therapy uses

creativity to allow for expression of deep emotions via non-verbal mechanisms because some

things may be difficult to talk about; these emotions may be in regard to illness, relationships,

hospitalizations and other concerns. The authors' goal in this study was to gain empirical

evidence on the effectiveness of art therapy on treating pain, anxiety and other symptoms of

inpatient cancer patients. All 50 patients were recruited from large medical center inpatient

oncology units. In order to measure symptoms connected to cancer, the Edmonton Symptom

Assessment Scale (ESAS) and the state portion of the State Trait Anxiety Inventory (STAI-S)

were used; only the state portion was used because only the anxiety at the time of intervention

was of interest. Baseline scores were obtained on both measures and then participants were

offered a choice of art activity by an art therapist; activity options included card making,

collages, drawing, jewelry making and woodcrafts. The session began with the patient stating

goals for the session and then working on the art project with the therapist for an hour; the

involvement of the therapist depended on the needs of the particular patient. During the

session, the therapist would put the patient at ease and help to reduce self-critique. At the end

of the session the patients could continue working on the art on their own time. They

completed the same post-tests measures as those that were administered at baseline. In addition

to survey measures, participants answered questions regarding the art therapy experience.

Eight of the nine symptoms measured by the ESAS, excluding nausea, were significantly

reduced after the art therapy session. Most, but not all domains of the STAI-S showed

significant differences as well. In regards to art therapy experience, 88% of participants had

never done art therapy before, 90% of participants said that the therapy focused their attention

on something positive via distraction, and 36% found the therapy calming and relaxing. In this day and age, many people are interested in supplementing conventional medical approaches with complementary therapies. The results of this study show that art therapy may be a viable complementary therapy option (Nainis, Paice, Ratner, Wirth, Lai and Shott, 2006). Women suffering from breast cancer may have a unique set of challenges that could be aided by art making.

When women with breast cancer are dealing with the disease, they are often exposed to stresses and strains that can lead to diminished quality of life, which may be improved by art therapy. Quality of life is a concept that includes people's perspectives on their own position in life in regards to value systems that they hold. Quality of life is important to consider in cancer patients because it is considered an indicator of how well some treatments work and may be representative of some aspects of overall health. Women diagnosed with breast cancer often experience physical changes such as hair loss and breast loss, which may alter commonly "feminine" aspects of the body and alienate women from their own bodies. In addition they may report fear and experience themselves as isolated from their community without anyone to really talk to. Art therapy is often used in the context of complementary and alternative therapies for women with breast cancer. Art therapy allows women to express and process these emotions in a non-verbal context; the experience may aid in lending legitimacy to those feelings. In this study, all the participants were women undergoing post-operative radiation in Sweden. This study was conducted using a randomized control and experimental group design. All women completed surveys on coping, quality of life, symptoms, self-image and interviews at three points, before randomization and radiotherapy, 2 months later and 6 months later. In order to measure quality of life, the study used the Swedish version of the

WHO survey, the WHOQOL-BREF and the European Organization for Research and Treatment of Cancer survey, the EORTC Quality of Life Questionnaire QLQ-BR23. The art therapy intervention lasted for 5 weeks, was led by a trained art therapist and included options of drawing and painting. The results from the WHOQOL-BREF showed that by the final measurement point, 6 months later, the women in the experimental group had significant improvements in overall quality of life and health. The EORTC QLQ-BR23 showed significance for the intervention group on the body image, future perspectives and systematic therapy side effect dimensions only. The results of this study show that 5 weeks of art therapy intervention did result in significant positive changes in quality of life and health and helped the women deal with their pain. The art therapy allowed the women to interpret and reflect their emotions and come to terms with them, which may have resulted in greater feelings of control. This study showed that for women dealing with breast cancer, art therapy could function as a tool in rehabilitation (Svensk, Öster, Thyme, Magnusson, Eismann, Åström and Lindh, 2009). Art therapy may not only be useful for those dealing with cancer but can be an aid in other chronic illnesses.

Art making, as a form of anxiety reduction should be broken down into particular tasks to see which tasks are the most efficacious. Going back to ancient times, the mandala has been an important meditative entity and has played a role in spiritual traditions. The coloring of mandalas may aide individuals in entering a state that resembles meditation due to its symmetry, repetition and complexity. The authors of this study set out to investigate the anxiety reduction properties of free form coloring, coloring a plaid design and coloring a mandala. They hypothesized that those in the mandala-coloring group would experience the greatest reduction in anxiety, assuming there is a special quality unique to mandalas. However,

they also hypothesized that if having a structured, complex form is all that is necessary then

the plaid group would exhibit anxiety reduction similar to the mandala. Both hypotheses were

based on the idea that a structured drawing activity would have greater anxiety reduction than

free form drawing. The participants in the study were all undergraduate students and were

randomly divided into a free form control group, a plaid experimental group and a mandala

experimental group. The State Trait Anxiety Inventory was used in order to measure anxiety in

the participants and all participants completed a baseline STAI at the beginning of the study.

As an anxiety induction, participants were then asked to recall the time they felt the most

fearful and to write about it for 4 minutes. After completing the induction, all participants

again completed the STAI. Those in the control group were then given blank paper and

instructed to color with colored pencils while those in the experimental groups were given

outlines of plaid and mandala patterns to color in with the pencils; all participants were asked

to color for a 20 minute time period. Once the coloring period was complete, all participants

again completed the STAI; each participant had three data points from the STAI, baseline,

post-induction and post-coloring. Initial results showed that the groups were statistically

random and that the anxiety induction did significantly increase anxiety as measured by the

STAI. There was a significant difference in final anxiety levels between all three groups.

When comparing final anxiety to post-induction anxiety, the mandala group exhibited

significantly greater reduction than the free form coloring group although there was not a

significant difference between the reduction of the mandala and plaid coloring groups. It is

also interesting to note that for both the plaid and mandala experimental conditions the mean

final anxiety score was actually lower than the baseline anxiety score although the effect was

only significant for those in the mandala group. The results of this study supported the

hypothesis that coloring a mandala lead to significantly greater anxiety reduction than free form coloring although there was little difference between the effects of coloring a plaid versus and mandala design. Both the plaid and mandala design were complex and had structure as compared to the free-form coloring and this may have resulted in the better result for those groups (Curry and Kasser, 2005). This study very closely relates to the overall study in that it also included coloring a design as the main experimental condition as compared to a free-form coloring group as a control.

In order to determine if the Curry and Kasser's findings were reproducible, a replication study reexamined the procedure and results of their study. Similar to the previous study, the authors focused on the importance of the mandala, using Jung and his use of the mandala as a reference. The goal of this study was to replicate the study of Curry and Kasser and therefore the authors similarly hypothesized that those who colored a mandala would exhibit significant anxiety reduction as compared to those in the plaid and free form groups. Although Curry and Kasser used the State Trait Anxiety Inventory, this study only focused on state anxiety and the population of this study was mostly graduate students. The protocol used was based on Curry and Kasser and therefore measured a baseline STAI-S and then induced anxiety using a writing exercise, following that another STAI-S value was obtained and then participants completed their artistic tasks and concluded with a final STAI-S. Similarly to the previous study, those in the mandala-coloring group exhibited significantly greater reduction in anxiety compared to those in the free-form group. In contradiction to Curry and Kasser, this study found that there was no significant difference in reduction between the free form and plaid coloring groups. In this study, only the mandala-coloring group was able to bring final mean anxiety below baseline mean anxiety levels. This replication study was able to show

that the mandala was significantly better than the other conditions in reducing anxiety. The difference between this replication and the original study may have been due to the differences in the participant population. Despite the differing results, this study came to a similar conclusion that the success of the mandala may be due to the participants entering a meditative-like state (van der Vennet and Serice, 2012).

Summary

The aim of this study was to investigate if there is any support to the idea that coloring books can actually reduce anxiety, as measured in multiple ways, more than free drawing. All participants underwent an anxiety induction to create a measurable level of anxiety. during the course of the study we collected self-report and physiological measures of anxiety. Participants were then randomly assigned to an active control or experimental condition. In the control condition, participants free drew, while those in the experimental condition colored a mandala, a specific pattern, for the same amount of time as the free drawing. Additionally, participants colored before falling asleep to see if coloring would increase the likelihood of them falling asleep within a 15-minute period. Therefore, if conceptual and physiological measures are related, an increase in anxiety, measured via self-report, should correlate with an increase in anxiety as measured by physiology. Additionally, coloring should have a more significant impact in reducing sleep onset compared to normal routines. Finally, if coloring is more effective than free drawing at reducing anxiety, then those in the experimental coloring group should exhibit greater reduction in anxiety as measured by conceptual, physiological and behavior measures.

<div align="center">**Methods**</div>

Participants

We recruited participants (8 women, 0 men, mean age =20.6 years, age range: 19-22) by word of mouth and social networking posts. The study excluded participants if they had a formal diagnosis of an anxiety disorder, depressive disorder or schizophrenia, or if they are taking psychiatric medication for anxiety, depression or schizophrenia. The Scripps College Institutional Review Board approved all aspects of the procedure.

Materials/Measures/Stimuli

We presented participants with an autobiographical mood induction to induce anxiety. We instructed them to recall a moment of intense anxiety and then to ruminate and then write about the moment for 4-5 minutes (Appendix 1). For the coloring conditions, we gave participants in the active control a blank sheet of paper with a circle and colored pencils while we gave those in the experimental condition colored pencils and a blank mandala design (Appendix 2). We collected physiological data using Biopac Student Lab BSL Pro 3.7 software as well as Biopac disposable electrodes and respiratory effort transducer.

Design

This was a mixed design study with 1 independent variable, specific pattern coloring. The within-group condition consisted of the first anxiety induction and subsequent passive control and data collection, while the between group condition consisted of ether the active control or experimental condition. For the sleep onset latency portion of the experiment, we counterbalanced the order of normal and experimental nights to limit order effects.

We quantified, anxiety, the main dependent variable in three different ways. We used the State Trait Anxiety Inventory (STAI) as a self-report measure of anxiety (Spielberger, 1970). The inventory can be broken down in the State Inventory and Trait Inventory, each of

which consists of 20 questions (Appendix 3). Additionally, we used heart rate variability

(HRV) and respiratory sinus arrhythmia (RSA) as physiological measures as measured by

Biopac kits. However, we calculated HRV from initial electrocardiogram (ECG) recordings.

Sleep onset latency was the third anxiety variable and we measured it by self-report of whether

the participant fell asleep in 15 minutes or not. Additionally, the Positive and Negative Affect

Scale (PANAS) was what we used to quantify other emotions (Appendix 4).

Procedure

We adapted the procedure from Curry and Kasser's 2005 study. Each trial began with the

experimenter informing the participant of the overall procedures and risks of the study. After

participants read over and signed the consent form they filled out basic demographic

information. After completing the demographic form, participants completed the first STAI

and the experimenter fitted them with electrodes and a respiratory transducer that collected a

baseline ECG and RSA for 5 minutes (T1). Participants then underwent the autobiographical

mood induction and immediately after completed a second STAI and a second round of

ECG/RSA data collection (T2). All participants were then instructed to quietly sit and breathe

for 15 minutes, after which a 3rd round of STAI and ECG/RSA data collection occurred (T3).

All participants then underwent a re-induction following the same procedure and STAI and

ECG/RSA data collection occurred again (T4). At this point, participants were randomly split

into two groups, active control (n=4) and experimental (n=4). The experimenter asked the

active control condition participants to free color for 15 minutes while the experimental

condition colored a mandala pattern for 15 minutes. The final set of STAI and ECG/RSA data

collection occurred after coloring (T5).

Following the final data collection, the experimenter unhooked the participants from the electrodes and belt and gave a partial debriefing in which participants were asked how they were doing and given a brief explanation of what had occurred. They were then asked if they would like to participate in the sleep portion of the study. If they declined they were given the full debriefing and then compensated for their time. If they agreed, the experimenter gave them a schedule, which included Sunday-Wednesday for four weeks (Appendix 5) as well as a sleep instruction form (Appendix 6) and a sheet in which to indicate their answers (Appendix 7). If they were originally in the control condition the experimenter gave them blank circles to color. However if they were originally in the mandala condition the experimenter presented them with 20 mandala options to take home and color and chose 8 of them (Appendix 8); they also rated each of the mandalas they chose (Appendix 9). The instructions and schedule indicated that either for the first and third or second and fourth weeks on Sunday and Tuesday they were to engage in their coloring activity for 15 minutes immediately prior to sleep and on Monday and Wednesday there were to engage in their normal before bed routine. For each night, Sunday-Wednesday, during the four weeks, as soon as they finished coloring or whatever they normally do before bed, they tried to fall asleep. The next morning they recorded whether it seemed to take them 15 minutes or not to fall asleep. Once they had finished the four weeks they should return the results sheet and receive a full debriefing. Due to its optional nature, only three participants completed the sleep portion so there was not enough data to allow for analysis.

Physiological Signal Analysis

We collected heart rate and respiration rate data using Biopac BSL Pro 3.7 software. We recorded each time point as an individual epoch for each participant. We used MATLAB

(Mathworks, Natick, MA) to transform the data from beats per minute to HRV. The heart rate data was analyzed with MATLAB to determine average BPM (Table 1) and R-R intervals and then a MATLAB script further transformed the data to determine root mean square of the successive differences in R-R interval (r-MSSD), a commonly used interval difference measure of HRV relating to respiratory sinus arrhythmia (RSA) (Table 2) (Task Force of The European Society of Cardiology and The North American Society of Pacing and Electrophysiology, 1996).

Analytical Protocol

Once we collected data, we used SPSS to perform statistical analyses. We performed multiple *t*-tests to see if the manipulations were successful based on STAI score (Table 3). Due to the large variation in initial STAI scores, we calculated anxiety reduction as a percentage of original anxiety level (Table 4). Additionally, we analyzed the physiological data using SPSS. We removed one participant for analysis due to unreadable data. Initial analysis showed a linear trend in r-MSSD by epochs so we corrected the data to remove the linear trend (Table 5). We transformed the results of the induction to be fractional differences of the change due to induction divided by initial corrected r-MSSD values (Table 6). We conducted a single subject t-test was to determine if the inductions were successful manipulations. We performed a mixed design ANOVA, using group as a between-subjects factor and the interval condition of whether the anxiety reduction was proceeded by relaxation or coloring as the within-subjects factor, with transformed fractional anxiety reduction values as the outcome measure, to see if there was any difference due to coloring manipulation or the interaction between them. We also conducted a repeated measures ANOVA with the corrected r-MSSD values using the epoch as the within subject factor and the group as the between subject factor. After noting the

small sample size and variation in results, we carried out a nonparametric test to compare

anxiety reduction values based on self-report data.

Results

Manipulation Effect Using Self-Report and Psychophysiology

Initial investigation revealed that control participants did not have different STAI scores after

initial induction (M = 50.00, SE = 6.96) compared to baseline (M = 46.00, SE = 9.60). This

difference, 95% CI [-25.506, 17.506], was not significant ($t(3)$= -0.592, p= 0.596, r= 0.381).

Control participants also did not have different STAI scores after the second induction (M =

48.75, SE = 8.88) compared to baseline (M = 45.75, SE = 8.29). This difference, 95% CI [-

11.319, 5.319], was not significant ($t(3)$= -1.148, p= 0.334, r= 0.564). Furthermore,

experimental participants did not have different STAI scores after initial induction (M = 47.75,

SE = 4.01) compared to baseline (M = 37.50, SE = 1.26). This difference, 95% CI [-21.970,

1.470], was not significant ($t(3)$=-2.783, p=0.069, r= 5.97). Experimental participants did not

have different STAI scores after the second induction (M = 46.25, SE = 2.96) compared to

baseline (M = 40.75, SE = 5.56). This difference, 95% CI [-22.415, 11.415], was not

significant ($t(3)$= -1.035, p= 0.377, r= -0.783). All participants showed lower HRV corrected

r-MSSD values after both inductions (M = -0.2427, SE = 0.0630 compared to the induction

baseline. This difference, 95% CI [-0.397, -0.088], was significant ($t(6)$= -3.846, p= 0.009, r=

2.621).

ANOVA Using Self-Report, Together With Other Tests

Further investigation using a mixed design ANOVA showed no statistically significant

difference due to group, ($F(1,6)$ = 0.175, p = 0.690, r = 0.168) or interval, ($F(1,6)$ = 0.577, p =

0.476, r = 0.296) or any interaction between them ($F(1,6)$ = 0.078, p = 0.790, r = 0.113)

(Figure 1). Follow up investigation using a Related Sample Wilcoxon Signed Rank model of

transformed anxiety reduction moreover showed no significant difference in anxiety reduction

between the control condition and the coloring manipulation for the control (*Mdn* = -0.013, *T* = 4, *p* = 0.715, *r* = -0.130) as well as the experimental group (*Mdn* = -0.053, *T* = 2, *p* = 0.273, *r* = -0.387).

ANOVA Using Psychophysiology, Together With Other Tests

For the repeated measures ANOVA, Mauchly's test indicated that the assumption of sphericity had been violated, ($\chi 2(9) = 19.90, p = 0.044$), therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon = 1.00$). The results showed no statistically significant difference due to group, ($F(1,4) = 0.089, p = 0.781, r = 0.149$) or epoch, ($F(1,4) = 1.643, p = 0.212, r = 0.539$) or any interaction between them ($F(1,4) = 2.609, p = 0.075, r = 0.628$) on anxiety levels as measured by HRV.

Discussion

The results of the study did not allow for rejection of the null hypothesis. Coloring a mandala did not reduce self-reported anxiety significantly more than free coloring, judging from tests conducted on both physiological and self-report data. Additionally, both coloring conditions did not reduce self-reported anxiety significantly more than simply relaxing. Analysis also revealed that as a manipulation check, the induction procedure did not significantly raise anxiety levels across all participants for self-report measures but physiological data did show a significant, successful manipulation of anxiety by induction. The results of this study suggest that coloring, either free form or of a mandala are not different or better than passive relaxation for anxiety reduction.

Interestingly, the numerical data for both self-report and physiology did show an increase in self-reported anxiety following inductions as well as a greater decrease in anxiety levels following coloring than passive relaxation as well as a greater reduction of anxiety for mandala coloring compared to free coloring. While the data did show numerical differences, none of the statistical measures showed any significant results, which does not allow us to draw any conclusions from the data.

It is curious to note that self-report data differed from physiological data. Although most all of the data was non-significant, physiology showed a successful manipulation while self-report data did not. While both types of data measure anxiety, it is clear that they are not measuring the same thing. We can explain some of the difference because completing the self-report questionnaires requires conscious action while the physiology recording requires no conscious participation from the participant. This could suggest that the conscious experience of anxiety may differ from the body and brain's processes.

Research has shown art making and art therapy to be effective in reducing anxiety (Bell and Robbins, 2007; Sandmire, Gorham, Rankin and Grimm, 2012; Walsh, Martin and Schmidt, 2004; Nainis, Paice, Ratner, Wirth, Lai and Shott, 2006; Svensk, Öster, Thyme, Magnusson, Eismann, Åström and Lindh, 2009; Curry and Kasser, 2005; van der Vennet and Serice, 2012). Similar research did show significant differences when comparing mandala coloring to free-form coloring, however those studies failed to use a passive control condition (Curry & Kasser, 2005; van der Vennet and Serice, 2012). Mandala coloring may have reduced anxiety significantly more than free-form coloring but the reduction was not compared to a passive relaxation or reduction condition, which may have reduced or limited the significance of the resultant difference. The fact that this past research did not use within subject designs may have lead them to draw false conclusions. It is important to note that randomization of participants does not always ensure matching participant groups. The assumption that randomization ensures matching may have lead to a misattribution on differences, with the authors attributing the differences to the experimental versus control condition and not to the fact that participant population were different. Because the results of this study were non-significant, we cannot consider the results of this study a contradiction of previous research but they may suggest possibly adapted procedures, with within subject designs for further studies.

We need to address several limitations of this study when considering the results and when conducting future research. The main limitation is the sample size; only having 4 participants in each group made it distinctly difficult to produce any significant result. Following the same procedure with a sample size of at least 20 participants per group would likely yield more significant results. Additionally, the participants in this study were all

undergraduate women, which doesn't allow for generalization of results to a broader

population. Furthermore, all the recruited participants lacked anxiety disorders, thus

eliminating the ability to contextualize these results in terms of a population who may

distinctly benefit from the activity. We believe further research would benefit from a larger,

more diverse participant group and would allow for more applicability and generalizability of

the results to the population at large.

Tables and Graphs

Table 1: Mean Beats per Minute (BPM) for participants at each of the time points.
T1=Baseline, T2=Post Initial Induction, T3= Post Passive Control, T4= Post Second
Induction, T5=Post Coloring Conditions

Time Point	BPM Mean ± SD T1	BPM Mean ± SD T2	BPM Mean ± SD T3	BPM Mean ± SD T4	BPM Mean ± SD T5
Control	87.65±12.42	86.65±11.61	83.97±9.64	84.58±9.90	85.64±9.98
Experimental	88.26±10.49	84.25±11.39	82.66±0.90	77.06±5.32	77.45±7.52

Table 2: Mean root Mean Square of the Successive Differences in RR interval (rMSSD) for
participants at each of the time points. T1=Baseline, T2=Post Initial Induction, T3= Post
Passive Control, T4= Post Second Induction, T5=Post Coloring Conditions

Time Point	rMSSD (ms) Mean ± SD T1	rMSSD (ms) Mean ± SD T2	rMSSD (ms) Mean ± SD T3	rMSSD (ms) Mean ± SD T4	rMSSD (ms) Mean ± SD T5
Control	3.39±1.94	3.67±1.94	4.47±2.17	N/A	4.20±1.85
Experimental	2.07±0.70	2.84±1.10	5.39±2.61	4.00±0.82	5.89±2.30

Table 3: Mean State Trait Anxiety Inventory (STAI) for participants at each of the time points.
T1=Baseline, T2=Post Initial Induction, T3= Post Passive Control, T4= Post Second
Induction, T5=Post Coloring Conditions

Time Point	T1 Mean ± SD (STAI score)	T2 Mean ± SD (STAI score)	T3 Mean ± SD (STAI score)	T4 Mean ± SD (STAI score)	T5 Mean ± SD (STAI score)
Control	46.00±19.20	50.00±13.93	45.75±16.58	48.75±17.77	38.00±8.29
Experimental	37.50±2.52	47.75±8.02	40.75±11.12	46.25±5.91	35.75±3.30

Table 4: Decrease in anxiety following passive control as a percentage of initial STAI anxiety
levels, $(\frac{T3-T2}{T1})$, for all participants as well as decrease in anxiety following either active control
or experimental anxiety reduction conditions, $(\frac{T5-T4}{T1})$.

	Induction 1 Mean ± SD	Induction 2 Mean ± SD
Control	-0.153 ± 0.263	-0.197 ± 0.186
Experimental	-0.178 ± 0.188	-0.271 ± 0.197

Table 5: Corrected mean root Mean Square of the Successive Differences in R-R interval
(rMSSD) for participants at each of the time points. T1=Baseline, T2=Post Initial Induction,
T3= Post Passive Control, T4= Post Second Induction, T5=Post Coloring Conditions

Time Point	rMSSD (ms) Mean ± SD T1	rMSSD (ms) Mean ± SD T2	rMSSD (ms) Mean ± SD T3	rMSSD (ms) Mean ± SD T4	rMSSD (ms) Mean ± SD T5
Control	4.76±1.94	4.07±1.10	4.97±2.61	N/A	3.30±2.30
Experimental	3.44±0.70	3.24±1.10	5.89±2.61	3.80±0.82	4.99±2.30

Table 6: Decrease in anxiety following passive control as a percentage of initial corrected r-MSSD anxiety levels, $(\frac{T3-T2}{T1})$, for all participants as well as decrease in anxiety following either active control or experimental anxiety reduction conditions, $(\frac{T5-T4}{T1})$.

	Induction 1 Mean ± SD	Induction 2 Mean ± SD
Control	-0.144 ± 0.152	-0.132 ± 0.058
Experimental	-0.064 ± 0.208	-0.627 ± 0.546
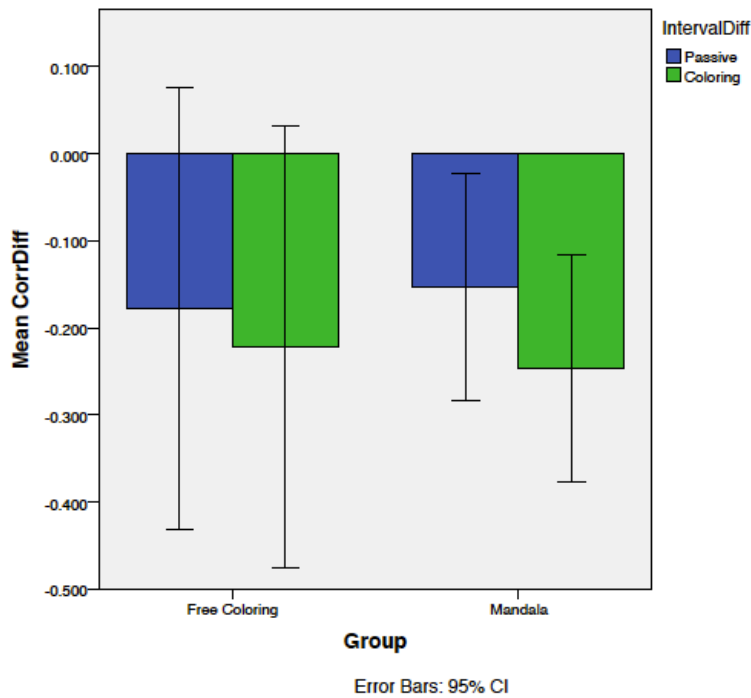
Figure 1: Plot of mean normalized corrected differences after both passive control condition and coloring manipulation for both the control and experimental groups on self-reported anxiety. Error bars represent 95% confidence intervals.

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Appendix

Induction:
At this moment, I would like you to recall a moment in your life when you felt especially anxious. I would like you to think about the moment and try to put yourself back into that moment and try and recall details of that event. I would then like for you to take 4-5 minutes and write about that experience and the anxiety you felt below.
Reinduction:
This time, I would like you to recall a different moment in your life when you felt especially anxious. I would like you to think about the moment and try to put yourself back into that moment and try and recall details of that event. I would then like for you to take 4-5 minutes and write about that experience and the anxiety you felt below.

Appendix 1: Induction and Reinduction Instructions
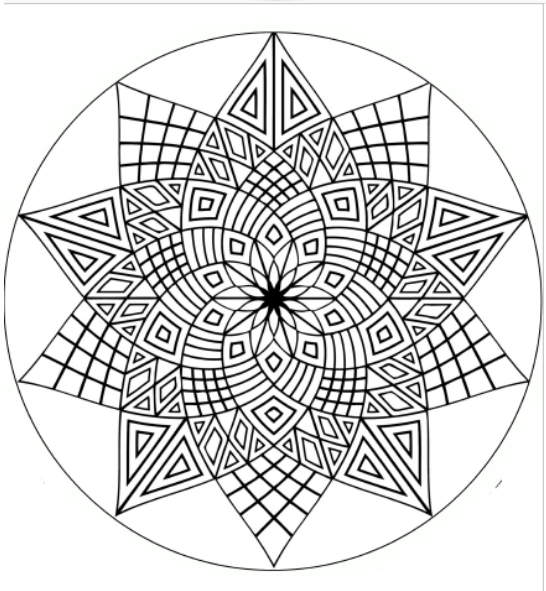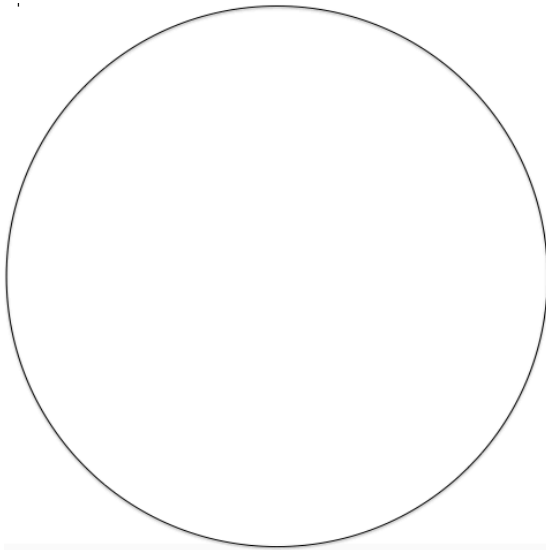
Appendix 2: Coloring form and mandala for active control and experimental coloring conditions

SELF-EVALUATION QUESTIONNAIRE   STAI Form Y-1

Please provide the following information:

ID _____   #

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

SELF-EVALUATION QUESTIONNAIRE
STAI Form Y-2

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Appendix 3: State Trait Anxiety Inventory

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way now. Use the following scale to record your answers:

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

_____ cheerful	_____ sad	_____ active	_____ angry at self
_____ disgusted	_____ calm	_____ guilty	_____ enthusiastic
_____ attentive	_____ afraid	_____ joyful	_____ downhearted
_____ bashful	_____ tired	_____ nervous	_____ sheepish
_____ sluggish	_____ amazed	_____ lonely	_____ distressed
_____ daring	_____ shaky	_____ sleepy	_____ blameworthy
_____ surprised	_____ happy	_____ excited	_____ determined
_____ strong	_____ timid	_____ hostile	_____ frightened
_____ scornful	_____ alone	_____ proud	_____ astonished
_____ relaxed	_____ alert	_____ jittery	_____ interested
_____ irritable	_____ upset	_____ lively	_____ loathing
_____ delighted	_____ angry	_____ ashamed	_____ confident
_____ inspired	_____ bold	_____ at ease	_____ energetic
_____ fearless	_____ blue	_____ scared	_____ concentrating
_____ disgusted with self	_____ shy	_____ drowsy	_____ dissatisfied with self

Appendix 4: PANAS Scale

MARCH 2016

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20 Color	21 Normal	22 Color	23 Normal	24	25	26
27 Normal	28 Color	29 Normal	30 Color	31	1	2

April 2016

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3 Color	4 Normal	5 Color	6 Normal	7	8	9
10 Normal	11 Color	12 Normal	13 Color	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
Notes						

Appendix 5: Sample coloring calendar for sleep portion

Instructions:

You have been given a calendar that starts this Sunday. On it are marked days in which you should color and days in which you should follow your normal before bed routine. You should color for 15 minutes immediately before going to sleep while trying to limit other distractions. As soon as you are done coloring you should turn off the light. The next morning you should record whether you colored or not and whether you think it took you under or over 15 minutes to fall asleep on the given sheet. Once your 4 weeks are done, please contact me to return the sheet and receive a full debriefing.

Please contact me if you have any questions during the process.

HTaylor5372@Scrippscollege.edu

Appendix 6: Sleep Instructions

ID #____

For each night of the week, please record the next morning.
Circle whether you colored or whether it was a normal night and then check whether you think it took under or over 15 minutes to fall asleep.

| Week 1	Sunday- Color/Control		Monday Color/Control		Tuesday Color/Control		Wednesday Color/Control	
	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min
Week 2	Sunday Color/Control		Monday Color/Control		Tuesday Color/Control		Wednesday Color/Control	
	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min
Week 3	Sunday Color/Control		Monday Color/Control		Tuesday Color/Control		Wednesday Color/Control	
	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min
Week 4	Sunday Color/Control		Monday Color/Control		Tuesday Color/Control		Wednesday Color/Control	
	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min	Under 15 min	Over 15 min

Appendix 7: Sleep portion participant result form
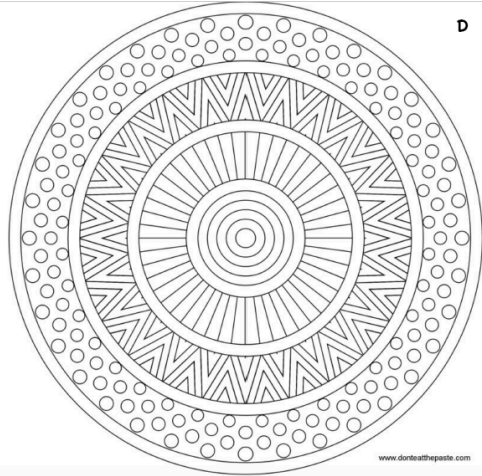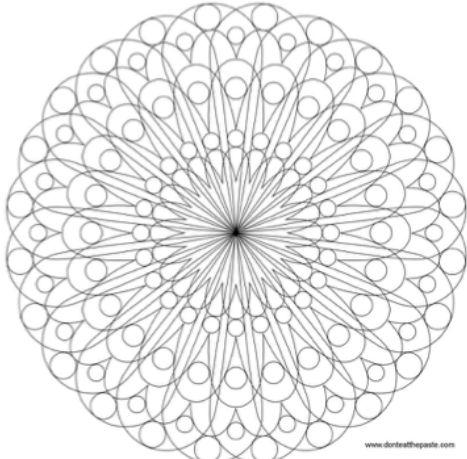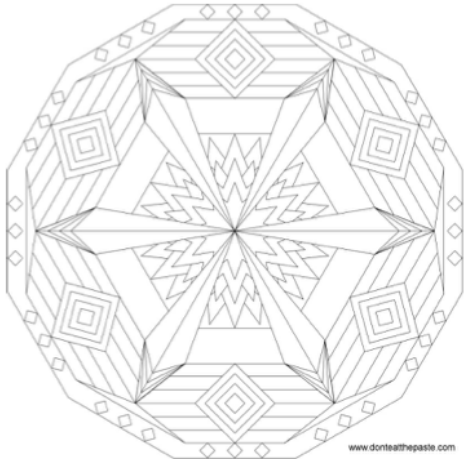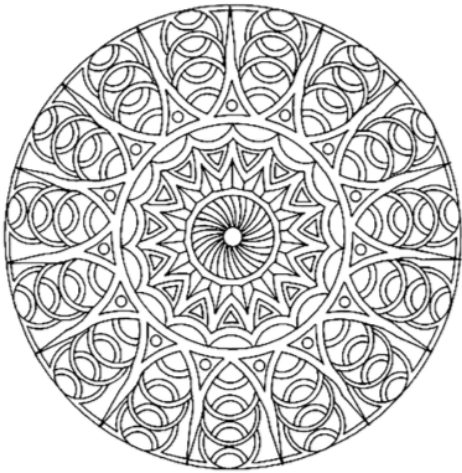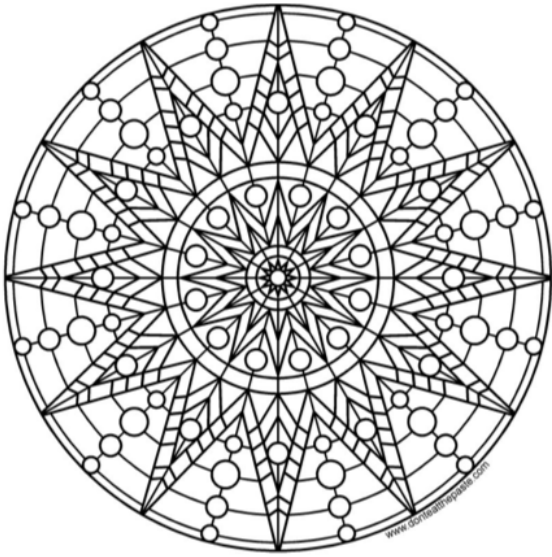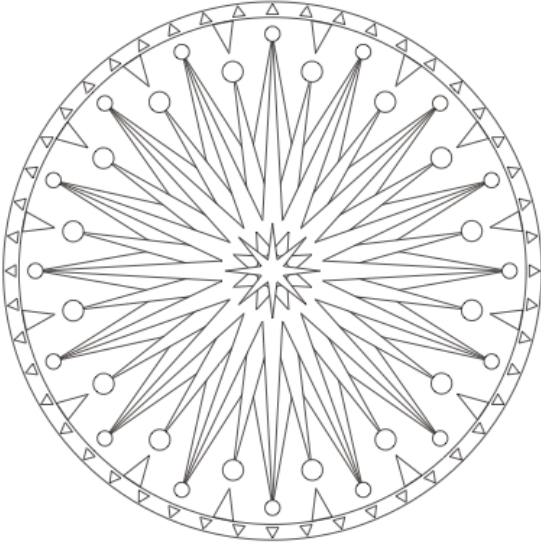
Nr.084© www.mandala-4free.de, O.Tölge
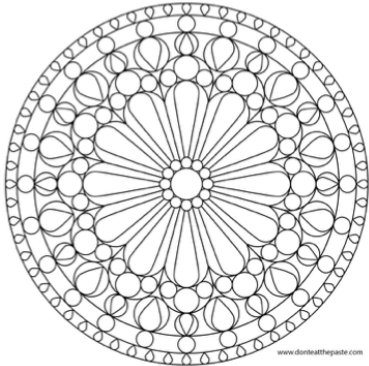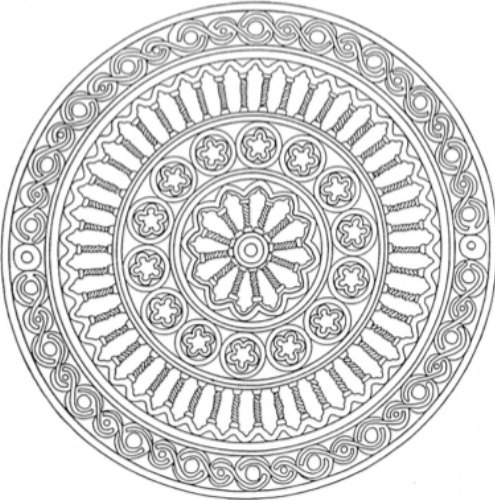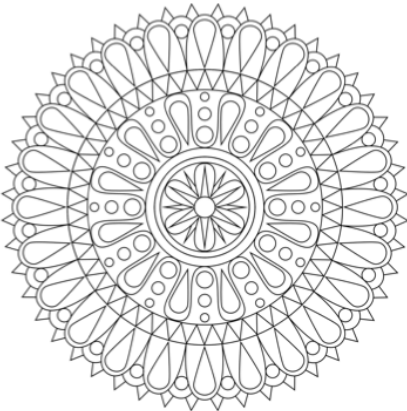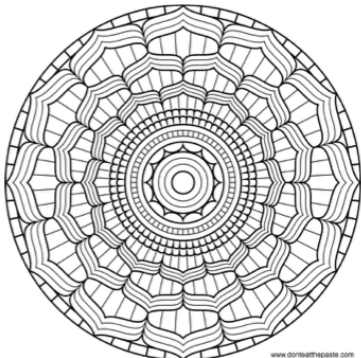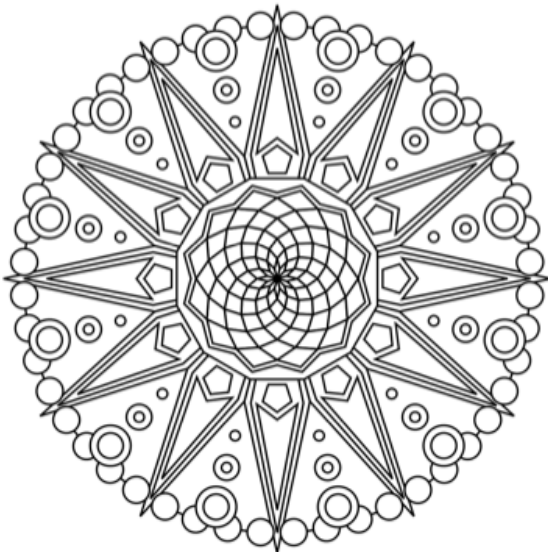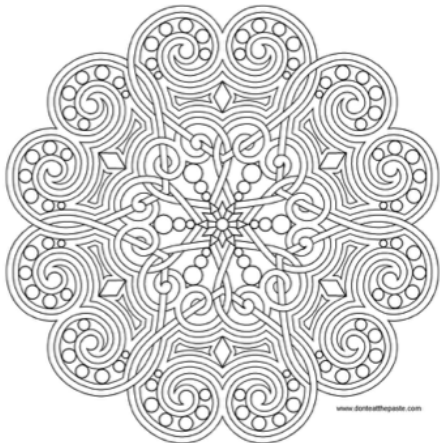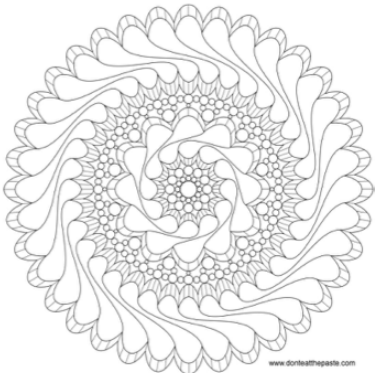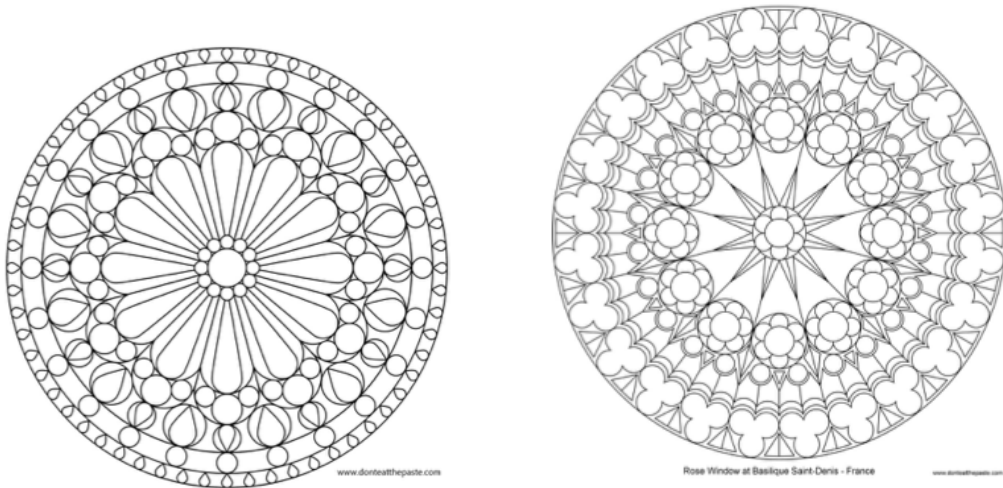
Appendix 8: Sleep portion mandala options

Please rank each of the 8 mandalas you chose on each of the three scales

Mandala ID-									
	1	2	3	4	5	6	7	8	
	Not at all attractive						Very attractive		
How attractive is it?									
	Not at all interesting						Very Interesting		
How interesting is it?									
	Do not like at all						Like very much		
How much do you like it?									

Appendix 9: Mandala rating scale