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# The relationship between cognitive inhibition, mental illness, and creativity

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# THE RELATIONSHIP BETWEEN COGNITIVE INHIBITION, MENTAL ILLNESS, AND CREATIVITY

by
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## Abstract

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The current study explored how the symptom severity of the affective and schizophrenia spectrums related to performance on a divergent thinking task and self-reports of creative achievement, as well as the contribution of cognitive inhibition as a moderating factor between these variables. 98 participants completed a 1.5 hour battery of tests that combined measures between this study and another study. Measures pertaining to this study included self-report measures of schizotypy and hypomania, a divergent thinking creativity task, a computerized stimuli-response task, and two self-reports of creative achievement. Correlations were conducted to examine linear relationships, nonlinear regression models were conducted to consider the presence of an inverted U-shaped relationship between mental illness and creativity, and hierarchical regression models were conducted to examine the potential of cognitive inhibition as a moderating factor. Results indicated mixed relationships between psychopathology and creativity with some significance between positive schizotypy and creativity, and the moderation of cognitive inhibition with hypomania.

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# Chapter 1

## Introduction and Literature Review

*The Starry Night* painting by Van Gogh, the album *Lithium* by Nirvana written mostly by Kurt Cobain, and the movie *Hell's Angels* produced by business tycoon Howard Hughes. These are all examples of creative, varied, and well-known works. As can be evidenced by the wide variety of works qualified as creative, creativity can be difficult to encompass in one definition. For the purpose of research, creativity has been defined as the ability to create novel and appropriate works, such as architecture, paintings, song lyrics, and plays (Rybakowski, Klonowska, Patrzala, & Jaracz, 2008). Although they vary in media (painting, music, film), they share one further commonality beyond belonging to the creative realm: they were all created by individuals with mental illness. The presence of mental illness in individuals who produce creative works does not appear to be novel or unusual and recent research has focused on the potential link between creativity and psychopathology.

One recent influential study examined rates of mental illness across different careers and found that creative writers were four times more likely to be diagnosed with a bipolar disorder and eighty percent of writers are diagnosed with a mood disorder (Andreasen, 1987). Since this time there has been a sharp increase in research examining the link between creativity and psychopathology. Interestingly, findings similar to Andreasen's initial research have been reported in a contemporary study where poets and artists demonstrated higher levels of schizotypy (i.e., sub-clinical characteristics associated with risk for schizophrenia) (Nettle, 2006). The mental illness-creativity link

with these disorders becomes even more interesting when considering the similarities that have been found between these two specific spectrums (schizophrenia and bipolar). As this paper will describe, there is a possibility that the strikingly similar relationship between creativity and these disorders as well as similar symptom manifestations across these disorders provide additional pieces of evidence that these disorders may exist on a single continuum. This line of thinking is supported by contemporary genetics research that suggests that schizophrenia-spectrum and bipolar affective disorders are highly co-occurring within family systems (APA, 2013; DSM-5). Given this information, there is clearly an impetus for additional research on the relationship between mental illness and creativity.

**Creativity and Links to Specific Domains of Psychopathology**

The relationship between psychopathology and creativity appears to be most robust when there is an abnormal elevation of mood (e.g., hypomania) and/or the presence of psychosis (Claridge & McDonald, 2009; Rodrigue & Perkins, 2012; Rybakowski & Klonowska, 2011). Results have been mixed when considering these disorders, but the overall trend has been that the presence of psychosis and/or mania are related to increased creativity, although severe levels appear to be detrimental to creative flow (Richards, Kinney, Lunde, Benet, & Merzel, 1988; Akiskal & Akiskal, 1988; Ghadirian, Gregoire, & Kosmidis, 2001). This relationship has been hypothesized to be an inverted-U, where mild or moderate levels of symptoms coincide with higher levels of creativity but severe levels are related to lower levels (Richards et al., 1988). The inverted-U relationship has been described independently in the schizophrenia-spectrum and mania literatures.

In the schizophrenia literature, it is important to note that the relationship with creativity appears to apply only to the predominance of "positive" symptoms (e.g., delusions, hallucinations) and not the "negative" symptoms (e.g., social withdrawal, apathy) (Jones, Caulfield, Wilkinson, & Weller, 2011; Nettle, 2006). This is possibly due to similarities in the thinking patterns of individuals experiencing positive symptoms and creative individuals. Both creative thought and the disordered thought inherent in the positive symptoms of schizotypy appear to behave through similar mechanisms. For example, both creativity and the positive symptoms of schizotypy entail seeing the world in novel ways. An individual who is creative may walk down a crowded street and suddenly have the inspiration to write a story about a woman fleeing a similarly crowded street from a villain. An individual prone to positive psychosis may walk down the same crowded street and suddenly have the idea that they need to flee because someone is following them despite there being no evidence of such a threat. These creative and disordered thoughts appear to be generally similar in that they both occur quickly in the mind and become fully formed into ideas (Carson, 2011). Despite these similarities, it does appear that severe symptom severity in schizophrenia is associated with extreme functional impairment, thought disorder, and loss of contact with reality. Generally, even basic self-care is difficult when symptoms are severe, often leading to hospitalization. Not surprisingly, there are few opportunities to engage in creative endeavors/processes when symptoms reach a certain threshold. However, the threshold for impairment (vs. potential benefits of novel perception/thinking) is not well defined in schizotypy, which does not involve severe functional impairment.

In the mania literature, usually in studies of Bipolar Affective Disorder (BPAD), greater levels of creativity have been observed in individuals with symptoms of mania (Claridge & Blakey, 2009; Jamison, 1989) and in the first-degree relatives of symptomatic individuals (Richards et al., 1988).Symptom severity issues are also very relevant for mania where severe symptoms may also involve functional impairment and hospitalization. Mania involves elevated or irritable mood accompanied by an increase in goal-directed activity, self-esteem, distractibility, flight of ideas, pressured speech, risky behavior, and difficulty sleeping (American Psychiatric Association [APA], 2013). Up to a certain point, these symptoms may appear to facilitate creative processes. The term "hypomania" refers to a less severe manifestation of mania that is comprised of the same symptoms but with a shortened duration of four days instead of one week (APA, 2013) and has been found to be positively related to the individual's ratings of their creativity (Furnham et al., 2008). Hypomanic episodes may better facilitate creative thought because they are less severe than manic episodes. One study found that the length of manic illness coincided with lower levels of creativity (Simeonova, Chang, Strong, & Ketter, 2005), suggesting that the longer duration of mania may result in lowered creativity than that of hypomania. Further, results from a study by Ghadirian, Gregoire, and Kosmidis (2001) suggests that a mild to moderate form of a bipolar disorder may result in higher creativity than more severe forms. These studies support the idea of inverted-U relationship with creativity in mania/ hypomania, although additional research is still needed to overcome methodological shortcomings of the research literature (Waddell, 1998).

This similar inverted U-shaped relationship between levels of symptoms and creativity in the schizophrenia and mania literatures is intriguing in other ways. The DSM-5 was recently re-organized to reflect a stronger relationship between schizophrenia-spectrum disorders and BPAD based largely on familial overlap of the disorders, suggesting shared biological underpinnings (APA, 2013). In support of this view, one study found higher levels of schizotypy in individuals with BPAD than in comparable controls (Heron et al., 2003). Therefore, it is highly likely that the similarities in the shape of the relationships among hypomania, schizotypy, and creativity are explained by these disorders existing on a single spectrum versus two separate spectrums (Barrantes-Vidal, 2004). The similarities between these disorders may account for the similarities in the form of the relationship between these mental illnesses and creativity.

However, these relationships noted between these disorders and creativity may vary when considering how creativity is being defined. The concept of creativity can vary from the creation of artistic works to mathematics. Due to the wide range of works that are considered to be creative, it becomes difficult to solidify a concrete definition of creativity. The "innovative" element of creativity is of particular interest since it involves for the production of works that are inspiring and useful. Recent research in the field has generally agreed to the conceptualization of creativity as ideas, actions, or works that are both appropriate and applicable (e.g., Rybakowski et al., 2008).Creativity has generally been broken down into two categories: everyday creativity and eminent creativity (Richards, 2000-2001).Eminent creativity entails those creative acts which are notably famous or pertinent to society, such as the artistic paintings of Van Gogh or the construction of the Golden Gate Bridge. This type of creativity is less common and is

marked by significant creative achievements that are acknowledged by society (Richards, 2000-2001). The other form of creativity is *everyday creativity*, or trait creativity, which consists of creative acts that emerge while engaging in day-to-day activities reflecting originality of thought and significance (Richards, 2000-2001). This form of creativity is much more common and is what recent research tends to focus on. Due to the small amount of individuals who fall into the "eminent creativity" category, it has been argued that this type of creativity should not be a mandatory criterion when measuring creativity (Santosa et al., 2007).

Further, researchers have used a variety of ways to measure creativity such as creative achievement, biographical creativity, and creativity as personality (Barrantes-Vidal, 2004). While it is difficult to precisely measure creativity due to the wide range activities that humans perform, several attempts have been made to identify the underlying processes that contribute to creative acts. For example, divergent thinking is a term used to describe fluency, flexibility, and originality aspects of creative thinking (Jones et al., 2011). Divergent thinking tasks such as the Wallach and Kogan Creativity Tests (Wallach & Kogan, 1965) are widely used as measures of creative ability or as measures of creative potential (Runco, 2008). Divergent thinking tasks tend to focus on two aspects when measuring creativity: fluency and uniqueness. In the case of the Wallach and Kogan battery, fluency is calculated by adding together the total number of answers given to the prompt, whereas uniqueness is calculated by adding together the number of items unique in the group of participants (Wallach & Kogan, 1965).

Creative achievement is also often used a measure of creativity through measuring the degree of creative acts achieved during the lifetime. This taps into the idea

of eminent creativity, where the creative acts are considered to be achievements through the subjective lens of society versus the individual's objective view (Lloyd-Evans, Batey, & Furnham, 2006, p. 117). This type of creativity differs significantly from the divergent thinking forms of creativity. Whereas divergent thinking entails originality and fluency, creative achievement focuses on the degree of achievement in the creative fields, an example being the Creative Achievement Questionnaire (CAQ) which focuses on different areas of creativity and individuals endorse achievements in each area (Carson, Peterson, & Higgins, 2005).

In addition to the definition and measurement of creativity, the direction of the relationship between mental illness and creativity is pertinent to the study of psychopathology and creativity. It has been proposed that creativity may cause psychopathology but it has also been proposed that psychopathology may lend to creative abilities (Richards, 2000-2001). However, recent research has proposed that the relationship is more likely bidirectional, with both factors affecting each other (Runco, 1991), and that there is likely a third unidentified variable that explains this relationship (Barrantes-Vidal, 2004). Although this third variable has been posited to be a number of different factors, such as intelligence (Benedek, Franz, Heene, & Neubauer, 2012) and emotional intelligence (Guastello, Guastello, & Hanson, 2004), there has been no overwhelmingly conclusive evidence.

Although the true identity of a third, moderating variable between mental illness factors and creativity is unclear, research suggests that a reduction in cognitive inhibition may account for some of the relationship between these variables. Cognitive inhibition is a cognitive mechanism whereby stimuli that are not relevant are suppressed from

conscious awareness (Green & Williams, 1999). Eysenck (1993) suggested that the relationship may be the result of over-inclusive thinking or lowered cognitive inhibition which has been noted in both creative individuals and those with schizotypy, although the same relationship has not been noted in the literature on affective disorders. With regards to schizotypy, individuals higher in schizotypy were found to have lower cognitive inhibition in a study that used a negative priming task (Beech & Claridge, 1987), adding to the research that suggests these individuals have this more over-inclusive thinking style. Due to their lowered inability to inhibit information, individuals with this type of thought pattern should be able to produce both creative answers and more answers when completing a measure of creativity such as a divergent thinking task (Green & Williams, 1999). Specifically, this relationship has been noted with the positive aspect of schizotypy (Peters et al., 2000), similarly to the relationship between schizotypy and creativity, and may only exist when the level of psychopathology is not too severe (Barrantes-Vidal, 2004). The relationship of reduced cognitive inhibition as a moderating factor remains unclear due to mixed results in the literature. This emphasizes the need for further research considering the role of reduced cognitive inhibition in moderation between mental illness and creativity. Thus, the current study aimed to examine the relationship between cognitive inhibition, schizotypy, hypomania, and creativity in the form of divergent thinking and creative achievement in order to add to the current literature on the subject.

Given the literature on schizotypy, hypomania, creativity, and cognitive inhibition, the following two hypotheses were proposed for the current study:

Hypothesis #1 stated that creativity would have an inverted U-shaped relationship with schizotypy and hypomania, where moderate levels of both traits would result in increased creativity and more severe traits or no traits would have decreased creativity. Sub-hypothesis (A) stated that this inverted-U relationship would be present for the positive symptom spectrum of schizotypy but not for the negative symptom spectrum.

Hypothesis #2 predicted that cognitive inhibition would act as a moderator between hypomania and creativity, and schizotypy and creativity. It was postulated that the relationship among creativity, schizotypy, and hypomania might only exist when there is reduced cognitive inhibition. Despite research indicating that schizotypy and hypomania/ mania exist on a single continuum, they were considered to be separate constructs for the current study. This is because these constructs continue to be considered separate disorders and are given different sections in the current diagnostic system, the DSM-5. However, as a sub-hypothesis (A), schizotypy and hypomania were added together in a single step in an exploratory regression model to examine their unique contribution to creativity when combined (i.e., through examining the beta weights within the resulting model). It was believed that this would provide us with some information about the shared variance between these constructs. The final step in this exploratory model contained cognitive inhibition

For the purpose of this study, a divergent thinking measure has been chosen for the measure of creativity in addition to two measures of creative achievement. An exploratory element of this project will involve the examination of how symptoms of hypomania and schizotypy relate to different elements of creativity (i.e., creative achievement and divergent thinking). It is hoped that this research will add to the current

literature in further clarifying the relationship between these mental illnesses, creativity, and cognitive inhibition through its use of multiple measures of creativity and mental illness.

# Chapter 2

# Methods

## Participants

The participants consisted of 100 undergraduate students from a medium-sized public university in New Jersey recruited through the electronic system SONA.The estimate of the necessary sample size for this study was acquired by using the G-power program and a hypothesized effect size of .8 was acquired (Bora, Yücel, & Pantelis, 2010). With an anticipated power of .8, 52 participants would have been required to identify the effect. There was 1 participant that was removed from the dataset due to a z-score exceeding 10 on the Creative Achievement Questionnaire (CAQ). Five additional participants had z-scores that exceeded an absolute value of 3 on different measures (CAQ, WKCT alternate uses, WKCT pattern meaning, WKCT line meaning, Stroop 3 task) but were retained in the dataset due to there being no obvious difference in their data administration per the guidelines discussed in Stevens (2009). In addition, one participant was removed for missing more than 10% of the data on a single measure, the CAQ, in the addition to missing data (less than 10%) on additional measures. The sample thus consisted of 98 participants (67.3% female, n=66) with a mean age of 19.79 years ranging from 18 to 51 years. The majority of the sample (70.4%, n=69) identified as White, 14.3% as African American (n=14), 8.2% as Hispanic (n=8), 3.1% as Asian-Pacific Islander (n=3) and 4% as Other or Multiracial (n=4). Please see Table 1 for a summary of this information. The racial/ ethnic demographic percentages are comparable

to that of the student population at the university. All participants recruited had to be age 18 or older.

Table 1

*Demographic information for Sample (n=98)*

| Variable | *f* (%) or *M* (SD) | Range |
|---|---|---|
| Age[a] | 19.79 (3.99) | 18-51 |
| Gender | | |
| Male | 32 (32.7%) | |
| Female | 66 (67.3%) | |
| Ethnicity | | |
| White | 69 (70.4%) | |
| African American | 14 (14.3%) | |
| Hispanic | 8 (8.2%) | |
| Asian-Pacific Islander | 3 (3.1%) | |
| Multiracial/ Other | 4 (4%) | |

*Note*. Standard deviations (SD) are stated for continuous variables and frequencies (%) for categorical variables.
[a] Data includes 97 of the 98 participants

**Measures**

**Demographics**. A basic demographic questionnaire created by the primary researcher was administered to all participants as the first measure in the battery. Participants were asked to report their age, gender, and race/ethnicity according to U.S. census categories. In addition, participants were asked to respond to three questions inquiring about any previous treatment for themselves or their family members for mania, hypomania, or a psychosis spectrum disorder in a YES/ NO format.

**Schizotypal Personality Questionnaire – Brief Revised (schizotypy).** The Schizotypal Personality Questionnaire – Brief Revised (SPQ-BR) is a 32-item self-report measuring schizotypy (Cohen, Matthews, Najolia, & Brown, 2010). Participants are instructed to endorse an item on a 5-point Likert scale from one to five (strongly disagree to strongly agree). Higher scores on the measure are suggestive of higher levels of schizotypy.

Psychometrics for the scale are reported to be strong, with an internal consistency for the subscales reported to vary from $\alpha$=.80 to $\alpha$=.90 (Cohen et al., 2010). In addition, all subtests were positively and significantly correlated with each other. Further research maintains that the measure has some structural validity and construct validity, as well as strong internal reliability (Callaway, Cohen, Matthews, & Dinzeo, 2014).

For the current study, this measure was used as one of the two measures of schizotypy. The scale can be separated into three separate subscales: cognitive perceptual which entails the positive symptom spectrum of schizotypy, disorganization which measures the disorganized symptom spectrum, and interpersonal which measures the negative symptoms (Callaway et al., 2014). In this study, these factors were created and considered in the analyses. The use of the subscale cognitive perceptual was used to test the sub-hypothesis of our first hypothesis considering positive schizotypy.

**Oxford-Liverpool Inventory of Feelings and Experiences short form (schizotypy).** The Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) short form is a 43-item self-report measure of schizotypy that consists of four subscales: Unusual Experiences (12 items) that focuses on the positive symptoms of schizotypy,

Cognitive Disorganization (11 items) that focuses on disorganization and thought disorder symptoms, Introvertive Anhedonia (10 items) which considers symptoms similar to the negative symptoms of schizotypy, and Impulsive Nonconformity (10 items) which considers symptoms similar to a lack of control such as impulsive or eccentric behavior (Mason, Linney, & Claridge, 2005). Each item is answered with a "yes" or a "no" answer. Points are given for the "yes" answers and no points for the "no" answers except for five of the Introvertive Anhedonia items and three of the Impulsive Nonconformity items which are reverse-scored. The points are then tallied for a single total schizotypy score, or can be tallied together for each subscale.

This shorter scale proposed by Mason, Linney, and Claridge (2005) has adequate internal consistency. Internal consistency was noted to range between $\alpha$=.62 and $\alpha$=.80 for the four subscales. In addition, concurrent validity scores with the original O-LIFE measure ranged between .90 and .94. It is advised that this shorter version of the O-LIFE only be used in non-clinical settings (Mason et al., 2005). Since the study was performed on a nonclinical sample, it is believed that this shorter scale is applicable to the current study. This measure was used as a second measure for schizotypy in addition to the SPQ-BR. Both measures were included due to their use in previous research regarding the relationship between schizotypy and creativity. Further, the inclusion of the O-LIFE short form is due to its ability to be broken into four subscales thus allowing positive schizotypy to be considered and analyzed separately from the remaining items.

**Hypomania Checklist-32 (hypomania).** The Hypomania Checklist-32 (HCL-32) is a 32-item self-report measure that aims to identify hypomania as a means of screening for bipolar disorders (Angst et al., 2005). The items are broken down into nine questions

with question number four determining which, if any, further questions need to be answered. These items are a combination of Likert scale items of varying numerical lengths, check boxes, yes/ no items, and one fill-in-the-blank. This measure was used as the only measure of hypomania for the study, and the total calculated score was examined for all analyses (correlation, nonlinear regression, and hierarchical regression). Total scores were calculated by summing the number of items endorsed on the symptom checklist portion of the measure.

The original measure was tested with outpatient individuals and in psychiatric clinics in Italy and Sweden respectively, but the positive and negative predictive numbers suggest that the measure should be able to be administered in a community setting (Angst et al., 2005). In the original study, Cronbach's alpha was reported as ranging from 0.75 to 0.83 for the Italian sample and ranging from 0.72 to 0.86 for the Swedish sample (Angst et al., 2005). In order to distinguish between MDD and BPAD, it is recommended that a cutoff score of 14 is used as the specificity is 51% and the sensitivity is 80% at this cutoff (Angst et al., 2005). Despite being able to distinguish between MDD and BPAD, the HCL-32 was shown to be unable to distinguish between BPAD-I and BPAD-II with regards to the subscales. However, for the purpose of this study, it was not necessary to distinguish between these two disorders.

**Wallach Kogan Creativity Tests (creativity – divergent thinking).** The Wallach Kogan Creativity Tests (WKCT) consist of five tests that aim to measure creativity abilities as defined by originality and fluency (Wallach & Kogan, 1965). The tests include instances, alternate uses, similarities, pattern meaning, and line meaning with the first three tests being verbal in nature and the remaining two figural. Each test

consists of a different number of items and should be administered without a time limit to allow the maximum amount of responses from the participant. The original measure was intended for use with children. However, several studies have confirmed there is high internal consistency for this measure with adult college populations (Cropley, 1968; Cropley & Maslany, 1969).

For the purpose of this study, only three of the five tests will be used: pattern meaning, line meaning, and alternate uses. Alternate uses tasks are verbal tasks where participants are given a prompt such as "type all the things you could do with a chair" and then proceed to record all of the different uses for the chair. Pattern meaning and line meaning differ from alternate uses in that they require a picture prompt. Participants are presented with a card with either a pattern (pattern meaning) or a line drawing (line meaning) and asked to "type all the things you think that could be," then record what they believe the image could be. It has been found that alternate uses and instances are very similar to each other, and thus there is no added benefit to having both tests in the battery (Silvia et al., 2008). In addition, only three items were used from each of these tests due to time constraints.

Further, Wallach and Kogan (1965) state that their measures should be administered in an untimed manner. Despite this, the tests were administered with a three-minute time limit. The three-minute time limit mimicked the methodology used in a previous study (Silvia et al., 2008) and has been argued by Hattie (1980) as not to affect the creation of unique responses. This measure will be used as a measure of creativity using divergent thinking. The purpose for the inclusion of this measure is to measure one

aspect of creativity that has been previously tested with psychopathology and is considered to be a good measure of creative ability.

In addition, this measure will be scored according to the average scoring method. This method involves having two raters rate each answer given by the participant on a one to five scale of creativity, after which the two scores are averaged to get one score of creativity (Silvia et al., 2008). The use of this type of scoring method may have eliminated some issues with the methodology of scoring on divergent thinking tasks in the past, such as items being marked as unique or creative simply because there are only a few participants (Silvia et al., 2008). Further, the averages of the scores were combined to create a total average score for each section of the WKCT. For example, the three averages for the Alternate Uses tasks were combined to create a total Alternate Uses average score.

**Creative Achievement Questionnaire (creativity – achievement).** The Creative Achievement Questionnaire (CAQ) is a 96-item self-report measure designed to measure creative achievement instead of creative ability (Carson, Peterson, & Higgins, 2005). It consists of three separate parts. The first part consists of a checklist of specific areas of creativity; the second part includes specific achievements in each of the domains listed in part one; and the third part asks three questions that measure perceptions of others in regards to the individuals' creativity. The reliability, internal consistency, and validity of the CAQ have been shown to be adequate. Test-retest reliability is reported to be .81 with an internal consistency of $\alpha = .96$ for the measure as a whole. When split, the split-half reliabilities were reported as $\alpha = .92$ and $\alpha = .91$. Individual internal consistencies for the ten different areas ranged from .70 to .96. Studies testing validity indicate that the CAQ

has good predictive validity, convergent validity, and divergent validity (Carson et al., 2005).

The CAQ was used as a second measure of creativity but measured a different aspect of creativity than the WKCT, creative achievement, which has been tested previously with psychopathology but does not appear to tap the same area of creativity as divergent thinking. For the purpose of this study, the CAQ was summed for all analyses as individual scores for each subsection were small in the majority of the cases.

**Kaufman Domains of Creativity Scale (creativity – achievement).** The Kaufman Domains of Creativity Scale (KDOCS) is a 50-item self-report measure of creative achievement measuring everyday creativity (Kaufman, 2012). The items can be summed to create five different factors: Self/ Everyday Creativity, Scholarly Creativity, Performance Creativity, Mechanical/ Scientific Creativity, and Artistic Creativity. Each item is measured on a Likert scale of 1 to 5 with higher numbers representing higher creativity on that item. Total scores are determined by summing all items together with higher scores indicating more creative achievement in the five factors. Reliability has been shown to be adequate for the five separate factors with regards to internal consistency for each factor and test-retest reliability with α values ranging from .83 to .87 for during the first test and between .82 and .87 for the second test (Kaufman, 2012).

Similar to the CAQ, this measured creative achievement in the battery. However, the KDOCS loads on five different factors that consider different aspects of creativity whereas the CAQ considers different creative acts in separate sections. For example, the CAQ has separate factors for music and dance whereas these types of creative acts would

be combined under the Performance Creativity factor for the KDOCS. However, for the purpose of this study, the KDOCS total score was used when completing regression analyses due to its strong positive correlation with the CAQ. The KDOCS factors were entered into the correlation matrix to consider the relationship between these factors and all other measures of creativity.

**Stroop Color and Word Test: Adult Version (inhibition).** The Stroop Color and Word Test: Adult Version (Stroop) is a 300-item measure that tests an individual's ability to differentiate between color and word stimuli with regards to naming (Golden & Freshwater, 1998). The measure is made of three pages with 100 items each. The first page includes color words (red, green, blue) written in black ink; the second page includes only the word "XXXX" colored in red, green, or blue ink; and the third page includes the words from the first page in the colors of the second page. Reliability for the Stroop is indicated to be strong for all three of the test. They have been noted to range from .71 to .88 for test-retest reliability in a study conducted by Jensen (1965). Research has suggested that creative individuals may perform more efficiently on the Stroop (Gamble & Keller, 1968 as cited in Golden & Freshwater, 1998). Research on the effects of schizophrenia on the Stroop, however, is mixed.

The Stroop task can be administered in two ways: the amount of time to complete the 100 items on each page, or the number of items completed within forty-five seconds. In the current study, the administration followed the forty-five second version with forty-five seconds being the time-constraint for each of the three pages. However, participants in the current study completed these tasks on a computer-based program, DirectRT, using files created by the primary researcher instead of the paper version. The computerized

version of the Stroop showed one item at a time in the same order as the paper version. The use of this method was for the study that was completed in conjunction with the current study in order to obtain response times.

The Stroop task was used as the measure of cognitive inhibition for the current study. The total number of items answered correctly in the forty-five second time constraint was used to measure the cognitive inhibition scores, specifically during the third task as this task represents the individual's ability to inhibit. The score is determined by the number of items answered within a 45 second period with higher scores indicating higher inhibition and lower scores indicating lower inhibition. For example, individuals with higher inhibition should be able to ignore the irrelevant data (what the word states) and respond to the relevant stimuli (the color of the ink of the word), whereas individuals with lower inhibition would have greater difficulty inhibiting and ignoring the word data and thus would answer fewer items within the time allotted. These scores were used to test whether cognitive inhibition acted as a moderator between psychopathology and creativity.

**Procedure**

The procedures of the current study were examined and approved by the Institutional Review Board of Rowan University. Undergraduate participants were recruited through the online SONA system from the Essentials of Psychology course and chose timeslots to complete the battery of tests. Participants arrived to the Rowan University Schizophrenia-Spectrum Lab (RUSSL) and met with one of nine trained researchers where they completed a battery of measures lasting approximately 1.5 hours

including an informed consent form, demographic questionnaire, self-report questionnaires, a creativity task, and a computerized response task. Participants completed all measures in the presence of a trained researcher and were given the opportunity to ask questions about the measures. At the completion of all measures, participants were given credit for their *Essentials of Psychology* course through the SONA system. All participants were made aware that the battery of measures was the combination of two batteries for two different thesis projects, that the nature of the questions in some of the measures may cause distress, and that they were free to leave the study at any point in time without repercussion. The informed consent included the number for the Rowan University Psychological and Counseling Services center in the event that a participant experienced any distress. Due to the length of the battery, three different orders were used and cycled in order to reduce the fatigue experienced by the battery length. Participants were not given the opportunity to take a break and had to complete the battery in one sitting. Measures used in the current study included in the battery in addition to a demographic questionnaire included: the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE), the Schizotypal Personality Questionnaire-Brief Revised (SPQ-BR), the Hypomania Checklist-32 (HCL-32), the Stroop Color and Word Test: Adult Version (Stroop), the Wallach-Kogan Creativity Tests (WKCT), the Creative Achievement Questionnaire (CAQ), and the Kaufman Domains of Creativity Scale (KDOCS). Following completion of the measures, participants were debriefed and given a debriefing statement including the numbers for the Rowan University Psychological and Counseling Services center and the Rowan

University HELP hotline as well as contact information for both primary investigators and the advisor of the study.

# Chapter 3

## Results

Preceding all analyses for the current study, the data was examined to determine whether it met the normality assumptions for the parametric tests. Skewness and kurtosis values, and histograms were inspected, and indicated that all variables were normal with the exception of the CAQ total score, which was positively skewed. The CAQ total score data was transformed utilizing square root transformation. The transformed CAQ total variable then met standards of normality. Analyses of Variance (ANOVAs) and Pearson correlations were then utilized to examine and identify variables that would confound the data such as gender, age, and ethnicity. Through these analyses, it was found that there was a significant gender difference on the KDOCS Factor 5. Through the use of an independent t-test it was determined that means on the KDOCS Factor 5 for females ($M$ = 31.53) and males ($M$ = 27.03) differed significantly ($t$ = -.2760, $p$ = .007). The data was also examined for any outliers on all measures using z-scores. Per the recommendations of Stevens (2009), one participant was identified as being an extreme outlier and was removed. The means and standard deviations for each measure can be viewed in Table 2.

Table 2

*Descriptive Statistics for Measures (n=98)*

| Variable | *M* (SD) | Range |
|---|---|---|
| Inhibition | | |
| Stroop 3 | 25.66(3.74) | 14.00-32.00 |
| Schizotypy | | |
| O-LIFE Total | 11.31(5.95) | 1.00-23.00 |
| O-LIFE Unusual Experiences | 3.00(2.67) | .00-10.00 |
| O-LIFE Cognitive Disorganization | 4.24(2.85) | .00-10.00 |
| O-LIFE Introvertive Anhedonia | 1.74(1.81) | .00-9.00 |
| O-LIFE Impulsive Nonconformity | 2.32(1.67) | .00-8.00 |
| SPQ-BR Total | 66.68(20.42) | 33.00-124.00 |
| SPQ-BR Interpersonal | 23.01(8.75) | 10.00-49.00 |
| SPQ-BR Cognitive-Perceptual | 24.32(8.21) | 14.00-50.00 |
| SPQ-BR Disorganization | 20.01(7.26) | 8.00-38.00 |
| Hypomania | | |
| HCL-32 Total | 17.21(5.22) | 2.00-28.00 |
| Creative Achievement | | |
| KDOCS Total | 155.04(23.55) | 92.00-213.00 |
| KDOCS Factor 1 | 40.89(5.04) | 29.00-53.00 |
| KDOCS Factor 2 | 35.03(7.62) | 14.00-52.00 |
| KDOCS Factor 3 | 27.89(9.88) | 10.00-49.00 |
| KDOCS Factor 4 | 21.15(7.87) | 9.00-41.00 |
| KDOCS Factor 5 | 30.06(7.82) | 10.00-45.00 |
| CAQ Total | 12.82(14.55) | 1.00-103.00 |
| Divergent Thinking | | |
| WKCT Total | 6.55(.79) | 4.47-8.58 |
| WKCT Alternate Uses | 2.18(.35) | 1.15-3.44 |
| WKCT Pattern Meaning | 2.20(.32) | 1.50-3.27 |
| WKCT Line Meaning | 2.16(.30) | 1.22-3.04 |

*Note*. Stroop 3- denotes the third STROOP task; O-LIFE- denotes the Oxford-Liverpool Inventory of Feelings and Experiences; SPQ-BR- denotes the Schizotypal Personality Questionnaire-Brief Revised; HCL-32- denotes Hypomania Checklist-32; KDOCS- denotes Kaufman Domains of Creativity Scale; CAQ- denotes Creative Achievement Questionnaire; WKCT- denotes Wallach Kogan Creativity Tests

In order to test the first hypothesis, a correlation analysis was conducted to examine the relationships between all variables. Since all variables met normal

assumptions once the CAQ total score was transformed, the Pearson correlation coefficient was used. Comparisons included the WKCT (3 scales and total), CAQ, KDOCS (5 factors and total), SPQ-BR total and subscales, O-LIFE total and subscales, and the HCL-32. All correlations are noted in Table 3. It was expected that none of the mental illness variables would significantly correlate with any of the creativity variables due to the proposed nonlinear relationship between these variables, although there may be some linear aspects to the nonlinear relationship. However, the HCL-32 did have a positive significant relationship with the KDOCS total score ($r$=.232, $p$=.022), the KDOCS factor 3 ($r$=.218, $p$=.031), and the KDOCS factor 5 ($r$=.243, $p$=.016), suggesting a linear relationship between these variables. Further, the interpersonal subscale of the SPQ-BR had a negative significant relationship with the KDOCS factor 1 ($r$=-.328, $p$=.001) as did the total SPQ-BR scale ($r$=-.229, $p$=.024) and the Cognitive Disorganization subscale of the O-LIFE ($r$=-.209, $p$=.039). This possibly indicates that the negative and disorganized symptoms are accounting for a negative relationship between the total SPQ-BR and the creativity measures. However, the Introvertive Anhedonia O-LIFE subscale was positively correlated with the KDOCS factor 4 ($r$=.217, $p$=.032), which was unanticipated since negative symptoms of schizotypy are generally associated with less creativity.

Table 3

*Pearson Correlations (r values) for All Variables (n=98)*

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Stroop | *** | | | | | | | | | | |
| (2) | OLIFE | .014 | *** | | | | | | | | | |
| (3) | UnEx | .025 | **.707**** | *** | | | | | | | | |
| (4) | CogDis | -.018 | **.782**** | **.298**** | *** | | | | | | | |
| (5) | ImpNon | .118 | **.514**** | **.250*** | **.241*** | *** | | | | | | |
| (6) | IntAnh | -.070 | **.532**** | .144 | **.330**** | .014 | *** | | | | | |
| (7) | SPQ-BR | -.061 | **.782**** | **.488**** | **.727**** | **.210*** | **.481**** | *** | | | | |
| (8) | CogP | -.129 | **.751**** | **.630**** | **.552**** | **.349**** | **.342**** | **.856**** | *** | | | |
| (9) | InterP | -.086 | **.594**** | .186 | **.698**** | .054 | **.526**** | **.863**** | **.549**** | *** | | |
| (10) | Disorg | -.043 | **.694**** | **.464**** | **.638**** | **.253*** | **.352**** | **.862**** | **.645**** | **.606**** | *** | |
| (11) | HCL | -.032 | **.318**** | **.332**** | **.249*** | .172 | .004 | **.387**** | **.408**** | .172 | **.448**** | *** |
| (12) | KDOCS | -.128 | -.057 | .015 | -.112 | .010 | -.042 | -.026 | .111 | -.066 | .005 | **.232*** |
| (13) | Fx 1 | -.111 | -.049 | .175 | **-.209*** | .040 | -.128 | **-.229*** | .072 | **-.328**** | -.146 | .173 |
| (14) | Fx 2 | -.067 | -.071 | -.053 | -.108 | .006 | .010 | -.077 | .093 | -.105 | -.067 | .100 |
| (15) | Fx 3 | -.075 | .002 | .044 | -.017 | .137 | -.158 | -.001 | .123 | -.079 | .075 | **.218*** |
| (16) | Fx 4 | -.036 | -.092 | -.120 | -.109 | -.186 | **.217*** | .049 | -.004 | .104 | -.016 | -.029 |
| (17) | Fx 5 | -.117 | .020 | .049 | .034 | .013 | -.073 | .091 | .046 | .110 | .097 | **.243*** |
| (18) | CAO | .086 | -.002 | .079 | -.034 | .046 | -.112 | -.061 | .036 | -.169 | .097 | .126 |
| (19) | WKCT | .155 | -.031 | -.050 | .025 | .001 | -.068 | -.035 | -.069 | -.047 | .104 | -.094 |
| (20) | AltUse | .106 | -.031 | -.035 | .013 | -.066 | -.009 | -.032 | -.080 | -.038 | .083 | -.066 |
| (21) | Pattern | .183 | -.019 | -.047 | .012 | .061 | -.066 | -.038 | -.058 | -.052 | .066 | -.113 |
| (22) | Line | .086 | -.026 | -.039 | .036 | .012 | -.097 | -.013 | -.027 | -.025 | .1066 | -.048 |

*Note*. Stroop 3- denotes the third STROOP task; Un.Ex.- denotes the O-LIFE Unusual Experiences subscale; CogDis- denotes the O-LIFE Cognitive Disorganization subscale; ImpNon – denotes the O-LIFE Impulsive Nonconformity subscale; IntAnh- denotes the O-LIFE Introvertive Anhedonia subscale; InterP- denotes the SPQ-BR Interpersonal subscale; CogPer- denotes the SPQ-BR Cognitive-Perceptual subscale; Disorg- denotes the SPQ-BR Disorganization subscale; Fx.- denotes the five factors of the KDOCS; AltUses- denotes the Alternate Uses task on the WKCT; Pattern- denotes the Pattern Meaning task on the WKST; Line- denotes the Line Meaning task on the WKCT; WKCT- denotes the total score on the WKCT; * = $p < .05$; ** = $p < .01$

Table 3 (continued)

| | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | Stroop | | | | | | | | | | | |
| (2) | OLIFE | | | | | | | | | | | |
| (3) | UnEx | | | | | | | | | | | |
| (4) | CogDis | | | | | | | | | | | |
| (5) | ImpNon | | | | | | | | | | | |
| (6) | IntAnh | | | | | | | | | | | |
| (7) | SPO-BR | | | | | | | | | | | |
| (8) | CogP | | | | | | | | | | | |
| (9) | InterP | | | | | | | | | | | |
| (10) | Disorg | | | | | | | | | | | |
| (11) | HCL | | | | | | | | | | | |
| (12) | KDOCS | *** | | | | | | | | | | |
| (13) | Fx 1 | **.432**** | *** | | | | | | | | | |
| (14) | Fx 2 | **.619**** | **.218*** | *** | | | | | | | | |
| (15) | Fx 3 | **.765**** | **.253*** | **.363**** | *** | | | | | | | |
| (16) | Fx 4 | **.535**** | -.027 | .139 | **.204*** | *** | | | | | | |
| (17) | Fx 5 | **.622**** | .151 | .149 | **.316**** | **.229*** | *** | | | | | |
| (18) | CAO | **.403**** | .066 | **.282**** | **.499**** | .078 | .186 | *** | | | | |
| (19) | WKCT | -.031 | **-.297**** | .181 | .068 | -.103 | -.059 | **.208*** | *** | | | |
| (20) | AltUse | .064 | **-.218*** | **.230*** | .056 | .001 | .037 | **.225*** | **.779**** | *** | | |
| (21) | Pattern | -.063 | **-.264**** | .137 | .043 | -.142 | -.064 | .149 | **.864**** | **.505**** | *** | |
| (22) | Line | -.085 | **-.239*** | .062 | .066 | -.117 | -.128 | .125 | **.784**** | **.344**** | **.599**** | *** |

*Note.* Stroop 3- denotes the third STROOP task; Un.Ex.- denotes the O-LIFE Unusual Experiences subscale; CogDis- denotes the O-LIFE Cognitive Disorganization subscale; ImpNon – denotes the O-LIFE Impulsive Nonconformity subscale; IntAnh- denotes the O-LIFE Introvertive Anhedonia subscale; InterP- denotes the SPQ-BR Interpersonal subscale; CogPer- denotes the SPQ-BR Cognitive-Perceptual subscale; Disorg- denotes the SPQ-BR Disorganization subscale; Fx.- denotes the five factors of the KDOCS; AltUses- denotes the Alternate Uses task on the WKCT; Pattern- denotes the Pattern Meaning task on the WKST; Line- denotes the Line Meaning task on the WKCT; WKCT- denotes the total score on the WKCT; * = $p < .05$; ** = $p < .01$

As expected, significant positive relationships were noted between like variables. The KDOCS and CAQ correlated strongly at the .01 level ($r$=.403, $p\leq$.001), and the CAQ also correlated positively with the KDOCS factor 2 ($r$=.282, $p$=.005) and the KDOCS factor 3 ($r$=.499, $p\leq$.001). The CAQ also correlated strongly with the WKCT alternate uses task ($r$=.225, $p$=.026) and the WKCT total score ($r$=.208, $p$=.040), but not with the WKCT pattern meanings task ($r$=.149, $p$=.143) or the line meanings task ($r$=.125, $p$=.221). The KDOCS total did not correlate with any of the WKCT tasks or the WKCT total score, but the WKCT alternate uses task correlated negatively with KDOCS factor 1 ($r$=-.218, $p$=.031) and positively with KDOCS factor 2 ($r$=.230, $p$=.023). In addition, the WKCT pattern meanings task correlated negatively with KDOCS factor 1 ($r$=-.264, $p$=.009). Lastly, the WKCT line meanings task correlated negatively with KDOCS factor 1 ($r$=-.239, $p$=.018) as did the WKCT total score ($r$=-.297, $p$=.003). The KDOCS total score was strongly, positively correlated with all five of its factors, as was the WKCT total score with its three measures.

Further, the O-LIFE total score correlated with all O-LIFE subscales, the SPQ-BR total score, and all SPQ-BR subscales. The SPQ-BR total score also correlated positively with all of the SPQ-BR subscales, O-LIFE total score, and O-LIFE subscales. The O-LIFE unusual experiences subscale did not correlate with the O-LIFE introvertive anhedonia subscale ($r$=144, $p$=.157) or the SPQ-BR interpersonal subscale ($r$=186, $p$=.066), which was expected given the two subscales measure negative symptoms whereas unusual experiences measures positive symptoms, but did correlate positively with the other O-LIFE and SPQ-BR scores. In addition, the O-LIFE impulsive nonconformity subscale correlated with all O-LIFE and SPQ-BR scores except the O-

LIFE introvertive anhedonia subscale ($r$=.014, $p$=.891) and the SPQ-BR interpersonal subscale ($r$=.054, $p$=.599).

Of note, the HCL-32 had significant positive correlations with the O-LIFE total score ($r$=.318, $p$=.001), the O-LIFE unusual experiences subscale ($r$=.332, $p$=.001), the O-LIFE cognitive disorganization subscale ($r$=.249, $p$=.013), SPQ-BR total score ($r$=.387, $p$=.000), the SPQ-BR cognitive perceptual subscale ($r$=.408, $p$=.000), and the SPQ-BR disorganization subscale ($r$=.448, $p$=.000). The HCL-32 did not have any significant relationships with subscales measuring negative symptoms of schizotypy. It is noteworthy that the HCL-32 also did not have a significant relationship with the impulsive nonconformity subscale of the O-LIFE which is characterized by impulsive behavior.

In order to test the inverted U-shaped relationship between the mental illness variables and the creativity variables proposed in the first hypothesis, a nonlinear regression was conducted on SPSS by converting the mental illness variables to z-scores and squaring the z-scores to create new variables. These variables were added into a single-step regression with each creativity measure as a dependent variable. Nonlinear regression models were run separately on the HCL-32, SPQ-BR total score, O-LIFE total score, and one model was conducted combining the SPQ-BR total score and the O-LIFE total score. These nonlinear regression results were not statistically significant for any of the models tested.

A second set of nonlinear regressions were used to test subhypothesis A of the first hypothesis testing to see if the inverted U-shaped relationship would be present for

only the positive symptom spectrum of schizotypy and the measures of creativity. For this model, the scores for the SPQ-BR cognitive perceptual subscale and the O-LIFE unusual experiences subscale were converted to z-scores and then squared to create new variables. These variables were then entered into a single step of a regression analysis with each of the creativity variables, and one model contained both subscales in one step. The model examining the O-LIFE unusual experiences subscale with the KDOCS factor 1 was significant for a nonlinear relationship ($t$=2.106, $p$=.038). The SPQ-BR cognitive perceptual subscale had a significant relationship with the KDOCS factor 5 for males only ($t$=-2.085, $p$=.046) indicating a nonlinear relationship. When examining the KDOCS factor 5, the dataset was split on gender due to a significant gender effect to determine which gender had a significant relationship. Please refer to Table 4 and Table 5 for these models.

Table 4

*Nonlinear Regression Model: Creative Achievement (KDOCS Factor 1) and Positive Schizotypy (O-LIFE Unusual Experiences) (n=98)*

| Model | | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | 40.004 | .657 | | 60.922 | .000 |
| | UnEx. | .903 | .429 | .210 | 2.106 | .038* |

a. Dependent Variable: KDOC_SUM1

*Note*. Unex- denotes the O-LIFE Unusual Experiences subscale

* = p < .05

Table 5

*Nonlinear Regression Model 2: Creative Achievement (KDOCS Factor 5) and Positive Schizotypy (SPQ-BR Cognitive Perceptual) for Males (n=32)*

| Model | | B | Std. Error | Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | 28.612 | 1.517 | | 18.856 | .000 |
| | CogPerc. | -1.414 | .678 | -.356 | -2.085 | .046* |

a. Dependent Variable: KDOCS_SUM5
*Note*. CogPerc.- denotes the SPQ-BR Cognitive Perceptual subscale
* = p < .05

To test our second hypothesis, hierarchical regression models were conducted for schizotypy, cognitive inhibition, and creativity to test whether cognitive inhibition acted as a moderator between schizotypy and creativity. Centered variables of the O-LIFE, the SPQ-BR, the O-LIFE unusual experiences subscale, the SPQ-BR cognitive perceptual subscale, and the third Stroop task were created and added into the first step of separate models. Interaction terms between these variables were then created (e.g., OLIFE*STROOP) and added into the second steps of the models. One model combined the SPQ-BR and O-LIFE total scores in the same steps, and another model combined the O-LIFE unusual experiences subscale and SPQ-BR cognitive perceptual subscale in the same steps to consider total schizotypy and total positive schizotypy. All models were non-significant for moderation. However, for the combination of the two positive schizotypy subscales with the dependent variable of the WKCT line meaning, the two interaction terms were significant but the overall model was not significant for moderation ($F(5,92)=1.337$, $p=.256$). The model examining the moderation of cognitive inhibition between the O-LIFE total score and the KDOCS factor 5 had a significant interaction term for males ($t=2.116$, $p=.043$) but the overall model was non-significant

($F(3,28)=1.822$, $p=.166$). Similarly, the interaction term for the O-LIFE unusual experiences regression with the KDOCS factor 5 was significant for males ($t=2.202$, $p=.036$) but the overall model was non-significant ($F(3,28)=1.957$, $p=.143$). The KDOCS factor 5 was split on gender for the analyses after the gender effect was significant in the non-split KDOCS factor 5 analyses to determine if there were any significant results for a specific gender.

In addition, hierarchical regression models were conducted for hypomania, cognitive inhibition, and creativity to examine cognitive inhibition as a moderating variable between hypomania and creativity as a part of the second hypothesis. In the first step, centered variables of the HCL-32 and the third Stroop task were added, and the second step included the interaction variable between the centered HCL-32 and centered Stroop task. The model examining moderation the KDOCS factor 5 and the HCL-32 was significant for females ($F(3,62)=3.842$, $p=.014$). Further analysis of the interaction indicated that the moderation relationship is significant only when cognitive inhibition is high ($t=2.191$, $p=.032$). Please refer to Table 6 for this model. In addition, the interaction term for the KDOCS factor 5 model was significant for males ($t=2.376$, $p=.025$) but the overall model was non-significant ($F(3,28)=2.372$, $p=.092$). The remaining models examined were all not statistically significant.

Table 6

*Hierarchical Linear Regression Model: Moderation of Cognitive Inhibition between Creative Achievement (KDOCS Factor 5) and Hypomania for Females (n=66)*

| | Model | B | Std. Error | Beta | T | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | 31.440 | .898 | | 35.009 | .000 |
| | HCL-32 | .414 | .165 | .303 | 2.503 | .015* |
| | Stroop | .031 | .237 | .016 | .131 | .896 |
| 2 | (Constant) | 31.666 | .878 | | 36.069 | .000 |
| | HCL-32 | .471 | .162 | .347 | 2.904 | .005** |
| | Stroop | .116 | .233 | .059 | .498 | .621 |
| | HCL*Stroop | .066 | .030 | .263 | 2.199 | .032* |

a. Dependent Variable: KDOCS_SUM5

*Note.* Stroop- denotes the third STROOP task; HCL*Stroop- denotes an interaction term between the two variables

* = p < .05, ** = p < .01

For hypothesis #2, sub-hypothesis A, schizotypy and hypomania were used in the same step of a hierarchical regression model to examine the shared variance of these constructs and their contributions to creativity in an exploratory manner. The second step included cognitive inhibition (third Stroop task) to test if cognitive inhibition added further variance to the model. In the KDOCS total regression, the first model was significant ($F(3,92)=2.824$, $p=.043$) whereas the second was not. Within the model, the only significant contributing factor was the HCL-32 ($t=2.574$, $p=.012$) which was to be expected given the relationship between the KDOCS and the HCL-32 in previous analyses. In addition, the first model for the KDOCS factor 1 was significant ($F(3,92)=4.553$, $p=.005$) as well as the second model with the addition of the Stroop task ($F(4,91)=3.640$, $p=.008$). The remaining models were not statistically significant.

# Chapter 4

## Discussion

Previous research has considered the relationship between creativity and mental illness as well as the possibility of a third, moderating variable. However, this area of research is still developing and the relationship between these variables remains unclear. Research in this field has generally noted an inverted U-shaped relationship between psychopathology and creativity with an unknown third variable moderating this relationship. Thus, it was anticipated that the relationship between the mental illness variables, schizotypy and hypomania, would have the inverted U-shaped relationship with creativity that has been noted in previous research (Richards et al., 1988). Contrary to our first hypothesis, this relationship was linear in nature between hypomania and creative achievement in the form of the KDOCS total score, KDOCS factor 3, and KDOCS factor 5. This linear relationship may be due to the sample used in the current study. The majority of the participants (71.4%) scored between 14-21 leaving only a small amount of individuals in the minor/ absent symptom range and the severe symptom range. With more participants, the relationship may have been more nonlinear in nature. Also, this relationship may exist with only the KDOCS because the KDOCS appears to contain creative achievement items that are more achievable to the college-age population than the CAQ. It is of note, however, that this relationship only exists for the factors of self/ everyday creativity, performance, and artistic creativity rather than the domains of scholarly and mechanical/ scientific creativity. It is possible that individuals who have more impulsivity and eccentric behavior characteristic of hypomania engage in

more free-form creative activities such as dance and painting rather than more structured creative activities like scientific thought.

In addition, there were significant negative linear relationships between the KDOCS factor 1 and the O-LIFE cognitive disorganization subscale, SPQ-BR total, and SPQ-BR interpersonal subscale, and a positive linear relationship between the O-LIFE introvertive anhedonia subscale and the KDOCS factor 4. The negative relationships between the KDOCS factor 1 and the O-LIFE cognitive disorganization subscale and the SPQ-BR interpersonal subscale are not surprising finds considering these subscales measure the disorganized and negative symptoms of schizotypy which may be associated with lower creativity than positive symptoms. It is possible that the scores on the interpersonal subscale and the disorganization subscale for the SPQ-BR are what is driving the negative relationship between the SPQ-BR total score and the KDOCS factor 1. It is of interest that the O-LIFE introvertive anhedonia subscale was positively related to the KDOCS factor 4. This relationship may consider the differences between scientific or mechanical creative thought and other types of creative thought that result in performance or art. It may be possible that individuals who experience more negative symptoms of schizotypy show more appeal for the sciences rather than aspects of creativity that may be more social in nature such as acting.

There were also significant nonlinear relationships between positive schizotypy and creativity as measured by the KDOCS. The unusual experiences subscale for the O-LIFE had a significant nonlinear relationship with the KDOCS factor 1, everyday creativity, and the cognitive perceptual subscale of the SPQ-BR had a significant nonlinear relationship with the KDOCS factor 5, artistic creativity, for males only. This

was anticipated given research suggesting a relationship between positive schizotypy and creativity, although it is interesting that the artistic creativity finding is for males only. It is also of interest to note that the relationships occurred for different aspects of creative achievement on the KDOCS for the two separate positive schizotypy subscales. This may be possible because of the differences between the scales, such as the use of a Likert scale on the SPQ-BR and the YES/NO answers for the O-LIFE. Participants may have been more inclined to endorse a higher number on a Likert scale due to the increase in options rather than being forced to choose between two answers. Both measures of positive schizotypy also did not correlate with the KDOCS factor 4, mechanical/scientific creativity, but did have negative non-significant *r*-values adding to the possibility that individuals with more negative symptoms of schizotypy might tend towards scientific or mechanical creativity. In addition, it is likely that these relationships were noted only for the KDOCS because of the apparent applicability of the items to the college population versus the CAQ.

Contrary to our second hypothesis, reduced cognitive inhibition in the form of the Stroop task did not appear to moderate the relationship between psychopathology and creativity for schizotypy. Prior results have been mixed regarding reduced cognitive inhibition's role in the relationship between these variables so the findings of the current study are interesting but not surprising. Considering mixed relationships were found between the schizotypy variables and the creativity variables, it is possible that this accounted for the non-significant findings for moderation. However, there was a significant finding for the moderation of cognitive inhibition between hypomania (HCL-32) and the KDOCS factor 5 for females but only when cognitive inhibition is high. This

indicates that higher scores on the Stroop are moderating the relationship between hypomania and the KDOCS factor 5, artistic creativity, but only for females. This is contrary to the hypothesis, which suggested that this relationship would only exist for lower cognitive inhibition. The possibility for this contrary finding is that individuals from the undergraduate sample may have higher levels of cognitive ability due to being from a college sample. Therefore, there were few lower scores on the Stroop task thus giving little variety in this measure.

For the exploratory portion of the study, sub-hypothesis A of our second hypothesis, all of the models were non-significant except for the KDOCS factor 1 model. The first step of this model, including all psychopathology variables, and the second step of the model, including the addition of the Stroop task, were significant. This indicates that there may be some shared variance between these constructs with regards to everyday creativity but not necessarily other aspects of creativity or creative achievement.

It is of interest to note that this research utilized varied measures of creativity that did not correlate as expected. It was anticipated that the measure of divergent thinking, the WKCT tasks, would correlate weakly if at all with creative achievement as they measure different aspects of creativity. However, the WKCT alternate uses task correlated positively with a portion of the KDOCS 2 and this task and the total WKCT score correlated positively with the CAQ. All WKCT tasks and the total WKCT score correlated negatively with KDOCS 1. The CAQ correlated positively with only three of the KDOCS scales but was positively correlated with the total KDOCS. Considering these results, it may be possible that portions of the creative achievement measures are

tapping into separate and distinct aspects of creativity that may not be related to other aspects of creativity. This is important to consider with the current research as the separate sections of the KDOCS were examined, but only a total score for the CAQ was used. It may be possible that there were no significant results found between the CAQ and the psychopathology variables because the total CAQ score is not representing the different facets of creative achievement but considering an achievement total score. The KDOCS, however, looks at different subsets of creative achievement that do not necessarily correlate with each other. Thus, it is possible the subsets of the CAQ may not also correlate strongly with each other, necessitating the use of scores for individual sections versus the total. Further, the WKCT measures may have been non-significant to the current study as a result of participant fatigue. The three tasks combined lasted approximately thirty minutes and one of the checklist orders administered the WKCT as the second-to-last measure.

However, the measures of schizotypy did correlate with each other as expected but had different relationships with the same variables. This is interesting considering the total scores of both schizotypy measures were highly correlated, as well as the majority of the subscales. The subscales that were not related were as expected, as positive symptoms of schizotypy generally do not relate strongly to the negative symptoms of schizotypy. The differences between the two different measures of schizotypy may account for the differences in the relationships between these measures and the creativity measures. The SPQ-BR is a shorter measure that focuses on three aspects of schizotypy, as well as uses a 5-point Likert scale, where the O-LIFE is a longer measure using four subscales and a forced YES/NO response. Individuals may have been more likely to

endorse higher numbers on the Likert scale than to endorse yes on the O-LIFE. In addition, the types of questions asked on both measures differ.

In addition, there was a positive, significant relationship indicated between the HCL-32, the O-LIFE, the SPQ-BR, and some of their subscales. This relationship adds further evidence for the existence of the bipolar disorders and the psychosis spectrum disorders existing on a single spectrum as recent research has suggested. Although the affective and psychosis spectrums are still considered to include separate and distinct disorders, research has considered the possibility that they may exist on a single spectrum. The strong positive correlations between these variables add further evidence to the possibility of this single spectrum theory as the measure of hypomania was correlated with two separate measures of schizotypy. However, the HCL-32 did not correlate with all of the subscales for these measures and thus cannot be considered to be related to all aspects of schizotypy. It may be possible that some of the more negative symptoms of schizotypy would be more related to the depressive episodes found in bipolar affective disorders rather than the hypomanic or manic episodes.

Several limitations can be noted for the study. Since the study included only undergraduate students from one university, it is possible that these participants were not representative of the general population. As expected, there was not a wide variety in schizotypy scores on either measure, with the majority of the participants scoring within the lowest score ranges. The lack of a sizeable moderate or severe symptom group could account for the lack of a linear or nonlinear relationship between schizotypy and creativity. In addition, there were some mechanical issues during the study. Due to an

issue with the computer, several participants had to take the battery out of order and return to complete the Stroop task at a later time.

Another limitation was participant fatigue. Although three different checklists in varied orders were used to lessen fatigue, the length of the battery was 1.5 hours and therefore it was likely that the participants experienced fatigue to some degree. Due to fatigue, the participants may not have read through the questions as thoroughly or answered accurately. Specifically, the WKCT measure lasted approximately thirty minutes with participants having to take the entire three minutes for each item. Thus, the length of time spent on this measure could have contributed to fatigue as it necessitated thought in order to develop creative answers.

In addition, the use of undergraduate population for the study could have resulted in cognitive inhibition data that is not comparable to a more general population. The participants were all enrolled in college and thus may have had higher cognitive inhibition ability than individuals who may have been randomly selected from society. The lack of diverse cognitive inhibition scores may account for the lack of moderation noted in the analyses. Thus, the use of a more diverse sample is recommended for future research.

Although these findings contradict some previous research, these findings still add to the current literature. Research in the field continues to be contradictory in nature with a portion of the research indicating no relationship between creativity and mental illness and another portion indicating there is a relationship. The results of the current study contribute to this growing literature by including multiple measures of creativity

including two different measures of creative achievement, as well as multiple measures of psychopathology. Further, the findings add to the literature suggesting a single spectrum between the affective spectrum and the psychosis spectrum. Thus, this research indicates the need for further research.

Although the link between psychopathology and creativity may not seem paramount, studies focusing on this connection could have several important outcomes for the field. Flaherty (2011) recommends that professionals weigh the costs and benefits of treatments when considering the creativity in individuals as some medications may enhance creativity but some may also stifle cognitive processes that promote creativity. For example, an individual in a hypomanic state may have the energy to engage in creative actions that are important to their person and to their life. When treated with a mood stabilizer, this person may no longer feel the motivation to engage in creative flow. This is not necessarily an issue unless this change in motivation is accompanied by a lack of creative ability. Further, individuals with mania may be more inclined towards creative careers because these types of careers tend to have fewer rules and guidelines (Vellante et al., 2011). If psychotropic medications may hinder their creative flow, these individuals may be forced to find other employment due to a stifling of their creative abilities.

Also, the presence of creativity may act as a possible vulnerability marker for future mental illnesses. As recommended by Santosa et al. (2007), research might want to focus on assessing individuals prior to onset for their creative tendencies. This becomes paramount when considering that creativity may act as a vulnerability marker for psychopathology. There is no research at this time that suggests this possibility, but it is still something that should be considered. If the potential for a mental illness can be noted

prior to the onset of the actual illness, it may be possible to assist these individuals before their symptoms become too severe possibly through the use of early therapeutic interventions and working to increase coping abilities.

Further, a link between creativity and psychopathology could lend evidence to the idea that psychopathological genes may have adaptive traits. A current theory in the research is that creativity could exist as an adaptive trait for individuals with mental illness (Burns, 2004). Thus, it is paramount that there is continued research in this field of study. Future directions may include the use of a different measure of hypomania. Although the Hypomania Checklist-32 is validated and reliable, there are various other measures of hypomania that may be a better indicator than the HCL-32. Future research should also utilize a more clinical sample. The use of a clinical sample may broaden the range of scores on measures of schizotypy and thus may be able to better assess the relationship between mental illness and creativity. Lastly, research may also utilize a shorter battery. The use of a combined battery assisted with data collection but also created an issue of participant fatigue. In using a shorter battery, participants may not experience fatigue and therefore their answers may be more representative.

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