

CANNABIS USE, SCHIZOTYPY, AND PERSONALITY: ASSOCIATIONS WITH CANNABIS-RELATED PROBLEMS AND EMOTION RECOGNITION

A thesis presented to the faculty of the Graduate School of
Western Carolina University in partial fulfillment of the
requirements for the degree of Master of Arts in Psychology.

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March 2013

ACKNOWLEDGEMENTS

I would like to thank my committee for their support throughout this process. Specifically, I would like to thank Dr. Åsberg for aiding me in the conceptualization and execution of this project. I would also like to thank David Scales for his genius and encouragement, as well as Dr. Gordon for being so accommodating and helpful. To Jessica Kelliher, Kimberlee Cooper, and Jessie Ramsey: This would not have been possible without your provided distractions and empathy. Finally, I would like to thank Adam Hicks for all of his support and help, especially for finding answers to questions only the truly detailed-oriented could provide.

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ABSTRACT

CANNABIS USE, SCHIZOTYPY, AND PERSONALITY: ASSOCIATIONS WITH CANNABIS-RELATED PROBLEMS AND EMOTION RECOGNITION

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Individuals with schizotypy often report more cannabis-related problems, which include cognitive, interpersonal, and social responsibility difficulties. Past studies have observed correlations between the factors of schizotypy (i.e., positive, disorganized, and negative) and the five-factor model of personality. Certain personality traits are also associated with cannabis use. Further, both schizophrenia-spectrum symptoms and cannabis use have been implicated in reduced ability to identify emotional facial expressions, which can lead to greater difficulties in social functioning. Therefore, the purpose of the current study is to better understand the associations between cannabis use, schizotypy, and personality. Additionally, this research aims to identify which of the aforementioned variables are most salient in individuals who experience cannabis-related problems and emotional identification deficits. The sample was comprised of 242 undergraduates attending Western Carolina University, and data were collected through self-report measures and an eye tracker.

Results from bivariate correlations and non-parametric statistics indicated that cannabis use was associated with higher disorganized schizotypy and total schizotypy, while the number of cannabis-related problems was significantly correlated to all factors

of schizotypy. Cannabis use, cannabis-related problems, and schizotypy were associated with lower Agreeableness and Conscientiousness, as well as higher levels of Immoderation and Excitement-Seeking. Individuals who met criteria for cannabis dependence were significantly higher in Excitement-Seeking, but lower in Cooperation, Dutifulness, Achievement-Striving, and Cautiousness compared to those who do not experience cannabis-related problems. Similar to the deficits seen on the schizophrenia-spectrum, cannabis use frequency was associated with decreased attention to the left visual field; moreover, cannabis-related problems were negatively correlated to attention to the eyes of most emotional faces. Personality traits such as Conscientiousness were associated with fixation on particular emotional features, as well as accuracy for identifying neutral faces. Taken together, the results of the current study suggest that there are significant associations between cannabis use, schizotypy, and personality, and these variables play a role in cannabis-related problems and facial affect recognition processing. Therefore, prevention of these potential problems should target identification of schizotypal traits, abstinence from cannabis, and social skills building in adolescence and emerging adulthood.

CHAPTER ONE: INTRODUCTION

Cannabis is the most used illicit substance in the world and is prevalent on college campuses (Caldeira, Arria, O'Grady, Vincent, & Wish, 2008). While cannabis has anxiolytic and analgesic properties (Morgan & Curran, 2008), cannabis use may induce also psychotic-like symptoms, especially among individuals at risk for schizophrenia-spectrum disorders (Stirling et al., 2008). An issue currently faced by clinicians is the treatment of comorbid cannabis dependence in individuals with schizophrenia (Drake & Mueser, 2000), as this population abuses cannabis more than the general population (Green, Young, & Kavanagh, 2005). When examining causation between psychosis and cannabis use, researchers have suggested bidirectional causation, with psychotic symptoms leading to cannabis use, and cannabis use inducing psychotic-like experiences (Ferdinand et al., 2005).

When studying problems associated with the schizophrenia spectrum, such as cannabis abuse, it is helpful to study schizotypy, which is defined as the genetic vulnerability for schizophrenia (Meehl, 1962). According to the American Psychiatric Association's Diagnostic and Statistical Manual, Fourth Edition, Text Revision, schizophrenia symptoms are categorized into three types: positive (e.g., hallucinations and delusions), disorganized (e.g., disorganized speech and behavior), and negative (flattened affect, avolition, and alogia; *DSM-IV-TR*; American Psychiatric Association, 2000). Individuals with schizotypy possess traits expressed as attenuated forms of schizophrenia symptoms, which also include positive (e.g., magical thinking and ideas of reference), disorganized (e.g., odd speech and behavior), and negative traits (e.g., constricted affect and no close friends; Raine, Reynolds, Lencz, & Scerbo, 1994).

Assessing cognitive, behavioral, and social problems of individuals with schizotypy allows researchers to better understand the schizophrenia spectrum while avoiding possible confounds that arise when conducting research with psychotic populations, such as side effects from antipsychotic medication and hospitalization (Völter et al., 2012).

While schizotypal traits are thought to be on a continuum leading to schizophrenia-spectrum disorders, some literature suggests that schizotypal traits may also be variants of normal personality as constructed by the five-factor model (Asai, Sugimori, Bando, & Tanno, 2011). Additionally, studies indicate that cannabis users and schizotypal individuals may share certain personality traits, including higher Openness to Experiences, as well as lower Agreeableness and Conscientiousness, than the general population (Flory, Lynam, Milich, Leukefeld, & Clayton, 2002; Ross, Lutz, & Bailey, 2002). Research has also found that low Extraversion and high Neuroticism predicts later psychotic symptoms in individuals who frequently consume cannabis (Fridberg, Vollmer, O'Donnell, & Skosnik, 2011).

The literature has shown that individuals on the schizophrenia spectrum and those with schizotypy report more negative effects, (e.g., abuse/dependence, interpersonal problems, psychotic-like experiences, and occupational difficulties) related to substance use than the general population (Drake & Wallach, 1989). When Najolia, Buckner, and Cohen (2012) investigated the associations between negative affective traits and cannabis use in a college sample, they found that certain traits, such as depression and anxiety, were significantly positively associated with cannabis-related problems, but this was only true in individuals with elevated schizotypal symptoms. In fact, some research indicates that college students with higher schizotypy scores experience two -to-five times more

cannabis-related problems than non-schizotypal individuals (Cohen, Buckner, Najolia, & Stewart, 2011).

Given this sensitivity to cannabis-related problems, schizotypal individuals who use cannabis may also experience more social difficulties. Emotional facial recognition deficits are common among individuals with psychotic disorders (Levy, Holzman, Matthyse, & Mendell, 1993) and have also been reported among chronic cannabis users (Platt, Kamboj, Morgan, & Curran, 2010). Further complicating the understanding of this underlying deficit is its association to personality. Individuals high in Neuroticism tend to spend more time viewing the eyes of negative emotive faces, such as fearful expressions (Perlman et al., 2009). Emotion recognition is a crucial skill in social functioning, and deficits may contribute the social difficulties of psychotic and cannabis-using populations.

This study will use the dimensional approach to evaluate associations between schizotypal traits, normal personality, and cannabis use in a nonclinical sample of college students. Additionally, this research aims to determine how well cannabis use, schizotypy, and the five-factor model of personality can predict cannabis-related problems, as well as understand the associations with emotion recognition processing deficits. The outcome of this research may help to better inform clinicians of the underlying factors most associated with cannabis-related problems and deficits in emotion recognition so that treatment can be targeted toward these variables.

CHAPTER TWO: LITERATURE REVIEW

Cannabis

Cannabis, commonly called *marijuana*, is the most used illicit substance in the world and is prevalent throughout the United States (Copeland & Swift, 2009). According to the Substance Abuse and Mental Health Services Administration ([SAMHSA], 2011), approximately 17.4 million Americans used cannabis in 2010. Individuals ages 18 to 25 use cannabis more than other age groups, with 18.5% of that age range reporting cannabis consumption in the past month. In addition to the increasing prevalence rates in the United States since 2002, individuals are now older on average when they first use cannabis (SAMHSA, 2011). Cannabis use is prevalent on college campuses (Caldeira et al., 2008; Gledhill-Hoyt, Lee, Striate, & Wechsler, 2000), with some studies estimating that approximately 30% of college students have consumed cannabis within the past year (Johnston, O'Malley, Bachman, & Schulenberg, 2011).

Physiological effects of cannabis. This high prevalence of cannabis use may be due to its perceived positive effects (Johnson, Mullin, Marshall, Bonn-Miller, & Zvolensky, 2010) and facilitation of social interaction (Beck et al., 2009). According to the DSM-IV-TR, cannabis intoxication “begins with a ‘high’ feeling followed by symptoms that include euphoria with inappropriate laughter and grandiosity, sedation, lethargy, impaired judgment, distorted sensory perceptions, impaired motor performance, and the sensation that time is passing slowly. Occasionally, anxiety, dysphoria, or social withdrawal occurs,” (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000, p. 237). Cannabis intoxication may also be accompanied by perceptual disturbances and magical thinking (Martinotti et al., 2011). Because these symptoms are

often seen in individuals on the schizophrenia-spectrum, it appears that cannabis use may induce cognitive and behavioral effects resembling psychotic disorders (Koethe, Hoyer, & Leweke, 2009).

Cannabis contains delta-9- tetrahydrocannabinol (Δ^9 -THC), which increases dopamine activity and can lead to effects such as psychomotor retardation, reduced social understanding, lack of spontaneity, blunted affect, and emotional withdrawal (D'Souza et al., 2004). Johns (2001) revealed that in higher doses, Δ^9 -THC increases anxiety, alertness, depression, and tension. Koethe and researchers (2006) also found that Δ^9 -THC induces effects resembling positive symptoms of schizophrenia. There are other cannabinoids in cannabis, including cannabidiol, which may counter the psychotic-like effects of Δ^9 -THC through anxiolytic and antipsychotic properties (Morgan & Curran, 2008). This is supported by the findings of Fusar-Poli and researchers (2009) which demonstrated that after ingestion of Δ^9 -THC, participants were more anxious and exhibited more psychotic symptoms, while administration of cannabidiol tended to decrease anxiety.

Although some researchers support the notion of “cannabis psychosis,” and cannabis-induced psychotic disorder is listed in the DSM-IV-TR (*DSM-IV-TR*; American Psychiatric Association, 2000), many studies suggest that cannabis-induced psychosis is not categorical, but rather an early sign of schizophrenia (D'Souza, Sewell, & Ranganathan, 2009). This is corroborated by the fact that the majority of cannabis users do not experience psychotic reactions. Stirling and colleagues (2008) noted that psychotic-like symptoms induced by cannabis were predicted by high scores on psychosis-proneness measures. Sensitivity to psychotomimetic effects (i.e., effects which

mimic the presentation of psychosis) of cannabis may be an indication of genetic vulnerability for psychotic disorders (Genetic Risk and Outcome in Psychosis [GROUP] Investigators, 2011).

Schizophrenia-Spectrum Disorders

As noted, schizophrenia, which affects approximately 1% of individuals worldwide, (*DSM-IV-TR*; American Psychiatric Association, 2000) is marked by a heterogeneous assortment of positive, disorganized, and negative symptoms. The positive symptoms include hallucinations and delusions. The *DSM-IV-TR* includes disorganized speech, (such as frequent derailment or incoherence), and grossly disorganized or catatonic behavior as possible disorganized symptoms (*DSM-IV-TR*; American Psychiatric Association, 2000). Negative symptoms may manifest as restricted affect, avolition, and asociality (*DSM-IV-TR*; American Psychiatric Association, 2000). According to the proposed changes of the upcoming *DSM-V*, psychotic disorders will now be labeled schizophrenia-spectrum disorders, which would include schizophrenia, schizophreniform disorder, brief psychotic disorder, delusional disorder, schizoaffective disorder, substance-induced psychotic disorder, psychotic and catatonic disorders associated with a known general medical condition, other specified psychotic disorder, and the schizotypal personality disorder (STPD; American Psychiatric Association, 2011). Two of these disorders are of particular interest to the current study and will be discussed next.

Schizotypal Personality Disorder. The prevalence of STPD is slightly greater than that of schizophrenia, occurring in roughly 3% of the population (*DSM-IV-TR*; American Psychiatric Association, 2000). Prodromal phases of schizophrenia may be

characterized by negative symptoms or attenuated positive symptoms, such as odd beliefs and bizarre perceptual experiences (*DSM-IV-TR*; American Psychiatric Association, 2000). This presentation is similar to that of schizotypal personality disorder, as both pathologies include magical ideation, interpersonal difficulties, eccentric behavior, and cognitive-perceptual alterations. Although individuals with prodromal schizophrenia symptoms are at a greater risk for later developing schizophrenia, (Bedwell & Donnolly, 2005), STPD is more prevalent in individuals related to those with schizophrenia-spectrum disorders (Kendler & Gardner, 1997). This suggests a strong genetic component associated with the continuum of psychotic disorders.

“The essential feature of schizotypal personality disorder is a pervasive pattern of social and interpersonal relationships marked by acute discomfort with, and reduced capacity for, close relationships as well as by cognitive or perceptual distortions and eccentricities of behavior,” (*DSM-IV-TR*; American Psychiatric Association, 2000, p. 697). The proposed DSM-V classification of STPD is comprised of three types of broad symptom domains: psychoticism, (e.g., eccentricity, cognitive and perceptual dysregulation, unusual beliefs and experiences), detachment, (e.g., restricted affectivity and withdrawal), and negative affectivity, (e.g., suspiciousness; American Psychiatric Association, 2011). The social deficiencies associated with STPD are similar to, but less severe than, social deficits in schizophrenia (Dickey et al., 2011), corroborating the notion of a schizophrenia-spectrum. In non-clinical individuals, the attenuated presentation of STPD characteristics is categorized as *schizotypy*.

Schizotypy. Within the general population, schizotypy, defined as a genetic vulnerability for schizophrenia-spectrum pathology (Meehl, 1962), and is marked by odd

thinking, perceptual aberrations, social withdrawal, and suspiciousness (Esterberg, Goulding, McClure-Tone, & Compton, 2009). The currently accepted model involves three factors: positive (e.g., magical thinking, ideas of reference, unusual perceptual experiences), negative (e.g., constricted affect, no close friends, social anxiety), and disorganized (e.g., odd speech and behavior; Raine, Reynolds, Lencz, & Scerbo, 1994). Schizotypal symptoms are similar to that of prodromal schizophrenia, except these traits tend to be stable (Bedwell & Donnolly, 2005).

There are two approaches to quantifying schizotypy. The first is the categorical or taxometric conceptualization (Meehl, 1962), in which only the top scoring individuals on a measure of schizotypy within a population are at greater risk of developing schizophrenia. This is approximately 10% of the general population (Lenzenweger & Korfine, 1992). Within college populations, studies have found the prevalence of clinical schizotypal scores to be slightly less than in the general population, at approximately 6% (Cohen et al., 2011). According to the alternative approach, the dimensional conceptualization, schizotypy is linear and exists on a continuum (Mason & Claridge, 1994). This conceptualization of schizotypy is supported by the fact that traits comprising psychosis proneness greatly resemble attenuated symptoms of schizophrenia and STPD (Nunn, Rizza, & Peters, 2001). While this dimensional approach theorizes that schizotypy is on a personality continuum with schizophrenia-spectrum disorders (Williams, Wellman, & Rawlins, 1996), others theorize that schizotypy may exist on the continuum of normal personality traits (Asai, Sugimori, Bando, & Tanno, 2011).

Personality

Currently, the most accepted conceptualization of normal personality is the five-factor model (Costa & McCrae, 1995). This model entails five broad factors of personality, (i.e., Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness), each consisting of six underlying facets. While the NEO-PI-R is the frequently used to measure the five-factor model of personality, the M5-120 is a comparable measure which produces the same five factors and 30 facets, although some facets differ in labeling (McCord, 2002). For a list of M5 domains and corresponding facets, as well as differing facet names for the NEO-PI-R, see Table 1.

Table 1.

M5 Domains and Facets (with Corresponding NEO-PI-R Facets in Parentheses)

Neuroticism

- Anxiety
- Anger (Angry Hostility)
- Depression
- Self-Consciousness
- Immoderation (Impulsiveness)
- Vulnerability

Extraversion

- Friendliness (Warmth)
- Gregariousness
- Assertiveness
- Activity
- Excitement-Seeking
- Cheerfulness (Positive Emotions)

Openness to Experience

- Imagination (Fantasy)
- Artistic Interests (Aesthetics)
- Emotionality (Feelings)
- Adventurousness (Actions)
- Intellect (Ideas)
- Liberalism (Values)

Agreeableness

- Trust
- Morality (Straightforwardness)
- Altruism
- Cooperation (Compliance)
- Modesty
- Tendermindedness

Conscientiousness

- Self-Efficacy (Competence)
- Order
- Dutifulness
- Achievement-Striving
- Self-Discipline
- Cautiousness (Deliberation)

Personality and schizophrenia-spectrum. There has been much research focusing on the associations between the schizophrenia-spectrum and normal personality

traits. For example, a meta-analysis of the literature indicated that individuals with schizophrenia are often neurotic and introverted (Berenbaum & Fujita, 1994). Schizophrenia is also associated with lower Agreeableness (Gurrera, Nestor, O'Donnell, Rosenberg, & McCarley, 2005). By asking STPD researchers to identify a typical schizotype, Lynam and Widiger (2001) noted that these individuals are described as high in Openness to Ideas and Self-Consciousness; furthermore, the prototypical schizotype was considered low in Positive Emotion, Warmth, and Gregariousness (Lynam & Widiger, 2001). Additionally, schizotypal traits sometimes coincide with less Agreeableness and Conscientiousness (Coolidge et al., 1994). Although STPD correlates with higher Openness, schizophrenia-spectrum personality disorders often demonstrate personality profiles similar to, but more attenuated than, the pattern of characteristics seen in schizophrenia (Camisa et al., 2005).

Personality and schizotypy. Individuals with schizotypal traits often possess certain personality traits, based on the five-factor model. For example, several studies have shown that schizotypal individuals tend to have elevated Neuroticism and low Agreeableness (Ross, Lutz, & Bailey, 2002). More specifically, positive schizotypal symptoms are associated with higher Extraversion and Openness (Barrantes-Vidal, Lewandowski, & Kwapil, 2010). Disorganized symptoms often correlate positively with Neuroticism (Kerns, 2006) and Openness to Experience (Fridberg et al., 2010), while negative schizotypal symptoms are predicted by lower Extraversion, Agreeableness, and Openness (Ross, Lutz, & Bailey, 2002).

On the facet level, there are also associations between schizotypy and personality. Literature on this topic suggests that at the facet level, schizotypy is associated with

higher Anxiety and Self-Consciousness, but lower Positive Emotions, Warmth, Gregariousness, and Trust (Edmundson & Kwapil, 2013). Ross and associates (2002) found a positive correlation between Depression, Impulsiveness, Excitement-Seeking, Tendermindedness, Fantasy, and Aesthetics, as well as a negative correlation with Trust and Straightforwardness in positive schizotypy. This contrasts with negative schizotypy, which is positively associated with Hostility and Self-Consciousness but is negatively correlated to Anxiety, Impulsiveness, Aesthetics, Feelings, and Actions facets (Ross et al., 2002).

The precise association between personality and schizotypy remains unclear. While some researchers suggest that schizotypal traits can be conceptualized as maladaptive versions of normal personality characteristics (Edmundson, Lynam, Miller, Gore, & Widiger, 2011), new literature on schizotypy and the five-factor model indicates that the association between the two may be linear. This research suggests that schizotypy is fully-dimensional and on continuum of normal personality, with more extreme presentations of Neuroticism and Extraversion (Asai, Sugimori, Bando, & Tanno, 2011). This is consistent with findings that healthy cannabis users with higher Neuroticism and lower Extraversion are at an increased risk for psychosis as they age (Fridberg et al., 2011).

Personality and cannabis use. Frequent cannabis users differ from non-using samples on measures of broad personality domains (Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008). Generally, cannabis use is associated with above Openness to Experience, low Agreeableness, and low Conscientiousness (Fridberg et al., 2011). Although Neuroticism and Extraversion are often average in cannabis users, Terracciano

and colleagues (2008) found that this population exhibits higher Angry Hostility and Vulnerability, which are two Neuroticism facets, as well as higher Activity and Excitement-Seeking. Within Openness to Experience, cannabis users score higher in Values and Ideas, but score lower in the Agreeableness facet of Compliance and lower in the Conscientiousness facets of Dutifulness and Deliberation (Terracciano et al., 2008).

When researching correlates of cannabis abuse and dependence symptoms, Flory and colleagues (2002) found that an association between these signs of problematic use and high Neuroticism, low Agreeableness and low Conscientiousness; however, after controlling for comorbid psychopathologies (e.g., antisocial personality disorder and internalizing psychopathology symptoms), only low Extraversion and high Openness were correlates of cannabis abuse/dependence symptoms. Additionally, cannabis users with higher Neuroticism, higher Openness, and lower Extraversion are at a higher risk for negative schizotypal symptoms (Fridberg et al., 2011). Because cannabis users and individuals on the schizophrenia spectrum tend to possess similar personality traits, (e.g., low Agreeableness, low Conscientiousness, and higher Neuroticism on specific facets) and cannabis users with particular personality profiles are thought to be at an increased risk for psychosis, it is important to address the complex relationship between the two.

Cannabis Use and the Schizophrenia Spectrum

Individuals on the schizophrenia-spectrum abuse cannabis at higher rates than the general population (Green, Young, & Kavanagh, 2005). Although many studies have focused on cannabis use in individuals with schizophrenia-spectrum disorders and psychosis proneness, the precise association remains unclear. Arendt, Rosenberg, Foldager, Perto, & Munk-Jørgensen (2005), suggested that individuals with

schizophrenia who use cannabis may experience their first psychotic episode at an earlier age than non-users, given that cannabis-induced psychosis predicted later schizophrenia-spectrum disorders in nearly half of their sample. Similarly, others hypothesize that cannabis use may provoke the onset of psychosis (González-Pinto et al., 2011). In fact, several studies suggest that cannabis use may be a component in the development of psychotic disorders, (Arseneault, Cannon, Witton, & Murray, 2004; Moore et al., 2007), though others dispute this claim (Phillips et al., 2002). Ferdinand and researchers (2005) suggested bidirectional causation, with psychotic symptoms leading to cannabis use, and vice versa. The association between cannabis use and schizotypy is also marked by inconsistent findings (Compton, Chien, & Bollini, 2009).

Cannabis use and schizotypal symptoms. Much of the literature suggests that schizotypy is positive correlated with cannabis use (Esterberg et al., 2009; Rössler, Hengartner, Angst, & Ajdacic-Gross, 2012; Williams et al., 1996). While examining the connection between cannabis use and schizotypal personality traits, Mass, Bardong, Kindl, and Dahme (2001) found that cannabis users have higher scores on schizotypal personality measures than controls in college populations; furthermore, duration of cannabis use is positively associated with self-reported schizotypal symptoms (Fridberg et al., 2010). Although no consensus can be established on the associations between cannabis use and positive, negative, and disorganized schizotypal symptoms, general trends emerge from the literature.

Cannabis use and positive symptoms. Several studies have reported that cannabis use is associated with increased positive schizotypy symptoms (Nunn et al., 2001; Skosnik, Spatz-Glenn, & Park, 2001). Moreover, the severity of positive

schizotypy is positively correlated to the amount of self-reported cannabis use weekly (Skosnik, Park, Dobbs, & Gardner, 2008). Positive symptoms are also associated with onset of cannabis use, with younger onset users reporting more positive schizotypal traits (Skinner, Conlon, Gibbons, & McDonald (2011). Barkus and Lewis (2008) reported that among non-clinical college students, those with high scores on a measure of schizotypy who also consumed cannabis experienced more psychotic symptoms during and after use. Cohen and associates (2011), however, did not find the link between cannabis use and increased positive symptoms to be exclusive to individuals with clinically-elevated schizotypy. This suggests that increased self-reported positive schizotypal symptoms may be a function of cannabis use and not strictly a predictor of later psychosis.

Cannabis use and disorganized symptoms. Previous research has indicated a positive association between cannabis use and disorganized schizotypal symptoms, with current users reporting more disorganized symptoms than previous and non-users (Barkus & Lewis, 2008). This positive association between cannabis use and disorganized schizotypy has also been found in samples of undergraduates (Bailey & Swallow, 2004; Schiffman, Nakamura, Earleywine, & LaBrie, 2005). Similarly, Esterberg and coworkers (2009) found that higher disorganized schizotypal symptoms predicted an increased risk for substance use and was significantly correlated to cannabis consumption. Associations between cannabis use and negative schizotypal symptoms have also been reported.

Cannabis use and negative symptoms. In individuals with schizophrenia, there is an inverse association between cannabis abuse and negative symptoms (Dubertret, Bidard, Adès, & Gorwood, 2006). When investigating the association between ultra-high schizophrenia risk and cannabis use, Machielsen, van der Sluis, and de Haan (2010)

found that pre-psychotic negative symptoms were negatively correlated to cannabis consumption. Skosnik and colleagues (2008) found that the cannabis users had lower negative schizotypy symptom scores than healthy controls, which has been corroborated by several previous studies (Nunn et al, 2001; Schiffman et al., 2005). Similarly, Cohen and colleagues (2011) found this inverse association between cannabis and negative symptoms in a college population, but only in individuals with schizotypy. If cannabis use is decreasing perceived negative schizotypal symptoms, this may be one explanation for the high prevalence in the comorbidity of schizotypy and cannabis use.

Proposed Associations between Cannabis Use and Schizophrenia-Spectrum

There are multiple theories which attempt to explain the association between cannabis use and schizophrenia-spectrum disorders. Dumas and colleagues (2002) suggested three possible pathways to comorbid schizotypal traits and cannabis use: schizotypal traits are exacerbated by cannabis use in high risk individuals, cannabis use is a form of self-medication for schizotypal traits, or the presence of an etiopathological component leading to both. Similarly, Potvin, Stip, and Roy (2003) hypothesized that there are two directions for this complex association, with cannabis use exacerbating positive symptoms in individuals on the psychotic spectrum, and cannabis being used to alleviate negative symptoms. While heightened positive symptoms can be explained by the dopamine hypothesis of schizophrenia, alleviation of negative symptoms is more congruent with self-medication models.

Dopamine hypothesis and the supersensitivity model. The primary psychoactive component of the cannabis sativa plant, Δ^9 -THC, mimics natural cannabinoids found in the body, such as anandamide, which can lead to hyperactive

dopaminergic activity (D'Souza et al., 2009). Seeman (2011) indicated that supersensitive dopamine receptors may be the underlying factor in psychotic symptoms. Because the effects of cannabis are similar to positive symptoms of schizophrenia, the cannabinoid model of psychosis was proposed, in which those at risk for schizophrenia have dysregulated endocannabinoid receptors (Skosnik et al., 2001). When exploring the dopamine hypothesis of schizophrenia, Hirvonen and Hietala (2011) found that the dopaminergic alternations seen in individuals with schizophrenia are also found in individuals at genetic risk; therefore, they propose a “dopamine hypothesis of schizophrenia vulnerability,” (p. 93). Research indicates that psychotic-like and dysphoric experiences from cannabis use by individuals on the schizophrenia spectrum are likely due to dopamine system sensitivity (Stirling et al., 2008). Individuals on the schizophrenia spectrum may be vulnerable to the rewarding effects of cannabis, by means of hypersensitive dopamine systems (Potvin et al., 2003).

The supersensitivity model (Mueser, Drake, & Wallach, 1998) is based on the stress-vulnerability model of schizophrenia (Nuechterlein & Dawson, 1984). From the theory that individuals with schizophrenia have genetic vulnerabilities which react differently to environmental stress, the supersensitivity model posits that these individuals are also especially sensitive to the effects of certain psychoactive substances, even with less use than the general population (Gregg, Barrowclough, & Haddock, 2007). While this is corroborated by findings of increased positive schizotypal symptoms with cannabis use, this model cannot explain why cannabis users report less negative schizotypy symptoms than their non-using counterparts in emerging adulthood populations (Skosnik et al., 2008).

Self-medication and alleviation of dysphoria models. The self-medication model of cannabis use has been supported (Hambrecht & Häfner, 1996) and refuted (Welch et al., 2011) throughout the literature. This model proposes that cannabis is used to reduce negative schizophrenia-spectrum symptoms; however longitudinal (González-Pinto et al., 2009) and meta-analyses of self-reports do not suggest long-term evidence for self-medication effects (Compton, Goulding, & Walker, 2007). Contrarily, there is evidence indicating that individuals with schizophrenia who also use cannabis exhibit significantly fewer negative symptoms, although frequency of hallucinations increase with cannabis use (Dubertret et al., 2006). A broader conceptualization of the self-medication model, the alleviation of dysphoria hypothesis (Mueser et al., 1998), may be more accurate in depicting the association between cannabis use and negative schizophrenia-spectrum symptoms.

The alleviation of dysphoria model proposes that severe mental illness and substance use co-occur because this population is trying to minimize negative affect (particularly boredom, depression and loneliness), and enhance pleasure (Kolliakou, Joseph, Ismail, Atakan, & Murray, 2011). While this is consistent with reported motives of schizophrenia patients who use cannabis (e.g., to reduce boredom, enhance socialization, improve socialization, and reduce negative affective states; Schofield et al., 2006), this model cannot explicate why individuals with schizotypy report more cannabis-related problems than the general public (Cohen et al., 2011; Najolia et al., 2012).

Cannabis-Related Problems

The general term *cannabis-related problems* often refer to the physiological, social, occupational, and abuse/dependence consequences associated with cannabis use. According to ICD-10 criteria, harmful use consists of “a pattern of psychoactive substance use that is causing damage to health,” (World Health Organization, 2013, p. 4); further, dependence criteria consists of three or more of the following: compulsion to use the substance, difficulties controlling substance intake, withdrawal, evidence of tolerance, neglect of other interests, and persistent use despite obvious detrimental consequences (World Health Organization, 2013). In otherwise healthy volunteers, Simons and Carey (2002) found a correlation between cannabis use-related problems and frequency was strongest in individuals with affect dysregulation problems; furthermore, they noted that the correlation between frequency of use and cannabis-related problems was strengthened by impulsivity.

Substance-related problems and poorer psychosocial functioning are often reported more frequently in individuals with schizophrenia-spectrum disorders ([Compton, Simmons, Weiss, & West, 2011; Drake & Wallach, 1989], as well as schizotypy (Cohen et al., 2011). In a large sample of undergraduate students, immediate cannabis-induced psychotic-like experiences were predicted by high schizotypy (Stirling et al., 2008). Additionally, Cohen and researchers (2011) found that individuals with higher levels of schizotypy report two to five times more cannabis-related problems than others, suggesting a unique adverse effect of cannabis on those who are psychosis-prone. In a college sample, Najolia and associates (2012) found that while depression, social anxiety, and trait anxiety were negatively associated with cannabis use frequency in the

control group, these traits were significantly positively correlated to cannabis-related problems in individuals with higher schizotypy scores.

Taken together, these data corroborate the supersensitivity model, which postulates that individuals at risk for the schizophrenia spectrum may be more vulnerable to the negative consequences of cannabis use, due to heightened sensitivity to its effects. If this is correct, then certain emotional processing deficits, which are seen in individuals on the schizophrenia-spectrum (Benson, Leonards, Lothian, St. Clair, & Merlo, 2007), as well as individuals who use cannabis (Platt et al., 2010) should be exhibited in individuals with schizotypal traits who use cannabis. Further, it may be that underlying personality traits, such as depression and anxiety, which are also seen positively related to schizotypy and cannabis-related problems, also contribute to social difficulties.

Emotion Recognition and Eye Tracking Deficits

Emotion recognition is an important aspect of social cognition, which broadly encompasses how individuals process information about the self and others (Myers, 2007). The skill of processing and accurately interpreting emotional facial expressions is a crucial component in social interaction. Throughout the literature, this skill is often assessed through tracking eye movements, as the ability to determine emotions from facial expressions involves correctly interpreting visual information (Ruhmann et al., 2012). Individuals on the schizophrenia spectrum and cannabis users commonly exhibit emotional recognition labeling and eye tracking dysfunctions (Benson et al., 2007; Platt et al., 2010; Waldeck & Miller, 2000).

Research suggests that exploratory eye movements and eye tracking dysfunctions are potential endophenotypes that may be used by clinicians to evaluate individuals on

the schizophrenia spectrum (Ishii, Morita, Shouji, Nakashima, & Uchimura, 2010; Phillips & David, 1997). Eye tracking dysfunctions have been seen in psychotic individuals, as well as some of their non-clinical family members (Levy et al., 1993). Lenzenweger and O'Driscoll (2006) confirmed the link between eye tracking dysfunction and schizotypal traits in a nonclinical population, further supporting the idea of eye tracking dysfunction as a biological marker of schizophrenia-spectrum liability. Individuals exhibiting schizotypal personality traits are associated with slowness and inaccuracy when identifying facial expressions (Dickey et al., 2011; Germine & Hooker, 2010). Research by Waldeck and Miller (2000) indicated that subjects with STPD have deficits in positive emotion processing. In a study of eye tracking performance, Mitropoulou and researchers (2011) found that individuals with schizophrenia and STPD perform worse at tracking constant velocity trapezoids than healthy controls; moreover, the individuals with STPD tended to perform worse than controls, but better than those with schizophrenia, suggesting a continuum of impairment. Individuals with schizophrenia and those clinically at risk for the development of psychosis often display more aberrant and limited scanpaths, which has been found to be associated with lower social functioning (Ruhrmann et al., 2012).

A scanpath is a mapped representation of saccades and gaze fixations, including length and direction (Noton & Stark, 1971). A saccade is the rapid, simultaneous movement of both eyes, while a gaze fixation occurs when the eyes linger for roughly 200-300 milliseconds between saccades (Rayner, 1998). Green, Waldron, Simpson, and Coltheart (2008) found limited scanning and increased gaze fixation in patients with schizophrenia, as well as delayed staring at faces in social contexts, suggesting a

restricted visual processing of faces. Additionally, research has indicated that individuals with schizophrenia may fixate on specific areas when viewing affective faces, but their gaze patterns suggest that they do not focus on the overall area (Ishii et al., 2010). Further, individuals with schizophrenia often exhibit limited scanning in the left visual field, particularly for happy and neutral faces (Loughland, Williams, & Gordon, 2002). Using a continuous approach to scan path changes, Benson and researchers (2007) examined differences in eye tracking dysfunction between cannabis-induced psychosis and first-episode schizophrenia patients. They found that both groups made fewer saccades and fewer fixations of longer duration compared to controls, but the cannabis-induced psychosis group showed less diversity in emotional features on which they fixated compared to schizophrenia and control groups. Overall, the results suggest that individuals with schizotypy should exhibit limited scanpaths, marked by fewer saccades and fixations, especially on non-negative emotional stimuli.

Lateralization preferences. Within the general population, a tendency emerges to shift the eyes leftward when viewing emotional stimuli, which is associated with right hemispheric function of the brain (Schwartz, Davidson, & Maer, 1975). While healthy controls are biased toward viewing the left side of the face first, Phillips and David (1997) found that patients with schizophrenia often viewed and focused on the right side of faces first, which they suggested may be due to right hemispheric dysfunction in schizophrenia. Interestingly, they also found that patients who first viewed the left side of faces tended to fixate on the left side of the face, indicating inflexibility in visual scanning paths (Phillips & David, 1997).

Regarding schizotypy and processing of emotion stimuli, the literature seems to be incongruent with the schizophrenia-spectrum hypothesis. While Leonards and Mohr (2009) found no association between facial processing biases and negative schizotypy, positive schizotypal symptoms were positively correlated with a leftward bias in the first saccade direction in processing facial features. Because negative schizophrenia symptoms are associated with less exploratory eye movements (Nishiura, Morita, Kurakake, Igimi, & Maeda, 2007), especially in the left visual field (Ishii et al., 2010), it may be that positive schizotypy is associated with a left side preference, while rightward biases may reflect negative schizophrenia-spectrum traits that were too attenuated to be significant in schizotypal studies. Alternatively, the deficits in emotion recognition observed in schizotypy, as well as cannabis users, may be better explained by a trait-congruency information processing perspective.

Trait-congruency perspective. When viewing faces the general population often focuses on the mouth, eyes, nose, and ears (Rayner, 1998); in addition, healthy individuals more readily identify faces depicting positive affect (Rotenberg, 2011). Research suggests that individuals tend to interpret information, particularly emotional information, in a way that is consistent with individual characteristics (Bargh, Lombardi, & Higgins, 1988). For example, individuals high in Neuroticism tend to make more saccades to the eye region when viewing fearful faces (Perlman et al., 2009). Loughland and researchers (2002) noted that schizophrenic patients paid more attention to facial features in sad faces but showed fewer fixations and less attention to prominent features in happy and neutral faces. Additionally, cannabis users take longer to identify emerging emotionally-charged faces, and they more readily label a neutral face as sad (Platt et al.,

2010). This negative bias is also seen in depressed individuals (Beevers, Wells, Ellis, & Fischer, 2009), which suggests that underlying negative affectivity (e.g., Neuroticism) may better account for emotion recognition problems.

Present Study

Genetic, psychological, and environmental factors may put vulnerable individuals at risk for cannabis consumption and schizophrenia-spectrum disorders, particularly during young adulthood (Gregg et al., 2007). Given the complex nature of the interaction, the current study aims to better understand the association between cannabis use, schizotypy, and personality, as well as their association to cannabis-related problems and emotional recognition deficits in a non-clinical young adult population. The following hypotheses and research questions will be explored:

Hypothesis One: Users of cannabis in the last 6 months will report more positive and disorganized schizotypal symptoms, but less negative schizotypal symptoms than the never-using group.

Hypothesis Two: Positive correlations are expected between cannabis use frequency, cannabis-related problems, and schizotypy total, positive, and disorganized scores. Negative schizotypy scores are expected to be negatively associated with cannabis use frequency and cannabis-related problems.

Hypothesis Three: Users of cannabis in the last 6 months will be lower in Agreeableness and Conscientiousness compared to non-users. Further, positive correlations are expected between cannabis use frequency and Openness to Experience, as well as its underlying facets. Negative correlations are expected between cannabis use frequency and Agreeableness, Conscientiousness, and their respective facets. On the facet

level of Neuroticism, positive correlations are expected between Anger, Vulnerability, and cannabis use frequency.

Hypothesis Four: Positive, disorganized, and negative schizotypy will be positively associated with Neuroticism and its facets. Positive correlations are expected between positive and disorganized schizotypy and Openness to Experience, although a negative correlation is expected between this domain and negative schizotypy. Additionally, schizotypy subscales will be negatively associated with Agreeableness, Conscientiousness, Extraversion, and the respective facets of these domains.

Research Question One: Can schizotypy and personality predict cannabis-related problems?

Research Question Two: Are cannabis use, schizotypy, and personality associated with emotion processing deficits (i.e., accuracy in identifying emotional expressions) and preferential areas of interest (i.e., left versus right lateralization preference and fixation on features of certain emotional faces)?

CHAPTER THREE: METHOD

Participants

Participants consisted of psychology undergraduate students enrolled at Western Carolina University ($N = 242$). The total sample consisted of 63 males (26%) and 179 females (74% of the sample). The majority of the sample (84.3%) identified themselves as White. Participants ranged from 18 to 37 years of age ($M = 19.52$, $SD = 2.32$). The eye tracker sample, which was comprised of 70 participants from the total sample, consisted of 52 females (74.3%) and 18 males (25.7%). These participants ranged in age from 18-32, ($M = 19.77$, $SD = 2.17$). This data was gathered through basic demographic information obtained from each participant. These items included age, sex, ethnicity, college classification, and GPA. Demographic questions were administered last to control for potential gender and ethnicity stereotype effects (Danaher & Crandall, 2008).

All participants reported normal or corrected vision. Course credit was given for the completion of the study. The collected data was de-identified to protect participant confidentiality. Exclusion criteria included being less than 18 years of age and legal blindness, due to the eye tracking component of the study. This study was approved by the university's Human Subject Review Board, and informed consent was obtained before administration of the self-report measures. Participants were then invited to complete the second portion of the study, the eye-tracker procedure, for which informed consent was also obtained.

Measures

Cannabis use behaviors. The Cannabis Use Disorders Identification Test (CUDIT) was utilized to assess frequency of cannabis use in the last 6 months. A

modification of the Alcohol Use Disorders Identification Test (AUDIT), this 10-item self-report measure evaluates cannabis abuse and dependence based on DSM-IV criteria (Adamson & Sellman, 2003). The Problematic Use of Marijuana (PUM) is based on ICD-10 criteria for harmful cannabis use. This questionnaire consists of eight yes/no items and was used to evaluate lifetime prevalence of cannabis-related problems. These include interpersonal, social responsibility, and cognitive difficulties (Okulicz-Kozaryn, 2007). The PUM has an internal consistency coefficient of .92 and has been deemed appropriate for males and females, as well as different age groups (Piontek, Kraus & Klemptova, 2008). In the current sample, the PUM exhibited acceptable reliability, with $\alpha = .76$.

Schizotypal traits. The Schizotypal Personality Questionnaire-Brief Revised was used to measure schizotypal traits (Cohen, Matthews, Najolia, & Brown, 2010). The SPQ-BR is comprised of 32 items selected from the original SPQ and quantifies cognitive-perceptual (i.e., positive), disorganized, and interpersonal (i.e., negative) traits. The SPQ-BR total score has excellent internal consistency, with a Cronbach's alpha of .90. The factor scales produce acceptable-to-good internal consistency in college students (i.e., positive factor $\alpha = .79$, disorganized factor $\alpha = .83$, negative factor $\alpha = .86$; Cohen et al., 2010). Reliability was good for the SPQ-BR in this sample, $\alpha = .89$. The SPQ-BR utilizes a 5-point Likert-type scale, with response options ranging from "Strongly Disagree" to "Neutral" to "Strongly Agree." Because the present study is based on the dimensional model of the schizophrenia spectrum, SPQ-BR scores from all participants were examined in analyses, similar to the methods of previous research by Wuthrich and Bates (2006).

The positive schizotypy factor is comprised of the Ideas of Reference, Suspiciousness, Magical Thinking, and Unusual Perceptions subscales. The disorganized factor includes the Odd Speech and Eccentric Behavior subscales. Interpersonal or negative schizotypy is made up of the No Close Friends and Constricted Affect subscales. Although other SPQ measures include the Social Anxiety subscale (Raine et al., 1994), Cohen and researchers (2010) found that the 3-factor model excluding social anxiety was also reliable and may better represent schizotypy, as the prototypical schizotypal individual is thought to be socially anhedonic (Mishlove & Chapman, 1985). Because social anxiety is not a core constituent of schizotypy, the social anxiety symptoms will not be analyzed. Due to incomplete responding, weighted means were calculated for four items for 10 individuals, and one item for 1 individual. One participant skipped the second page of the SPQ-BR, so this participant's scores for the SPQ-BR were eliminated from analyses.

Personality. Participants completed the M-5 120, which measures the following five broad factors of personality and their six corresponding facets: Neuroticism, Openness, Agreeableness, Conscientiousness, and Extraversion. The M-5 utilizes a five-point Likert-type scale, with one being "Very Inaccurate" and five being "Very Accurate." The 120 items are divided equally with 24 questions per domain and four questions per individual facet (Johnson, 2001). While previous findings have indicated that the reliability for the M5-120 is in the acceptable range with an average Cronbach's alpha of .68 (Johnson, 2001), internal consistency was good in the current sample, $\alpha = .80$.

Emotional expression recognition. To register eye movements, the present study utilized the Tobii TX 300 Eye Tracker. Pictures from the Ekman series of basic emotional expressions were used in a facial expression recognition task (Ekman, 1993). The task required participants to view 34 randomized pictures of happy, sad, angry, disgusted, and neutral faces, 14 male and 14 female. First, a ten-point calibration, (i.e., five points per eye) was performed for each participant prior to the task. Next, the participant received the directions on the screen, along with verbal instructions. The task required participants to press a corresponding key on the computer, indicating whether they saw a positive, negative, or neutral facial expression, (by pressing ‘f’, ‘j’, or space bar, respectively). Each picture appeared on the screen until the participant pressed the answer key. After the first five pictures, the participants were given a reminder to ensure that they pressed the correct key for their intended responses.

Accuracy scores were created based on whether or not the participant pressed the correct key identifying positive, negative, or neutral affect. Next, these scores were converted into accuracy percentages for each type of emotion, (e.g., happy, sad, disgust, angry, and neutral). In addition to correct responses, gaze durations on areas of interest within a face were categorized by emotion and summed. Specifically, these areas included the eyes and mouth.

The lateralization preference of each participant was determined by summing the total visit duration (i.e., total time including fixations and saccades) for the left and right sides of every picture. While previous studies have calculated lateralization preference based on the direction of the first saccade, (Leonards & Mohr, 2009), other research suggests that this marker may only be indicative of a visual preference in schizophrenia,

as this population has problems shifting visual attention to different facial hemispheres after the initial fixation (Phillips & David, 1997). Because the current sample consists of college students, the total visit duration of left and right facial hemisphere may be more useful in determining lateralization preference.

CHAPTER FOUR: RESULTS

Self-Report Results

Normality testing. Exploratory analyses were conducted to examine the distribution of the data. Cannabis use frequency was not normally distributed (skewness = 1.92, $SE = .16$, kurtosis = 2.57, $SE = .31$). The dichotomous grouping of cannabis users of the last 6 months, (i.e., no use versus use) was non-normally distributed, (skewness = .86, $SE = 0.16$, kurtosis = -1.27, $SE = .31$), as was the problematic cannabis use, (skewness = 2.19, $SE = .16$, kurtosis = 4.20, $SE = .31$). Additional analyses were conducted, and the results of a series of Kolmogorov-Smirnova Tests of Normality verified this non-normal distribution. Additionally, two schizotypy variables were significant, which indicates non-normality: disorganized schizotypy ($D = .071$, $df = 241$, $p < .01$) and negative schizotypy ($D = .116$, $df = 241$, $p < .01$). Because the cannabis variables and two schizotypy variables are not normally distributed, non-parametric tests were chosen to analyze the data (Pallant, 2010).

Descriptive statistics. Of the total sample, 169 (69.8%) participants had not used cannabis in the last 6 months. Seventy-three (30.2%) participants in the sample had used cannabis in the last 6 months, which is consistent with literature citing a 33% prevalence rate of cannabis use among college students within the past year (Johnston et al., 2011). Cannabis use frequency can be seen in the following (Table 2). For descriptive statistics for schizotypy factors and total, as well as personality domains, please see Table 3.

Table 2.

Cannabis Use Frequency of the Total Sample

<u>Cannabis Use Frequency</u>	<u><i>n</i></u>	<u>Percent</u>
Never	169	69.8%
Monthly or Less	36	14.9%
2-4 Times a Month	12	5.0%
2-3 Times a Week	10	4.1%
4 or More Times a Week	15	6.2%

N = 242

Table 3.

*Descriptive Statistics for Schizotypal Personality Questionnaire-Brief Revised (SPQ-BR)
Total and Factors and M-5 Personality Domains*

<u>Characteristic</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>
Total Schizotypy*	73.00	34.00	118.00
Positive Schizotypy	34.00	16.00	58.00
Disorganized Schizotypy*	25.00	8.00	40.00
Negative Schizotypy*	13.00	6.00	29.00
Extraversion	53.31	25.67	70.42
Agreeableness	54.66	27.18	73.23
Conscientiousness	54.26	33.46	73.70
Neuroticism	45.76	23.62	71.77
Openness to Experience	43.66	17.45	67.21

N = 242, **N* = 241

Cannabis Use and Schizotypy

Mann-Whitney U tests. To test the first hypothesis, a series of Mann-Whitney U Tests were conducted with a Bonferroni correction (i.e., .05 divided by 4) of .0125.

Results revealed no significant differences in negative schizotypy between individuals who did not use cannabis in the last 6 months, ($Md = 13.00$, $n = 168$) and those who used cannabis in the last 6 months, ($Md = 14.00$, $n = 73$), $U = 5590.00$, $z = -1.09$, $p > .05$.

There was also no significant difference in positive schizotypy, with cannabis users in the last 6 months ($Md = 35.00$, $n = 73$) and non-users in the last 6 months, ($Md = 34.00$, $n = 169$), $U = 5331.00$, $z = -1.68$, $p > .05$. A significant difference in disorganized schizotypy

was found between non-users of cannabis in the last 6 months, ($Md = 24.00, n = 168$) compared to users of cannabis ($Md = 28.00, n = 73$), $U = 4869.00, z = -2.54, p = .01, r = .16$. There was also a marginally significant difference in total schizotypy, with cannabis users in the last 6 months ($Md = 76.00, n = 73$) and non-users in the last 6 months, ($Md = 71.30, n = 168$), $U = 5037.00, z = -2.20, p < .05, r = .14$. Overall, users of cannabis in the last 6 months had significantly higher disorganized schizotypy and marginally higher total schizotypy scores compared to non-users. Thus, the first hypothesis was partially supported.

Correlations. A bivariate correlation matrix was analyzed to test hypothesis two and determine associations between schizotypy total and subscale scores, frequency of cannabis use, and cannabis-related problems. As expected, there was a significant positive correlation between cannabis use frequency and cannabis-related problems, $r(242) = .739, p < .001$. Consistent with hypothesis two, all schizotypy factors were significantly associated with cannabis-related problems in the positive direction; however, only disorganized and total schizotypy were significantly correlated to cannabis use frequency. The whole sample was used because nine participants who did not use cannabis in the last 6 months reported cannabis-related problems. If participants refrained from use due to these issues, this data is relevant to the current study.

Table 4.

Correlations between Schizotypy, Cannabis Use Frequency, and Cannabis-Related Problems

Schizotypy	Cannabis Use Frequency	Cannabis-Related Problems
Total ($N = 241$)	$r = .154^*$	$r = .201^{**}$
Positive ($N = 242$)	$r = .119$	$r = .156^*$
Disorganized ($N = 241$)	$r = .157^*$	$r = .168^{**}$
Negative ($N = 241$)	$r = .073$	$r = .141^*$

* $p < .05$, ** $p < .01$

Cannabis Use and Personality

Mann-Whitney U tests. Next, the third hypothesis was tested with a series of Mann-Whitney U Tests, calculated to assess for significant differences between users versus non-users in personality domains. A Bonferroni correction of 5 was applied. As can be seen from Table 5, only Agreeableness, ($U = 3907.00$, $r = .29$) and Conscientiousness, ($U = 4135.50$, $r = .27$) were significantly different, with users of cannabis in the last 6 months scoring lower in both domains. There were no significant differences in Neuroticism, Extraversion, and Openness to Experience between users and non-users of cannabis in the last 6 months. While hypothesis three was correct in that users of cannabis were lower in Agreeableness and Conscientiousness, they were not higher in Openness to Experience or the Neuroticism facets of Anger and Vulnerability, as predicted; however, cannabis users were higher in Immoderation, consistent with hypothesis three.

Table 5.

Medians, U-Statistics, and Z-Scores for Personality Domain Comparisons between Non-Cannabis and Cannabis Users of the Last 6Months

<u>Statistics</u>	<u>No Cannabis Use</u>	<u>Cannabis Use</u>	<u>Mann-Whitney</u>	
	(<i>n</i> = 168) Md	(<i>n</i> = 74) Md	<i>U</i>	<i>z</i>
Personality Domains				
Neuroticism	45.76	46.17	5645.00	0.26
Extraversion	53.31	53.97	5729.00	0.33
Agreeableness	55.40	49.49	3917.00	-4.58*
Conscientiousness	55.97	51.19	4122.50	-4.17*
Openness to Experience	42.33	44.74	5645.00	-1.20

**p* < .01

Because Agreeableness and Conscientiousness were significantly lower in cannabis users, another series of Mann-Whitney U Tests were conducted to examine facet-level differences within these domains between cannabis and non-cannabis users. Results can be seen in Table 6. A Bonferroni correction of .004 was set to control Type I error inflation. Compared to non-users, cannabis users in the last 6 months were lower in Trust, Tendermindedness, Cooperation, Dutifulness, Achievement-Striving, Self-Discipline, and Cautiousness. These results partially support the third hypothesis, which predicted that cannabis users would be lower in all facets of Conscientiousness and Agreeableness, although only the aforementioned facets were significantly lower in cannabis users in this sample.

Table 6.

Medians, U-Statistics, and Z-Scores for Personality Facet Comparisons between Non-Cannabis and Cannabis Users of the Last 6Months

Personality Facets	No Cannabis Use	Cannabis Use	Mann-Whitney Statistics	
	(<i>n</i> = 169) Md	(<i>n</i> = 73) Md	<i>U</i>	<i>z</i>
Trust (A1)	54.73	49.39	4374.00	-3.61*
Morality (A2)	51.57	48.32	4921.50	-2.52
Altruism (A3)	53.57	52.40	5196.00	-1.97
Cooperation (A4)	55.82	50.74	4681.00	-2.99*
Modesty (A5)	51.96	51.07	5615.50	-1.11
Tendermindedness (A6)	56.17	49.84	4575.50	-3.21*
Self-Efficacy (C1)	55.00	50.92	5080.50	-2.21
Order (C2)	56.73	54.46	5163.00	-2.02
Dutifulness (C3)	57.28	49.99	4486.00	-3.40*
Achievement-Striving (C4)	54.63	51.69	4767.00	-2.82*
Self-Discipline (C5)	55.44	52.40	4486.50	-3.38*
Cautiousness (C6)	52.86	45.64	4312.00	-3.72*

**p* < .004

Correlations. To complete testing of the third hypothesis, bivariate correlations were calculated between personality and cannabis use frequency. Additional correlations were conducted between personality and cannabis-related problems to address the first research question. Results can be seen in the following table. Overall, Immoderation, Gregariousness, and Excitement-Seeking were positively associated to cannabis use

frequency and cannabis-related problems. Cannabis use and related problems were also associated with lower Emotionality, Agreeableness, Trust, Altruism, Cooperation, Tendermindedness, Order, Dutifulness, Achievement-Striving, Self-Discipline, and Cautiousness. Low Activity was only correlated with cannabis use frequency, while low Morality was only correlated with cannabis-related problems.

Table 7.

Correlations between Personality Domains, Facets, Cannabis Use Frequency, and Cannabis-Related Problems

Domains and Facets	Cannabis Use Frequency	Cannabis-Related Problems
	(<i>N</i> = 242)	(<i>N</i> = 242)
Neuroticism	<i>r</i> = .057	<i>r</i> = .059
Anxiety	<i>r</i> = .003	<i>r</i> = -.035
Anger	<i>r</i> = .110	<i>r</i> = .117
Depression	<i>r</i> = -.006	<i>r</i> = .067
Self-Consciousness	<i>r</i> = -.074	<i>r</i> = -.113
Immoderation	<i>r</i> = .218**	<i>r</i> = .242**
Vulnerability	<i>r</i> = .002	<i>r</i> = -.014
Extraversion	<i>r</i> = .100	<i>r</i> = .081
Friendliness	<i>r</i> = -.040	<i>r</i> = -.027
Gregariousness	<i>r</i> = .211**	<i>r</i> = .156*
Assertiveness	<i>r</i> = .029	<i>r</i> = .010
Activity	<i>r</i> = -.134*	<i>r</i> = -.068
Excitement-Seeking	<i>r</i> = .245**	<i>r</i> = .241**
Cheerfulness	<i>r</i> = .027	<i>r</i> = -.041
Openness to Experience	<i>r</i> = .045	<i>r</i> = .091
Imagination	<i>r</i> = .085	<i>r</i> = .066
Artistic Interests	<i>r</i> = .044	<i>r</i> = .108
Emotionality	<i>r</i> = -.146*	<i>r</i> = -.133*
Adventurousness	<i>r</i> = .049	<i>r</i> = .095
Intellect	<i>r</i> = .024	<i>r</i> = .062
Liberalism	<i>r</i> = .081	<i>r</i> = .109
Agreeableness	<i>r</i> = -.249**	<i>r</i> = -.302**
Trust	<i>r</i> = -.294**	<i>r</i> = -.255**
Morality	<i>r</i> = -.121	<i>r</i> = -.225**
Altruism	<i>r</i> = -.129*	<i>r</i> = -.175**
Cooperation	<i>r</i> = -.168*	<i>r</i> = -.231**
Modesty	<i>r</i> = -.035	<i>r</i> = -.077
Tendermindedness	<i>r</i> = -.195**	<i>r</i> = -.207**
Conscientiousness	<i>r</i> = -.262**	<i>r</i> = -.288**
Self-Efficacy	<i>r</i> = -.068	<i>r</i> = -.041
Order	<i>r</i> = -.131*	<i>r</i> = -.183**
Dutifulness	<i>r</i> = -.307**	<i>r</i> = -.340**
Achievement-Striving	<i>r</i> = -.145*	<i>r</i> = -.205**
Self-Discipline	<i>r</i> = -.229**	<i>r</i> = -.214**
Cautiousness	<i>r</i> = -.222**	<i>r</i> = -.221**

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

Schizotypy and Personality

Correlations. To assess the fourth hypothesis, bivariate correlations were calculated between personality and schizotypy scores. Hypothesis four was partially supported, with all schizotypy scales significantly positively associated with Neuroticism, and all schizotypy scales were negatively correlated with Conscientiousness, as predicted. Further, all factors of schizotypy were significantly negatively associated with Extraversion and Agreeableness except disorganized schizotypy. While positive and disorganized schizotypy were positive association with Openness to Experience as hypothesized, negative schizotypy was not significantly negatively associated with Openness to Experience. Hypothesis four was correct in that all facet-level correlations between schizotypy factors and Neuroticism were significantly associated, although negative schizotypy was not associated with Immoderation. All facets of Conscientiousness were also negatively associated with all factors of schizotypy as predicted, with the exception of associations between negative schizotypy, Order, and Cautiousness. Associations with the facets of Extraversion, Agreeableness, and Openness to Experience vary by schizotypy factor. For all domain- and facet-level results, see Table 8.

Table 8.

*Correlations between Personality Domains, Facets, Total Schizotypy, and Schizotypy**Factors*

Domains and Facets	Total Schizotypy	Positive Schizotypy	Disorganized Schizotypy	Negative Schizotypy
	(N = 241)	(N = 242)	(N = 241)	(N = 241)
Neuroticism	$r = .503^{**}$	$r = .484^{**}$	$r = .323^{**}$	$r = .321^{**}$
Anxiety	$r = .361^{**}$	$r = .368^{**}$	$r = .240^{**}$	$r = .187^{**}$
Anger	$r = .317^{**}$	$r = .315^{**}$	$r = .223^{**}$	$r = .162^*$
Depression	$r = .473^{**}$	$r = .422^{**}$	$r = .248^{**}$	$r = .431^{**}$
Self-Consciousness	$r = .306^{**}$	$r = .207^{**}$	$r = .200^{**}$	$r = .342^{**}$
Immoderation	$r = .345^{**}$	$r = .388^{**}$	$r = .264^{**}$	$r = .071$
Vulnerability	$r = .374^{**}$	$r = .390^{**}$	$r = .228^{**}$	$r = .205^{**}$
Extraversion	$r = -.242^{**}$	$r = -.134^*$	$r = -.093$	$r = -.409^{**}$
Friendliness	$r = -.478^{**}$	$r = -.333^{**}$	$r = -.244^{**}$	$r = -.608^{**}$
Gregariousness	$r = -.114$	$r = -.008$	$r = -.072$	$r = -.253^{**}$
Assertiveness	$r = -.140^*$	$r = -.106$	$r = -.095$	$r = -.131^*$
Activity	$r = -.098$	$r = -.044$	$r = -.062$	$r = -.150^*$
Excitement-Seeking	$r = .161^*$	$r = .159^*$	$r = .214^{**}$	$r = -.049$
Cheerfulness	$r = -.329^{**}$	$r = -.236^{**}$	$r = -.108$	$r = -.486^{**}$
Openness to Experience	$r = .185^{**}$	$r = .130^*$	$r = .238^{**}$	$r = .046$
Imagination	$r = .330^{**}$	$r = .266^{**}$	$r = .328^{**}$	$r = .147^*$
Artistic Interests	$r = .126$	$r = .075$	$r = .158^*$	$r = .057$
Emotionality	$r = .006$	$r = .074$	$r = .090$	$r = -.225^{**}$
Adventurousness	$r = -.011$	$r = -.007$	$r = .075$	$r = -.050$
Intellect	$r = -.079$	$r = -.124$	$r = -.008$	$r = -.023$
Liberalism	$r = .251^{**}$	$r = .184^{**}$	$r = .206^{**}$	$r = .202^{**}$
Agreeableness	$r = -.361^{**}$	$r = -.355^{**}$	$r = -.122$	$r = -.357^{**}$
Trust	$r = -.381^{**}$	$r = -.302^{**}$	$r = -.152^*$	$r = -.478^{**}$
Morality	$r = -.275^{**}$	$r = -.298^{**}$	$r = -.097$	$r = -.219^{**}$
Altruism	$r = -.249^{**}$	$r = -.226^{**}$	$r = -.079$	$r = -.288^{**}$
Cooperation	$r = -.334^{**}$	$r = -.334^{**}$	$r = -.178^{**}$	$r = -.235^{**}$
Modesty	$r = .022$	$r = -.037$	$r = -.074$	$r = .042$
Tendermindedness	$r = -.175^{**}$	$r = -.188^{**}$	$r = -.031$	$r = -.184^{**}$
Conscientiousness	$r = -.477^{**}$	$r = -.400^{**}$	$r = -.399^{**}$	$r = -.284$
Self-Efficacy	$r = -.365^{**}$	$r = -.301^{**}$	$r = -.262^{**}$	$r = -.285^{**}$
Order	$r = -.239^{**}$	$r = -.215^{**}$	$r = -.215^{**}$	$r = -.095$
Dutifulness	$r = -.331^{**}$	$r = -.315^{**}$	$r = -.221^{**}$	$r = -.209^{**}$
Achievement-Striving	$r = -.332^{**}$	$r = -.276^{**}$	$r = -.216^{**}$	$r = -.283^{**}$
Self-Discipline	$r = -.389^{**}$	$r = -.259^{**}$	$r = -.377^{**}$	$r = -.286^{**}$
Cautiousness	$r = -.365^{**}$	$r = -.330^{**}$	$r = -.351^{**}$	$r = -.114$

* $p < .05$, ** $p < .01$

Cannabis-Related Problems

While the first research question sought to find significant predictors of cannabis-related problems, this could not be examined with this dataset. Despite recoding and transforming the data to reduce skewness and kurtosis in the cannabis-related problems variable, no transformation reduced skewness and kurtosis to acceptable levels. Every viable suggestion from multiple sources (Field, 2005, pp. 153-155; Pallant, 2010, p. 93) was used in an attempt to transform the data. Because the outcome variable is not normally distributed, a regression would not be appropriate, and non-parametric options were then explored. When using the PUM as an indicator of cannabis-related problems, the cutoff score of 2 for ICD-10 dependence classification has 80.9% sensitivity (Okulicz-Kozaryn, 2007). Based on this information, the sample was divided into three categories: 1.) Zero (0) or no cannabis-related problems, 2.) One to two cannabis-related problems, and 3.) Three or more cannabis-related problems, with each category representing the total PUM score.

Cannabis-Related Problems and Schizotypy

Kruskal-Wallis test. In order to find differences in schizotypy as a function of cannabis-related problems, a Kruskal-Wallis Test was conducted. While there were no significant differences in positive schizotypy, there was a statistically significant difference across groups within disorganized, $\chi^2 = 7.46$, $p < .05$, negative, $\chi^2 = 7.08$, $p < .05$, and total schizotypy, $\chi^2 = 9.85$, $p < .01$. A series of nonparametric Mann-Whitney U Tests post-hoc analyses at the Bonferroni adjusted level (i.e., .05 divided by 12) of .004 indicated no differences in schizotypy between those with one or two problems and those with three or more problems. When compared to those with no problems, individuals

with one to two problems endorsed more negative, $U = 2459.00$, $z = -2.47$, $p = .01$, $r = .17$ and total schizotypy, $U = 2422.00$, $z = -2.57$, $p = .01$, $r = .17$, although these differences were only marginally significant. Descriptive statistics for each group can be found in the following table. Again, disorganized, negative, and total schizotypy was significantly different among cannabis-related problems groups, and this appears to be driven by differences in disorganized schizotypy between those who have any cannabis-related problems versus those with no cannabis-related problems, as well as the subclinical group's higher negative schizotypy scores.

Table 9.

Median Schizotypy Scores across Cannabis-Related Problems Groups

Schizotypy	<u>Cannabis-Related Problems Groups</u>		
	No Problems ($n = 179$)	1-2 Problems ($n = 34$)	3+ Problems ($n = 25$)
Total Schizotypy	71.00*	78.00	77.00
Positive Schizotypy	33.00	36.00	35.60
Disorganized Schizotypy	24.00	28.00	29.00
Negative Schizotypy	13.00	15.00	14.00

* $n = 180$

Cannabis-Related Problems and Personality

Kruskal-Wallis test. Next, another Kruskal-Wallis Test was analyzed for differences in personality across cannabis problem groups. Only Agreeableness, $\chi^2 = 23.33$, $p < .001$, and Conscientiousness, $\chi^2 = 23.67$, $p < .001$, were significantly different across groups. A Kruskal-Wallis Test was also conducted to assess facet-level personality

differences across cannabis problem groups. The following facets were significantly different: Excitement-Seeking, $\chi^2 = 17.89, p < .001$, Trust, $\chi^2 = 15.20, p < .001$, Morality, $\chi^2 = 10.78, p < .01$, Cooperation, $\chi^2 = 14.04, p = .001$, Tendermindedness, $\chi^2 = 8.86, p < .05$, Self-Efficacy, $\chi^2 = 7.37, p < .05$, Order, $\chi^2 = 9.90, p < .01$, Dutifulness, $\chi^2 = 20.434, p < .001$, Achievement-Striving, $\chi^2 = 16.59, p < .001$, Self-Discipline, $\chi^2 = 10.54, p < .01$, Cautiousness, $\chi^2 = 16.13, p < .001$, Anger, $\chi^2 = 6.17, p < .05$, and Immoderation, $\chi^2 = 12.41, p < .01$.

Mann-Whitney U tests of personality domains. Post-hoc analyses consisted of a series of Mann-Whitney *U* Tests. For the two domains of interest, a Bonferroni correction was applied, (i.e., .05 divided by 6) of .008. Agreeableness was significantly different between those with no cannabis-related problems ($Md = 55.40$) and those with 1-2 cannabis-related problems, ($Md = 49.46$), $U = 2192.50, z = -3.27, p = .001, r = 0.22$. This difference was also found between the no-problem group ($Md = 55.40$) and the 3 or more problem group ($Md = 49.46$), $U = 1138.50, z = -4.00, p < .001, r = 0.28$. There were no differences between the 1-2 and 3+ cannabis-related problems groups, $U = 407.50, z = -0.79, p > .05$. Conscientiousness was also significantly different between the no cannabis-related problems group ($Md = 55.63$) and those with 1-2 cannabis-related problems, ($Md = 50.51$), $U = 2206.50, z = -3.23, p = .001, r = 0.22$. This difference was even more pronounced between the no-problem group ($Md = 55.63$) and the 3 or more problem group ($Md = 47.37$), $U = 1143.50, z = -3.98, p < .001, r = 0.28$. No differences were observed between the 1-2 problems groups ($Md = 55.63$) and the 3+ group ($Md = 47.37$), $U = 368.00, z = -1.36, p > .05$. In sum, Agreeableness and Conscientiousness were higher in individuals with no cannabis-related problems.

Mann-Whitney U tests of personality facets. Another series of Mann-Whitney U Tests were then conducted post-hoc with a Bonferroni correction (i.e., $.05/39$) .001 to test for group differences in significant personality facets previously reported. Results can be seen in Table 10, while the medians of the facets of interest for each group are listed in Table 11. The data suggests that when compared to individuals who do not experience cannabis-related problems, those who meet criteria for cannabis dependence (i.e, three or more cannabis-related problems), are significantly higher in Excitement-Seeking, marginally higher in Immoderation, and significantly lower in Cooperation, Dutifulness, and Cautiousness. Interestingly, those with one or two cannabis-related problems were significantly lower in Trust and Achievement-Striving when compared to those with no problems.

Table 10.

Mann-Whitney U Statistics for Facet-Level Personality Differences across Cannabis-Related Problems Groups (With Z Statistic in Parentheses)

<u>Personality Facets</u>	<u>Group Comparisons</u>			<u>Effect Size</u>
	0 v 1-2	0 v 3+	1-2 v 3+	<i>r</i>
Excitement- Seeking (E5)	2424.00(-2.62)	1252.00(-3.61)*	342.50(-1.74)	*0.25
Trust (A1)	2134.50(-3.45)*	1613.50(-2.30)	443.50(-0.27)	*0.23
Morality (A2)	2617.00(-2.07)	1470.00(-2.83)	409.00(-0.77)	
Cooperation (A4)	2578.00(-2.18)	1332.50(-3.32)*	370.50(-1.33)	*0.23
Tendermindedness (A6)	2825.50(-1.46)	1474.00(-2.81)	393.00(-1.01)	
Self-Efficacy (C1)	2395.50(-2.72)	2221.50(-0.10)	347.50(-1.69)	
Order (C2)	2845.00(-1.40)	1424.00(-2.99)	359.50(-1.48)	
Dutifulness (C3)	2740.50(-1.72)	1056.00(-4.34)*	280.50(-2.64)	*0.30
Achievement-Striving (C4)	2207.50(-3.25)*	1449.50(-2.90)	452.00(-0.15)	*0.22
Self-Discipline (C5)	2709.00(-1.80)	1443.50(-2.92)	372.50(-1.30)	
Cautiousness (C6)	2411.00(-2.65)	1321.50(-3.35)*	385.00(-1.12)	*0.23
Anger (N2)	2496.00(-2.41)	1971.50(-1.01)	414.50(-0.69)	
Immoderation (N5)	2657.00(-1.95)	1375.00(-3.16)	362.50(-1.44)	

* $p < .001$

Table 11.

Median Facet Scores across Cannabis-Related Problems Groups

<u>Personality Facets</u>	<u>Number of Problems</u>		
	<u>None</u> (<i>n</i> = 180) <i>Md</i>	<u>1-2</u> (<i>n</i> = 37) <i>Md</i>	<u>3+</u> (<i>n</i> = 25) <i>Md</i>
Excitement-Seeking (E5)	47.39	51.51	54.26
Trust (A1)	54.73	46.72	52.06
Morality (A2)	51.57	51.57	45.08
Cooperation (A4)	55.82	50.74	48.20
Tendermindedness (A6)	54.59	53.00	46.68
Self-Efficacy (C1)	50.92	50.92	50.92
Order (C2)	56.73	54.46	52.19
Dutifulness (C3)	57.28	53.64	46.35
Achievement-Striving (C4)	54.63	48.75	48.75
Self-Discipline (C5)	55.44	52.40	52.40
Cautiousness (C6)	52.86	45.64	45.64
Anger (N2)	44.48	49.16	46.04
Immoderation (N5)	43.52	46.36	49.20

Eye Tracker Results

Descriptive statistics. Within the eye-tracker sample (*N* = 70), 49 participants (70.0%) had not used cannabis in the last 6 months, while 21 participants (30.0%) had

used cannabis. Descriptive statistics of cannabis use frequency can be seen in the next table. Table 13 lists descriptive statistics of schizotypy scores and personality domains.

Table 12.

Cannabis Use Frequency of the Eye Tracker Sample

<u>Cannabis Use Frequency</u>	<u><i>n</i></u>	<u>Percent</u>
Never	49	70.0%
Monthly or Less	10	14.3%
2-4 Times a Month	4	5.7%
2-3 Times a Week	2	2.9%
4 or More Times a Week	5	7.1%

N = 70

Table 13.

*Descriptive Statistics for Schizotypal Personality Questionnaire-Brief Revised (SPQ-BR)
Total and Factors and M-5 Personality Domains*

<u>Characteristic</u>	<u>Median</u>	<u>Minimum</u>	<u>Maximum</u>
Total Schizotypy*	73.00	45.00	118.00
Positive Schizotypy	35.00	18.00	56.00
Disorganized Schizotypy*	24.00	12.00	40.00
Negative Schizotypy*	13.00	6.00	24.00
Extraversion	55.61	30.93	67.13
Agreeableness	53.92	32.38	72.49
Conscientiousness	52.90	34.82	73.70
Neuroticism	44.95	25.45	69.33
Openness to Experience	43.54	19.86	64.00

N = 70

To examine associations between emotion recognition accuracy and the variables of interest, a bivariate correlation was calculated with schizotypy (positive, disorganized, negative, and total), frequency of cannabis use, cannabis-related problems, personality, total feature fixation duration and fixation counts for eyes and mouths of each type of emotion, and emotion recognition accuracy. Accuracy for each emotion, along with the fixation duration and fixation count for the eyes and mouth of each type of emotion, were analyzed in a bivariate correlation matrix with total and subscales of schizotypy, frequency and problematic cannabis use, and personality domains and facets.

Emotion Identification Accuracy

Correlations. The correlational results suggest that total, positive, and disorganized, but not negative schizotypy, are associated with a reduced ability to identify neutral; conversely, individuals higher in these characteristics were associated with an increased ability to identify happy faces. Excitement-Seeking correlates to inaccuracy in identifying emotions overall, but sad faces in particular. Accuracy for identifying all faces was also negatively correlated with Self-Efficacy, $r(70) = .242, p < .05$, and Cautiousness, $r(70) = .306, p = .01$. Additionally, accuracy in identifying neutral faces was positively associated with Conscientiousness, $r(70) = .307, p = .01$, as well as the Conscientiousness facets of Self-Efficacy, $r(70) = .331, p < .01$, Self-Discipline, $r(70) = .360, p < .01$, and Cautiousness, $r(70) = .302, p = .01$. Immoderation was marginally negatively associated with accuracy for identifying neutral faces, $r(70) = -.233, p = .05$.

With regard to negative emotions, accuracy in identifying sad faces was negatively associated with Excitement-Seeking, $r(70) = -.236$, and $p < .05$, Cheerfulness, $r(70) = -.250, p < .05$. Positive associations with accuracy for sad faces include Anxiety, $r(70) = .239, p < .05$, and Intellect, $r(70) = .330, p < .01$. Disgust accuracy was positively correlated to Trust, $r(70) = .245, p < .05$, and negatively correlated with Liberalism, $r(70) = -.263, p < .05$. Identifying angry faces correctly was positively associated with Trust, $r(70) = .263, p < .05$. For all emotional identification accuracy correlations, refer to Appendix I. It should also be noted that emotional identification accuracy was not associated with cannabis use frequency or cannabis-related problems.

Feature Fixation

Correlations. Cannabis-related problems were negatively associated with fixation duration of happy eyes, $r(70) = -.250, p < .05$, and fixation count for happy eyes, $r(70) = -.252, p < .05$. Fixation count for neutral eyes was negatively associated with cannabis-related problems, $r(70) = -.266, p < .05$, as well as marginally negatively correlated with Extraversion, $r(70) = -.231, p = .05$. For neutral mouths, total fixation count was positively associated with disorganized schizotypy, $r(70) = .249, p < .05$, and negatively correlated with Conscientiousness, $r(70) = -.258, p < .05$. For sad eyes, cannabis-related problems were negatively associated with fixation count, $r(70) = -.247, p < .05$. For sad mouths, disorganized schizotypy was positively correlated with total fixation duration, $r(70) = .259, p < .05$.

Extraversion was negatively correlated with the total fixation duration on angry eyes $r(70) = -.251, p < .05$, and fixation count for angry eyes, $r(70) = -.299, p = .01$. Moreover, total fixation duration for angry mouths was significantly positive associated with disorganized schizotypy, $r(70) = .258, p < .05$, and cannabis-related problems, $r(70) = .243, p < .05$; however, this associated was negative for fixation on angry mouths and Conscientiousness, $r(70) = -.277, p < .05$. Cannabis-related problems were negatively associated with fixation duration, $r(70) = -.255, p < .05$, as well as fixation count, $r(70) = -.252, p < .05$, for eyes of disgusted faces. Conversely, total fixation duration on disgust mouths was positively correlated with disorganized schizotypy, $r(70) = .274, p < .05$. All fixation associations, including personality facet correlations, can be found in Appendix K. In sum, as the number of cannabis-related problems increased, focus on happy, neutral, disgust, and sad eyes decreased, although attention to angry mouths increased.

Disorganized schizotypy was positively associated with fixation on angry, sad, disgust, and neutral, but not happy, mouths.

Lateralization

Unexpectedly, schizotypy was not associated with the total visit duration of the left or right side. However, cannabis use frequency was negatively correlated with visit duration of left lateralization. While no personality domains were correlated to lateralized visit duration, the Agreeableness facet of Altruism, $r(70) = -.296$, $p = .01$, and the Openness facet of Feelings, $r(70) = -.374$, $p < .01$, were negatively associated with the total visit duration of the right side of emotional faces. All lateralization correlations can be found in Appendix J. Next, a chi square test of independence was conducted between cannabis use in the last 6 months and lateralization preference. There was a marginally significant association between cannabis use in the last 6 months and right lateralization preference, $\chi^2(1, N = 70) = 3.053$, $p = .08$, $\phi = -.209$.

CHAPTER FIVE: DISCUSSION

Within the last 6 months, 30.2% of the total sample and 30.0% of the eye tracker subsample used cannabis. These rates are similar to those in Johnston and colleagues' findings (2011), which examined substance use habits of college students and adults ages 19-50 and found a cannabis prevalence rate of 33% on college campuses and 32% in noncollege young adults. Further, daily cannabis use is reported by between 4.4% (college students) and 7.7% (noncollege individuals) in previous research (e.g., Johnston et al., 2011). Although daily use was not assessed in the current study, 6.2% of the total sample and 7.1% of the eye tracker subsample endorsed using cannabis four or more times a week. Given this high rate of frequent use, these results may be generalizable to emerging adulthood and not necessarily restricted to college settings.

Cannabis Use and Schizotypy

Consistent with previous literature (Barkus & Lewis, 2008; Schiffman et al., 2005) and partially supporting the first hypothesis, disorganized schizotypy scores were higher for cannabis users of the last 6 months relative to non-users. Although positive symptoms were only marginally higher in cannabis users than non-users, this difference was significant before controlling for Type I error inflation, suggesting that this difference might be significant with a larger sample. For example, Cohen and associates (2011) found that frequent cannabis use was associated with more positive and disorganized schizotypy traits, regardless of whether or not the individual met the clinical cutoff for schizotypy. This corroborates the dopamine hypothesis in that cannabis, a dopaminergic agonist, increases the psychosis-prone traits in individuals, although this is not specific to those at a higher risk for later schizophrenia-spectrum disorders. In other

words, the significantly higher disorganized and marginally higher cognitive schizotypy scores in this sample may be a function of the effects of cannabis use, rather than a genetic predisposition for schizophrenia-spectrum disorders. Illicitly distributed cannabis is now lower in cannabidiol and higher in Δ^9 -THC, which could more easily potentiate anxiogenic and psychotic symptoms (Potter, Clark, & Brown, 2008). More research needs to be on schizotypy and cannabis use, as these associations are still largely unexplained.

The significant association between cannabis use frequency and disorganized schizotypy may be artificially inflated. Previous work (Earlywine, 2006; Esterberg et al., 2009) has shown that substance users may misinterpret certain items on the SPQ-B, and SPQ-BR (e.g., “I sometimes use words in unusual ways”; “Other people see me as slightly eccentric [odd]”; and “People sometimes comment on my unusual mannerisms and habits”). While the first item was removed in the creation of the SPQ-BR, the second and third items are within the Eccentric Behavior subscale of disorganized schizotypy on the SPQ-BR. Interestingly, cannabis users had significantly higher scores on these items when compared to non-users within this sample (data not shown). Because this has also been observed in alcohol users, substance users in general may be perceived as different or unconventional, and these individuals may label themselves as such from interpretations of social interactions (Esterberg et al., 2009).

The other subscale comprising disorganized schizotypy is Odd Speech, on which are two items that cannabis users scored higher on in this sample: “Do you tend to wander off the topic when having a conversation?” and “I sometimes forget what I am trying to say.” These items reflect loose associations and short-term memory deficits,

both of which are symptomatic of cannabis use, regardless of psychosis-proneness.

Further, Barkus and Lewis (2008) noted higher disorganized schizotypy scores in current versus former cannabis users, as well as those who had used cannabis at least once versus never. Taken together, these data suggest that the higher disorganized schizotypy scores in cannabis users of the last 6 months, as well as the association between cannabis use frequency and disorganized schizotypy, are artificially inflated by item functioning and physiological effects of immediate cannabis use, rather than an increase in the risk for psychosis.

Unlike the findings of Skosnik and researchers (2008), the negative schizotypy scores of cannabis users were not significantly different from non-users in this study, which contradicts the self-medication model and the notion that individuals with less negative schizotypal traits are more likely to use substances (Potvin, Sepehry, & Stip, 2006). It is possible that because the majority of the cannabis users only used cannabis approximated once a month, this is not representative of the more frequent cannabis user, who may experience less negative schizotypy symptoms. Another plausible explanation is that negative schizotypy traits are only ameliorated in individuals who are clinically schizotypal. This hypothesis would explain the why cannabis use frequency was not significantly associated with negative symptoms in this sample and is consistent with previous research findings of lower negative schizotypy scores with cannabis use only in individuals with clinically elevated levels of schizotypy (Cohen et al., 2011). Regardless of the cause, the results of the current study suggest that cannabis use does not decrease negative schizotypal symptoms in college students, although there was a trend suggesting

that negative schizotypal symptoms are lowered in individuals with more cannabis-related problems.

Like frequency of cannabis use, related problems were most closely associated with disorganized schizotypy. Unlike frequency, which was only significantly associated with disorganized and total schizotypy, cannabis-related problems were significantly correlated to all schizotypy factors, as well as the total; however, it should be noted that these correlations were weak (i.e., $r < .25$). Despite this, the data trend suggests that there is something unique about the association between cannabis-related problems and schizotypy not captured by cannabis use alone. It may be that those experiencing cannabis-related problems are more likely to also experience schizotypal symptoms, with an underlying predisposition toward general psychopathology and impairment in functioning. While this perspective seems congruent with the supersensitivity hypothesis, it may not be that cannabis use and related problems increase the vulnerability for schizophrenia-spectrum disorders.

Cannabis Use and Personality

Contrary to hypothesis three, cannabis use was not associated with Openness to Experience. Only the facet of Emotionality was associated with cannabis use frequency and related problems. These inverse associations suggest that cannabis users may have slightly blunted affect and may not consider emotions to be of high importance. While the finding that Neuroticism was not significantly related to cannabis use frequency is consistent with research by Terracciano and researchers (2008), the current findings are different in that only the facet of Immoderation was positively associated with cannabis use, not Anger or Vulnerability. This discrepancy may be due to the ages of participants,

as this sample was comprised of college students, while Terracciano and colleagues (2008) had participants who ranged from 30 to 94 years old. The association with Immoderation was stronger for cannabis-related problems. Higher impulsivity may lead to trouble controlling cannabis use frequency, as well as adhering to social responsibilities, such as school or work. This finding of trait impulsivity is consistent with previous conceptualizations of individuals who use substances (Bardo, Kelly, Lynam, & Milich, 2006).

Although no hypothesis was made regarding cannabis use and Extraversion, Gregariousness and Excitement-Seeking were positively associated with cannabis frequency and cannabis-related problems. This indicates that cannabis users are social individuals who seek out stimulation. Within Extraversion, the facet of Activity was only associated with cannabis use, not related problems. Individuals with lower activity levels seem more leisurely and relaxed. Previous studies have suggested that individuals use cannabis as a coping mechanism for social anxiety (Buckner & Schmidt, 2008). Further, cannabis use also can induce physiological responses of well-being and sedation (Julien, Advokat, & Comaty, 2011). The lack of association between cannabis-related problems and low Activity suggests that these individuals would not appear to be calm and relaxed, as a cannabis user who does not experience related problems may be perceived.

As predicted, cannabis users of the last 6 months were lower in Conscientiousness and Agreeableness (Fridberg et al., 2011). While all correlations between cannabis use frequency, cannabis-related problems, and all facets of Conscientiousness and Agreeableness were negative, Modesty (A5) and Self-Efficacy (C1) were not significantly associated with the cannabis-related variables. Further, Morality was

negatively associated with cannabis-related problems only, suggesting that those who experience functional impairment from cannabis use are more guarded and willing to manipulate others, although this trait is not associated with cannabis use in general.

When compared to non-users, cannabis users are lower in the Agreeableness facets of Trust, Cooperation, and Tendermindness. This profile is consistent with individuals who are cynical realists who prefer logic to emotion, are not reluctant to express anger, and are skeptical of others. Cannabis users of the last 6 months were also lower in the Conscientiousness facets of Dutifulness, Achievement-Striving, Self-Discipline, and Cautiousness. Terracciano and researchers (2008) also found cannabis users to be lower in Dutifulness and Deliberation. Based on this configuration, cannabis users may be unreliable, spontaneous, easily discouraged, engage in avoidance, and lazy or unmotivated; however, these individuals are often quite content with their lives and may not feel the need to fulfill moral obligations. This pattern of traits was also associated with schizotypy.

Schizotypy and Personality

The strongest associations with Neuroticism were total and positive schizotypy. Genetic research has indicated that 51% of the variation shared by Neuroticism and positive schizotypy can be accounted for by genetic influences (Macare, Bates, Heath, Martine, and Ettinger, 2012). Further, affect dysregulation and depression are common in schizophrenia-spectrum patients, and some research suggests that depressive symptoms may be indicative of later psychosis (Yung, Phillips, Yuen, & McGorry, 2004). The current data supports this idea, as Depression was the strongest Neuroticism facet-level association for total, positive, and negative schizotypy. Previous research has found

disorganized schizotypy to be associated with higher Neuroticism (Kerns, 2006). In addition to replicating this finding, the present study also found that the strongest facet correlation with disorganized schizotypy was Immoderation, which is strongly linked with cannabis use.

Unlike the other factors and total schizotypy, disorganized traits were not associated with the domain of Extraversion. This may be because disorganized schizotypy was significantly associated with Friendliness in the negative direction, while the association with Excitement-Seeking was positive. Less friendliness and more reserved mannerisms were associated with all factors of schizotypy; moreover, the strongest association was found between negative schizotypy and Friendliness ($r = -.61$). This is in line with work by Ross and researchers (2002), in which they assert that positive schizotypy is harder to predict with the five-factor model than negative schizotypy. Interestingly, only the negative schizotypy factor was not significantly associated with Excitement-Seeking, as all other factors were positively correlated. When combined with the lack of association with Immoderation, it appears that negative schizotypal traits may serve as a protective factor against traits associated with substance use; however, the current data found no differences in negative schizotypy between the cannabis users and non-users. One possible explanation is that individuals with negative schizotypy traits use cannabis for different reasons (e.g., alleviation of dysphoria through substance use) than those with trait impulsivity who seek stimulation.

Openness to Experience was positively associated with positive and total schizotypy, although the strongest correlation was to disorganized schizotypy. This is consistent with previous findings (Fridberg et al., 2011). This also has some degree of

face validity, as individuals high in Openness are perceived as unconventional and disorganized schizotypy is a measure of unusual speech and peculiar behavior. Negative schizotypy was associated with low facet Emotionality, much like cannabis use frequency. There are two possible reasons for these associations: Cannabis users and those with negative schizotypal traits inherently experience a lack of affect, which they try to increase through cannabis use, or cannabis is used to blunt negative affect.

Much like the profile of cannabis users, schizotypy scores were associated with lower Agreeableness and Conscientiousness. At the domain level, only disorganized schizotypy was not significantly correlated with Agreeableness. At the facet level, no schizotypy factor was associated with Modesty, but positive, negative, and total schizotypy were negatively associated with every other facet of Agreeableness. This is consistent with individuals who are cynical, skeptical, self-centered, deceptive, and unsympathetic. When combined with low Conscientiousness, it is understandable that individuals with schizotypal traits may have problems within social relationships.

Conscientiousness was associated negatively with all factors of schizotypy at the domain and facet level, although low Conscientiousness was mostly strongly associated with total schizotypy. At the facet level, all schizotypal traits were associated with the personality profile of individuals who lack ambition, are eager to quit, do not consider consequences, are unorganized, and may be unreliable. While this is extremely similar to the pattern of characteristics associated with cannabis use frequency, there is one important difference. As schizotypy increases, the facet of Self-Efficacy decreases, indicating that schizotypal individuals feel that they are inept to deal with life and struggle with self-esteem. This association was not found with cannabis use frequency or

cannabis-related problems, suggesting that perception of self-inadequacy at the trait level is not due to impairment of social functioning due to cannabis use.

Cannabis-Related Problems and Schizotypy

After the sample was trichotomized according to the number of cannabis-related problems endorsed, there were no group differences in positive schizotypy. This runs counter to the supersensitivity and dopamine hypotheses, as the effects of cannabis are similar to those of positive schizotypy, and more pronounced positive schizotypal traits were not observed in cannabis users or those with who have experienced one or more cannabis-related problems. While disorganized schizotypy was found to be different amongst the groups, post-hoc analyses revealed none of these differences to be significant. When taken with the significant but weak correlation between these constructs, the data suggests that disorganized schizotypal traits do not increase as cannabis-related problems increase. This supports the aforementioned notion that disorganized schizotypy scores may be artificially inflated due to item wording that is biased towards individuals who use cannabis.

Negative schizotypy and total schizotypy scores were highest amongst those who only endorsed 1-2 cannabis related problems. This was unexpected, as one would expect those who meet criteria for harmful use/dependence of cannabis (i.e., 3 or more items endorsed on the PUM), to have more elevated schizotypy symptoms. Previous literature (Najolia et al., 2012) and the supersensitivity model (Gregg et al., 2007) indicate that individuals with schizotypal traits endorse more cannabis-related problems. Refuting this notion is research by Gonzales, Bradizza, Vincent, Stasiewicz, & Paas (2007) which found no empirical evidence for the supersensitivity model, as dual-diagnosis patients

(i.e., individuals with schizophrenia and co-occurring substance use disorders), did not endorse more substance-related problems than individuals with only substance use diagnoses. Data from the current study is also contradictory of the supersensitivity model, as individuals who experienced few cannabis-related problems endorsed more negative schizotypal traits than those who reported problematic use.

While not significant, the negative and total schizotypy scores in the three or more cannabis-related problems group were lower than those with 1-2 problems. This finding may not be significant within a larger sample, but this seems to be consistent with dual-diagnoses (i.e., schizophrenia with co-occurring substance use) patients reporting less negative symptoms and better social skills (Potvin et al., 2006). This could also be explained by a Δ^9 -THC-induced increase in sociability (Julien et al., 2011). Although future research should examine this association with a larger sample, these results suggest that cannabis dependence may decrease negative schizotypal symptoms, concurrent with the alleviation of dysphoria model.

The alleviation of dysphoria model of schizophrenia posits that individuals use cannabis to relieve boredom, depression, and loneliness, and aspects of these states may be tapped into by the negative schizotypy subscales of Constricted Affect and No Close Friends. It is plausible that individuals who meet criteria for cannabis dependence use the substance in social situations, which would lessen the perception of alienation accompanying negative schizotypy. This is unlikely, however, because those who exhibit negative schizotypal traits aiming to decrease boredom and depression are likely to be introverted and not seek social interaction. Therefore, results of the present study superficially support the alleviation of dysphoria model. Research from Cohen and

associates (2011) also support this model, as those with schizotypy who use cannabis frequently reported significantly more cannabis-related problems, yet they were not more interested in treatment for reducing cannabis use. There is also the possibility that those who meet cannabis dependence criteria have underlying psychopathology traits, such as anxiety and depression (Degenhardt, Hall, & Lynskey, 2003), that are not expressed as schizotypal traits but contribute to poorer functioning, especially when combined with cannabis use.

Cannabis-Related Problems and Personality

The five-factor model associated with cannabis-related problems was very similar to that of cannabis use frequency, which included high Excitement-Seeking, high Immoderation, and low Emotionality. Given the high correlation between the two, this was expected. However, there are some specific differences between the two. Specifically, low Morality was associated with increased cannabis-related problems, suggesting that this trait tendency to be guarded may contribute to social functioning problems and decreased social support, leading to more cannabis-related problems. Problematic use was also not associated with relaxed and slower physical pace, as cannabis use frequency was. Additionally, while not significant, the data showed the highest facet-level Anger in those with only one or two problems. This group also exhibited lower in Trust and Achievement-Striving. Together, these trait patterns are consistent with the current finding that this group reported the highest levels of negative schizotypy. This indicates that those with more cannabis-related problems are less relaxed, more easily frustrated, more skeptical of others, and less motivated than cannabis users without related problems appear to be.

Those who endorsed one or more cannabis-related problems were much lower in Agreeableness and Conscientiousness than those who did not experience cannabis-related problems. Moreover, those with 3 or more problems were even lower in Conscientiousness. Interestingly, a marginal difference was found in Dutifulness between 1-2 and 3+ problem groups, which indicates that those who report a clinical number of cannabis-related problems are more likely to be unreliable than those without problematic cannabis use. It may be that individuals who are inherently more undependable experience more cannabis-related problems because they may already fail to meet social, school, and/or work obligations.

Overall, it appears that problematic cannabis-users are spontaneous, novelty-seeking individuals, who may be perceived as undependable and aggressive. This is consistent with Flory and colleagues' (2002) research which found symptoms of cannabis dependence to be associated with low Agreeableness and Conscientiousness, as well as antisocial characteristics. Given that Morality decreases as cannabis-related problems increase, it is not surprising that those with dependence problems have antisocial personality traits, such as willingness to manipulate others. Although not significant, Immoderation increased with number of cannabis problems, which is congruent with previous findings that impulsivity strengthened the association between cannabis use and related problems. When combined with lack of motivation or ambition, it is understandable that these individuals' experience more impairment in social and general functioning due to cannabis use. It is important to note that some social functioning problems may be related to an individual's ability to recognize and interpret emotions of others.

Emotion Recognition

Contrary to previous research (Perlman et al., 2009), Neuroticism was not significantly associated with fixation on features of any emotion, including negative expressions. However, facet-level Anxiety was positively associated with sad face identification accuracy, while Immoderation decreased neutral face accuracy. Higher depression scores increased fixation on angry eyes, while Self-Consciousness decreased fixation on all mouths (e.g., angry, disgust, sad, happy, and neutral mouths). These findings partially support the trait-congruency hypothesis (Bargh et al., 1988), as anxious individuals were better at identifying sad faces and depression increased attention to angry eyes.

An interesting finding was the negative pattern between Extraversion and fixating on angry and neutral eyes. Those high in Friendliness avoided angry eyes. Further, the Extraversion facets of Excitement-Seeking and Cheerfulness decreased accuracy in identifying sad faces. Individuals higher in Excitement-Seeking fixated more on angry and neutral mouths. Cheerfulness or positive emotion was also negatively associated with accuracy for sad faces. These findings partially support the trait-congruency hypothesis, as traits indicative of social individuals were associated with decreased accuracy for identifying sadness and avoidance of angry eyes. As mentioned above, trait anxiety had the exact opposite association with identifying sadness, which fits conceptually and with the research of Bradley, Mogg, and Millar (2000), who found that those with anxiety tend to be hypervigilant toward negative social cues.

Contrary to the trait-congruency hypothesis was the association between Trust and the ability to recognize disgust, while Liberalism decreases the accuracy for

identifying disgust. Intellect increased ability to identify sad faces, although there is no obvious explanation for this association. Overall emotional identification accuracy increased with Conscientiousness facets of Self-Efficacy and Cautiousness. Reduction in accuracy was associated with more Excitement-Seeking. Individuals with schizotypy and users of cannabis are both low in Conscientiousness and higher in Excitement-Seeking, (with the exception of negative schizotypal traits). Previous research indicates that these individuals exhibit deficits in emotional identification.

Based on previous findings, one would expect cannabis-related variables (Platt et al., 2010) and schizotypy (Germine & Hooker, 2010) to be associated with this facial affect recognition. Although cannabis use frequency and related problems were not associated with accuracy, positive, disorganized, and total schizotypy were associated with inaccuracy in identifying neutral faces. Attenuated attention to prominent facial features when viewing neutral expressions has been found in schizophrenia (Loughland et al., 2002). Conversely, fixation duration on neutral mouths was positively associated with disorganized schizotypy in the present study, suggesting that focusing on the mouth of neutral faces makes these expressions harder to identify. This is corroborated by the fact participants with higher positive, disorganized, and total schizotypal traits were more inaccurate in identifying neutral faces.

Inconsistent with the findings of Perlman and colleagues (2009), Conscientiousness was significantly associated with avoidance of neutral and angry mouths in this sample, whereas they found a negative association between Conscientiousness and attention to emotional eyes. Because Conscientiousness was also associated with accuracy in identifying neutral faces, it would appear that those with high

in this trait use a visual scanning method that is effective. Countering this idea is the finding that Self-Discipline decreased accuracy for identifying happy faces; however, this may be because those high in Self-Discipline avoided the mouths of angry, disgust, happy, and neutral mouths.

An unexpected pattern emerged between number of cannabis-related problems and avoiding the eyes of most emotional faces, (e.g., disgust, happy, sad, and neutral). Those with more cannabis problems did spend more time on angry mouths, like those with scoring higher in disorganized schizotypy. Therefore, this avoidance of the eyes may be related to inaccuracy when identify neutral faces. This would also explain why accuracy for happy faces was positively associated with positive, disorganized, and total schizotypy, as these individuals focus on the mouth. In the happy pictures, identification of the positive emotion may be easier when focusing on the mouth, which would explain why those high in Self-Discipline who avoid mouths, can easily identify neutral mouths but are more inaccurate with happy expression.

A significant finding was the negative association between cannabis use frequency and left lateralization preference. Inattention to the left side of emotional faces is often seen in schizophrenia (Loughland et al., 2002; Phillips & David, 1997). Because there were no associations with schizotypy and lateralization preference, it may be that emotional recognition deficits previously seen in schizophrenia and cannabis use may be related to dopaminergic alterations in the frontal lobe and not necessarily an underlying etiological factor which leads to both. For example, high Emotionality was associated with decreased visual attention to the right side of faces, so individuals with lower

Emotionality may spend more time on the right side of the face, such as those who use cannabis and/or exhibit negative schizotypal traits.

Findings of a recent study by Abbott and Green (2013) contradict the findings of the current study. In their sample, negative schizotypy was associated with reduced accuracy in identifying emotions. One reason for this discrepancy is the calculation of negative schizotypal symptoms. Abbott and Green (2013) included the subscales of Social Anxiety and Suspiciousness, in addition to No Close Friends and Constricted Affect. Because this study used the SPQ-BR, Suspiciousness was captured under positive schizotypy. This makes sense conceptually, as suspiciousness is an attenuated form of paranoia. Further, Abbott and Green found the strongest correlation between facial affect identification inaccuracy and social anxiety, which is not a core construct of schizotypy. Due to these potential limitations, the findings of the current study may better reflect associations between schizotypy and the ability to recognize universal human emotions.

Limitations

The aforementioned results conclusions should be interpreted in light of the following limitations. First, this study relied on self-report measures for variables related to cannabis use, schizotypy, and personality. While type of assessment is frequently used and is considered an acceptable means of obtaining data (Baumeister, Vohs, & Funder, 2007), underreporting is possible. This is especially true for sensitive items related to cannabis use, given its Schedule I classification in the United States (DOJDEA, 2012). Despite the heavy use of self-report questionnaires, behavioral measures were collected through the use of the eye tracker.

The current sample lacks diversity, as most participants were White. It should be noted that the sample was largely consistent with the demographic make-up of the regional university where the data was collected. Additionally, because the sample is comprised of college undergraduates, these results may not generalize to a larger population; however, the frequency of daily use of those who reported cannabis use in the last 6 months suggests that these results may be generalizable to non-college young adults who use cannabis. The results of the current study may not extend to individuals with clinical schizotypal symptoms or individuals outside of the emerging adulthood age range, (i.e., adolescence, middle-age, and elderly populations); however, these results may be useful in understanding sub-clinical symptoms related to the schizophrenia-spectrum, given its dimensional nature (Rössler et al., 2012).

There are several potential confounding variables that were not taken into account in the current study. For example, based on the research of Teracciano and researchers (2008), cigarette smokers have a very similar personality profile to current marijuana users. When added to the fact that cannabis and tobacco use often co-occur (Agrawal, Silberg, Lynskey, Maes, & Eaves, 2010), not controlling for cigarette use is a potential limitation of this study. Further, although trait depression was not strongly associated with cannabis use or schizotypy, state depression and social anxiety, (Najolia et al., 2012) have been found to be comorbid with the previously mentioned groups. Further, psychiatric history and family histories were not taken, which could have strengthened the assessment of schizotypy.

For the eye tracker portion of the study, it is possible that the results may have been skewed by participants' head movements. Leonards and Mohr (2009) corrected this

by including a point of fixation between pictures to correct for natural movement. Additionally, a stationary chair would provide a more restrictive range of motion for the participant during the task. Although this study utilized pictures from the Pictures of Facial Affect series (Ekman, 1993), which is has standardized and highly used in research, these are static representations of emotion and are not ethnically diverse. Ecological validity may increase with use of a video with context when assessing processing of emotion (Miller & Lenzenweger, 2012). The set of 34 pictures used in the eye-tracking task were unequal in the frequency of emotional faces represented. This study did not assess fearful or surprise faces, two universal emotional expressions. By having only one key for negative emotions, (i.e., sad, angry, and disgust), and only one positive emotion (i.e., happy), the participants may have anticipated hitting the button corresponding to negative emotions because these were higher in proportion.

It should also be noted that an item analysis of the emotional accuracy data revealed that the accuracy of happiness was the least reliable of all emotions. This may be because so many participants could accurately identify the positive emotional faces. In fact, two of the happy face stimuli had 100% accuracy, which reduced the reliability of the task. Continuing research may want to use attenuated versions of emotions, thus making identification harder, and the testing of the ability to distinguish emotions more reliable. While the task created in the current study exhibited poor reliability (i.e., $\alpha = .52$), to this author's knowledge, no previous emotion recognition research has taken reliability into account (e.g., Abbott & Green, 2013; Perlman et al., 2009; Platt et al., 2010). Last, the bivariate correlations were not corrected for Type I error inflation, and a Poisson regression may have been a better choice to analyze the data. Future endeavors

researching cannabis use, schizotypy, and personality should take these limitations into account and aim to improve this methodology.

Future Directions

Future studies should examine the association between cannabis use and disorganized schizotypy. A longitudinal study could determine whether disorganized schizotypy is exacerbated by cannabis use, or if this correlation is due to the short-term cognitive effects of cannabis intake. Individuals at the subclinical significance for cannabis dependence exhibited more negative and overall schizotypal traits than those who met criteria for cannabis dependence. Further research should focus on individuals who fall into this sub-clinical threshold category, as these young adults may have potential dysfunction-provoking traits not found in individuals with cannabis dependence disorders. Longitudinal studies could also contribute to a greater understanding of the association between cannabis use, schizotypy, Agreeableness, and Conscientiousness. Future research should also focus on predicting cannabis-related problems, as this is indicative of current problems in social and general functioning, as well as potential for later psychopathology. Based on the current findings, there are personality differences between individuals who use cannabis, and those who develop cannabis-related problems and dependence. Potential avenues of research include finding psychological markers which can predict dependent, problematic versus recreational use.

Future studies may also want to evaluate gender differences between the variables of interest in this study. It is well-accepted that Neuroticism is generally higher in females (Costa, Terracciano, & McCrae, 2001), while cannabis use frequency (SAMHSA, 2011), schizotypy (Cohen et al., 2010) and Openness to Experience (Perlman

et al., 2009) are typically higher in males. Rubinstein (2005) noted that men are often exhibit lower Agreeableness and Conscientiousness than women, which may be one reason why males are more likely to engage in cannabis use. Females were better at emotion identification within this sample, which is consistent with previous literature (Hampson, van Anders, & Mullin, 2006). The differences in cannabis use, personality, schizotypy, and emotional identification may indicate a need for gender-specific interventions and treatments.

Previous research has found that individual differences, such as mood (Schmid, Schmid Mast, Bombari, Mast, & Lobmaier, 2011), and schizophrenia-spectrum symptoms (Bellgrove, Vance, & Bradshaw, 2003; Landgraf et al., 2011) affect information processing strategies, (i.e. global versus local processing). When combined with the fixation on certain facial features and facial affect recognition associations with schizotypy and personality variables found in the present study, upcoming research should explore information processing differences in schizotypy and personality. Another potential avenue of research would be incorporating fMRI technology when exploring the association between the variables of interest in the present study. While brain activation when viewing emotional faces has been done by Fusar-Poli and associates (2009), only used fearful faces were used as stimuli.

The upcoming DSM-V includes attenuated psychosis syndrome, which involves attenuated positive and disorganized symptoms that occur at least once a week for one month, into Section III, conditions requiring further study (as cited in Carpenter & van Os, 2011). The current study, as well as previous and future schizotypy research, should be applied when investigating attenuated psychosis syndrome. For example, the role of

cannabis use and personality in attenuated psychosis syndrome warrant exploration.

Further, if this condition is on the schizophrenia-spectrum, examining eye-tracking and emotional identification patterns may be valuable when assessing attenuated psychosis syndrome.

Conclusion

The present research is consistent with previous findings of associations between cannabis use and schizotypy. There was a clear association between cannabis use and disorganized schizotypy, although more research needs to be done to determine if this relationship is inflated due to the cognitive effects of cannabis ingestion, rather than a predisposition for schizophrenia-spectrum disorders. Results of the current study were inconsistent with the supersensitivity model of schizophrenia, as positive schizotypy symptoms were not significantly higher as a function of cannabis-related problems. The findings partially supported the alleviation of dysphoria model, as negative schizotypy was higher in those with one to two cannabis related problems, but not individuals with clinical levels of cannabis-related problems.

Regarding the five-factor model, low Agreeableness and Conscientiousness were associated with cannabis use, related problems, and schizotypy. The strongest association observed in this study at the domain level of personality was between total schizotypy scores and Neuroticism. At the facet level, the association between low Friendliness and negative schizotypy was strongest, which is consistent with the conceptualization of negative schizotypy as traits related to reserved or restricted affect and poorer interpersonal functioning. Individuals endorsing a clinical number of cannabis-related

problems were higher in Excitement-Seeking, but lower in Cooperation, Dutifulness, and Cautiousness compared to individuals with no cannabis-related problems.

Individuals with positive and disorganized schizotypy exhibited deficits identifying neutral faces, but were better at recognizing happy faces. Conversely, as Conscientiousness increased, as did the ability to identify neutral faces, and this association appeared to be driven by the facets of Self-Efficacy, Self-Discipline, and Cautiousness. These facets were also negatively associated with fixation on neutral mouths, suggesting that individuals high in these specific traits use a successful visual scanning process when processing emotional ambivalent stimuli. Considering that these traits are lower in cannabis users, it is conceivable that lacking these traits increases inaccuracy. Cannabis-related problems were associated with avoidance of the eyes for most emotions, similar to individuals with schizophrenia. Moreover, as cannabis use increased, attention to the left side of the face decreased. This left visual field deficit is commonly seen in schizophrenia; therefore, dopaminergic alteration may explain some of the phenotypical similarities between these populations.

Overall, the results of the current study indicate that cannabis use tends to increase disorganized schizotypal symptoms. Schizotypy and cannabis use also share a number of personality characteristics, particularly low Agreeableness and Conscientious, which may increase the likelihood of seeking out cannabis and experiencing related problems. Additionally, these personality traits play a role in the visual strategies used by these individuals to identify emotions of others. Because those experiencing social dysfunction may isolate themselves due to particular personality traits, prevention of cannabis use, detection of schizotypy, and training in social skills during adolescence and

early adulthood would be most helpful in preventing later cannabis-related problems and emotional identification deficits.

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APPENDIX A

Informed Consent Form for Thoughts, Habits, and Consequences Study**What is the purpose of this research?**

The purpose of this research is to explore the relationships among personality traits and multiple negative outcomes, including potential cannabis-related problems and emotion processing tendencies in students.

What will be expected of me?

If you are a student and you are 18 years of age or older, you are eligible to participate in this study; however, individuals who are legally blind are not eligible due to the eye-tracking portion of the study. First, you will be introduced to the study, including risks and benefits, and if you want to participate, you will sign an informed consent form prior to filling out the study survey. Participation is completely voluntary, and you can decide to withdraw from the study at any time without penalty. If you consent to participation, you may be given research credits (units), extra credit points, or other types of points toward a course grade as determined by your instructor. No other reward (monetary or otherwise) will be provided for participation.

Next, you will be asked to fill out a packet of surveys, which will take approximately 30 minutes. Some people need more or less time, but we will ask you to please read each question carefully. Please do not put your name on any of the questionnaires – only on the consent forms! When you have completed the packet of questionnaires, you will return the packet and the informed consent form to the experimenter and he or she will separate the consent form from the rest of the packets. This keeps your responses confidential. When you return your informed consent form and questionnaire packet, you will also be given a Debriefing Form that further explains the purpose of the study and lists contact information for the researcher and appropriate resources. After completing these surveys, you may be contacted to complete the second portion of the study. This non-invasive procedure includes sitting at a computer monitor and looking at images of facial expressions for approximately 10 minutes.

How long with the research take? Survey: Approx. 30 min.; Eye-tracker: 5 min.

Will my answers be anonymous?

Your answers will remain confidential. Specifically, you will not be asked to provide your name or identifying information on the surveys. Your consent form is the only form that will have your name on it, and it will be separated from your survey packet. The surveys and consent forms will be kept in separate files in a locked office. Your responses will only be linked to your answers if you are eligible for the second portion of the study. (Not every participant will be selected for this portion.) If you contacted for the second portion of the study, you files will be re-entered into separate files as before.

Can I withdraw from the study if I decide to?

Yes! You can withdraw from the study at any time without penalty. If you opt to withdraw, your surveys will be removed from the study and destroyed.

Is there any harm that I might experience from taking part in the study?

There are no risks of physical or psychological harm. Because all information regarding illicit drug use will be kept separate from the consent forms, there are no foreseeable legal or social risks. Other than transient emotional discomfort that you may experience as a result of reflecting on your symptoms and perceptions while filling out the surveys, every effort will be made to ensure your safety and well-being. Specifically, the experimenter will remain alert and you can ask questions at any time. Also, the debriefing form will list resources available to students (free of charge) in the event you should experience more lasting distress.

How will I benefit from taking part in the research?

Participants will earn one credit for completing the surveys. An additional credit will be given for completing the eye tracking portion. In addition to the direct benefit of earning points toward a course, the potential benefits to participants include the following opportunities: experiencing first-hand how researchers conduct studies and gather information in this type of psychological research, receiving an individualized personality profile, and reflecting on your own experiences and perceptions as evoked by your participation. Finally, your participation may ultimately inform clinicians, researchers, consumers, and the community at large regarding the relationships among study variables that are included in our research.

Who should I contact if I have questions or concerns about the research?

Contact me, Brittany Blanchard, at beblanchard@email.wcu.edu. You can also contact Dr. Åsberg, faculty director of the project, at 828-227-3451 (or kasberg@email.wcu.edu). If you have concerns about your treatment as a participant in this study, contact the chair of WCU's Institutional Review Board through the office of Research Administration at WCU (828-227-7212).

**If you would like to receive your personality profile, put your contact information (e-mail address, mailing address, or phone number) below your signature.*

Name _____

Signature _____ Date: _____

APPENDIX B

Informed Consent Form for Thoughts, Habits, and Consequences Study**What is the purpose of this research?**

The purpose of this research is to explore the relationships among personality traits and multiple negative outcomes, including potential cannabis-related problems and emotion processing tendencies in students.

What will be expected of me?

If you are a student and you are 18 years of age or older, you are eligible to participate in this study; however, individuals who are legally blind are not eligible due to the eye-tracking portion of the study. Because you have been contacted to participate in this portion of the *Thoughts, Habits, and Consequences Study*, you have already been introduced to the study. If you wish to participate, you will sign this consent form prior to the start of the eye-tracking task. Participation is completely voluntary, and you can decide to withdraw from the study at any time without penalty. If you consent to participation, you will be compensated through research credit. No other reward (monetary or otherwise) will be provided for participation. When you return your consent form, we will begin. This non-invasive procedure involves sitting at a computer monitor and looking at images of various facial expressions.

How long with the research take? Approx. 5 minutes

Will my answers be anonymous?

Your performance will remain confidential. Your consent form is the only form that will have your name on it. All data collected from the eye-tracker will be analyzed using assigned participant identification numbers to further ensure confidentiality.

Can I withdraw from the study if I decide to?

Yes! You can withdraw from the study at any time without penalty. If you opt to withdraw, your surveys and eye-tracking data will be removed from the study and destroyed.

Is there any harm that I might experience from taking part in the study?

There are no risks of physical or psychological harm related to this study. Because all information regarding illicit drug use will be kept separate from the consent forms, there are no foreseeable legal or social risks. With regard to the eye-tracker, participants may feel mild discomfort when looking at sad or angry faces; however, this discomfort is no greater than one would experience in daily life. Also, the debriefing form will list resources available to students (free of charge) in the event you should experience more lasting distress.

How will I benefit from taking part in the research?

In addition to the credit you have received for completing the survey, another credit may be given for completing the eye tracking portion (depending on the number of

extra credits awarded by your instructor and/or your course requirement for research participation) Other potential benefits to participants include the following opportunities: experiencing first-hand how researchers conduct studies and gather information in this type of psychological research, receiving an individualized personality profile (survey portion), and reflecting on your own experiences and perceptions as evoked by your participation. Finally, your participation may ultimately inform clinicians, researchers, consumers, and the community at large regarding the relationships among study variables that are included in our research.

Who should I contact if I have questions or concerns about the research?

Contact me, Brittany Blanchard, at beblanchard@email.wcu.edu. You can also contact Dr. Åsberg, faculty director of the project, at 828-227-3451 (or kasberg@email.wcu.edu). If you have concerns about your treatment as a participant in this study, contact the chair of WCU's Institutional Review Board through the office of Research Administration at WCU (828-227-7212).

Name _____

Signature _____ Date: _____

APPENDIX C

Debriefing Form**Project Title: Thoughts, Habits, and Consequences Study**

Investigator: Brittany Blanchard, B.S., Department of Psychology, WCU

Thank you for participating in the Thoughts, Habits, and Consequences Study. As stated in the informed consent form, the purpose of this study is to investigate the relationships among aspects of personality and substance use. Specifically, we are examining which personality factors contribute to cannabis-related problems. We are also interested in the relationship between personality, cannabis use, and how individuals interpret facial expressions. Overall, the findings may contribute to the study of personality, substance-related problems, and emotion processing. Additionally, participation in this study may contribute to a greater understanding of oneself, should you choose to receive your five factor personality profile.

If you have questions about any aspect of this study, please feel free to contact the investigator, Brittany Blanchard at beblanchard@email.wcu.edu. You may also contact the faculty supervisor, Dr. Åsberg, via email at kasberg@wcu.edu or via phone 828-227-3451. You can also contact the IRB Chair at 828-227-3177. Finally, if you are experiencing distress as a result of participating in this study or would like to speak with a mental health professional regarding emotional or substance use problems, please contact the Counseling Center at Western Carolina University, (828)-227-7469, which offers services to students free of charge. Please contact the investigator for additional resources if needed.

APPENDIX D

Demographic Information:

Age: _____

Gender: _____

Ethnicity: _____

WCU Classification: _____

Major: _____

GPA: _____

APPENDIX E

Schizotypal Personality Questionnaire- Brief Revised (SPQ-BR)

1. Do you often feel nervous when you are in a group of unfamiliar people?

Strongly Disagree Disagree Neutral Agree Strongly Agree

2. I am an odd, unusual person.

Strongly Disagree Disagree Neutral Agree Strongly Agree

3. Do you believe in telepathy (mind-reading)?

Strongly Disagree Disagree Neutral Agree Strongly Agree

4. Other people see me as slightly eccentric (odd).

Strongly Disagree Disagree Neutral Agree Strongly Agree

5. I sometimes jump quickly from one topic to another when speaking.

Strongly Disagree Disagree Neutral Agree Strongly Agree

6. I tend to keep my feelings to myself.

Strongly Disagree Disagree Neutral Agree Strongly Agree

7. I often hear a voice speaking my thoughts aloud.

Strongly Disagree Disagree Neutral Agree Strongly Agree

8. Do you tend to wander off the topic when having a conversation?

Strongly Disagree Disagree Neutral Agree Strongly Agree

9. I rarely laugh and smile.

Strongly Disagree Disagree Neutral Agree Strongly Agree

10. I often feel that others have it in for me.

Strongly Disagree Disagree Neutral Agree Strongly Agree

11. I get anxious when meeting people for the first time.

Strongly Disagree Disagree Neutral Agree Strongly Agree

12. Do you believe in clairvoyance (psychic forces, fortune telling)?

Strongly Disagree Disagree Neutral Agree Strongly Agree

13. When you look at a person or yourself in a mirror, have you ever seen the face change right before your eyes?

Strongly Disagree Disagree Neutral Agree Strongly Agree

14. Do you feel that you cannot get “close” to people?

Strongly Disagree Disagree Neutral Agree Strongly Agree

15. I often ramble on too much when speaking.

Strongly Disagree Disagree Neutral Agree Strongly Agree

16. I feel very uncomfortable in social situations involving unfamiliar people.

Strongly Disagree Disagree Neutral Agree Strongly Agree

17. I find it hard to be emotionally close to other people.

Strongly Disagree Disagree Neutral Agree Strongly Agree

18. Do you sometimes feel that people are talking about you?

Strongly Disagree Disagree Neutral Agree Strongly Agree

19. I sometimes avoid going to places where there will be many people because I will get anxious.

Strongly Disagree Disagree Neutral Agree Strongly Agree

20. Have you had experiences with astrology, seeing the future, UFO's, ESP, or a sixth sense?

Strongly Disagree Disagree Neutral Agree Strongly Agree

21. Are your thoughts sometimes so strong that you can almost hear them?

Strongly Disagree Disagree Neutral Agree Strongly Agree

22. Have you ever felt that you are communicating with another person telepathically (by mind- reading)?

Strongly Disagree Disagree Neutral Agree Strongly Agree

23. I sometimes forget what I am trying to say.

Strongly Disagree Disagree Neutral Agree Strongly Agree

24. Do you sometimes get concerned that friends or co-workers are not really loyal or trustworthy?

Strongly Disagree Disagree Neutral Agree Strongly Agree

25. Do you sometimes feel that other people are watching you?

Strongly Disagree Disagree Neutral Agree Strongly Agree

26. When shopping, do you get the feeling that other people are taking notice of you?

Strongly Disagree Disagree Neutral Agree Strongly Agree

27. Do everyday things seem unusually large or small?

Strongly Disagree Disagree Neutral Agree Strongly Agree

28. Do you often have to keep an eye out to stop people from taking advantage of you?

Strongly Disagree Disagree Neutral Agree Strongly Agree

29. Do you feel that there is no one you are really close to outside of your immediate family, or people you can confide in or talk to about personal problems?

Strongly Disagree Disagree Neutral Agree Strongly Agree

30. I have some eccentric (odd) habits.

Strongly Disagree Disagree Neutral Agree Strongly Agree

31. People sometimes comment on unusual mannerisms and habits.

Strongly Disagree Disagree Neutral Agree Strongly Agree

32. I am not good at expressing my true feelings by the way I talk and look.

Strongly Disagree Disagree Neutral Agree Strongly Agree

APPENDIX F

Cannabis Use Disorders Identification Test (CUDIT)

Over the past 6 months...

1. How often did you use cannabis?

Never Monthly or less 2-4x a month 2-3x a week 4 or more x a week

2. How many hours were you "stoned" on a typical day when you had been using cannabis?

1 or 2 3 or 4 5 or 6 7 to 9 10 or more

3. How often were you "stoned" for 6 or more hours?

Never Less than monthly Monthly Weekly Daily or almost daily

4. How often did you find that you were not able to stop using cannabis once you had started?

Never Less than monthly Monthly Weekly Daily or almost daily

5. How often did you fail to do what was normally expected from you because of using cannabis?

Never Less than monthly Monthly Weekly Daily or almost daily

6. How often did you need to use cannabis in the morning to get yourself going after a heavy session of using cannabis?

Never Less than monthly Monthly Weekly Daily or almost daily

7. How often did you have a feeling of guilt or remorse after using cannabis?

Never Less than monthly Monthly Weekly Daily or almost daily

8. How often have you had a problem with your memory or concentration after using cannabis?

Never Less than monthly Monthly Weekly Daily or almost daily

9. Have you or someone else been injured as a result of your use of cannabis?

No Yes

10. Has a relative, friend or doctor or other health worker been concerned about your use of cannabis or suggested you cut down?

No Yes

APPENDIX G

Problematic Use of Marijuana (PUM)

Please read each item and circle your response.

1) Have you ever skipped school classes or came late to school because of cannabis use?

Yes No

2) Have you had a serious argument with family members because of your cannabis use?

Yes No

3) Have you had a serious argument with friends because of your cannabis use?

Yes No

4) Have you ever bought cannabis yourself?

Yes No

5) Do you have more and more problems in studying and understanding new information?

Yes No

6) Have you ever used cannabis when you were alone?

Yes No

7) Do you often feel desire for cannabis?

Yes No

8) Have you ever spent so much money on cannabis that you had to resign from other things or activities?

Yes No

APPENDIX H

M5-120 Questionnaire

David M. McCord, Ph.D., Western Carolina University

Age: _____ M F Date: _____

This is a personality questionnaire, which should take about 15 minutes. There are no right or wrong answers to these questions; you simply respond with the choice that describes you best.

If you feel that you cannot see the questions appropriately because of sight difficulties, cannot use a pencil well because of hand-motor problems, or know of any other physical, emotional, or environmental issues which would affect your performance on this test, please notify the testing administrator now.

The *M5 Questionnaire* is used primarily for research purposes, though in certain cases individual results may be shared with the test-taker through a professional consultation. In general, results are treated anonymously and are combined with other data in order to develop norms, establish psychometric properties of these scales and items, and to study various theoretical and practical issues within the field of personality psychology.

By proceeding with the process and responding to these questionnaire items, you are expressing your understanding of these terms and your consent for your data to be used for research purposes. You are also agreeing to release and forever discharge *Western Carolina University* and *David M. McCord, Ph.D.*, from any and all claims of any kind or nature whatsoever arising from the assessment process.

- Without spending too much time dwelling on any one item, just give the first reaction that comes to mind.
- In order to score this test accurately, it is very important that you answer *every* item, without skipping any. You may change an answer if you wish.
- It is ultimately in your best interest to respond as honestly as possible. Mark the response that best shows how you really feel or see yourself, not responses that you think might be desirable or ideal.

Turn the page over now

M5-120 Questionnaire						Page 2
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate
1	Worry about things.	0	0	0	0	0
2	Make friends easily.	0	0	0	0	0
3	Have a vivid imagination.	0	0	0	0	0
4	Trust others.	0	0	0	0	0
5	Complete tasks successfully.	0	0	0	0	0
6	Get angry easily.	0	0	0	0	0
7	Love large parties.	0	0	0	0	0
8	Believe in the importance of art.	0	0	0	0	0
9	Use others for my own ends.	0	0	0	0	0
10	Like to tidy up.	0	0	0	0	0
11	Often feel blue.	0	0	0	0	0
12	Take charge.	0	0	0	0	0
13	Experience my emotions intensely.	0	0	0	0	0
14	Love to help others.	0	0	0	0	0
15	Keep my promises.	0	0	0	0	0
16	Find it difficult to approach others.	0	0	0	0	0
17	Am always busy.	0	0	0	0	0
18	Prefer variety to routine.	0	0	0	0	0
19	Love a good fight.	0	0	0	0	0
20	Work hard.	0	0	0	0	0
21	Go on binges.	0	0	0	0	0
22	Love excitement.	0	0	0	0	0
23	Love to read challenging material.	0	0	0	0	0
24	Believe that I am better than others.	0	0	0	0	0
25	Am always prepared.	0	0	0	0	0
26	Panic easily.	0	0	0	0	0
27	Radiate joy.	0	0	0	0	0
28	Tend to vote for liberal political candidates.	0	0	0	0	0
29	Sympathize with the homeless.	0	0	0	0	0
30	Jump into things without thinking.	0	0	0	0	0
31	Fear for the worst.	0	0	0	0	0
32	Feel comfortable around people.	0	0	0	0	0
33	Enjoy wild flights of fantasy.	0	0	0	0	0
34	Believe that others have good intentions.	0	0	0	0	0
35	Excel in what I do.	0	0	0	0	0
36	Get irritated easily.	0	0	0	0	0
37	Talk to a lot of different people at parties.	0	0	0	0	0
38	See beauty in things that others might not notice.	0	0	0	0	0
39	Cheat to get ahead.	0	0	0	0	0
40	Often forget to put things back in their proper place.	0	0	0	0	0
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate

M5-120 Questionnaire						Page 3
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate
41	Dislike myself.	0	0	0	0	0
42	Try to lead others.	0	0	0	0	0
43	Feel others' emotions.	0	0	0	0	0
44	Am concerned about others.	0	0	0	0	0
45	Tell the truth.	0	0	0	0	0
46	Am afraid to draw attention to myself.	0	0	0	0	0
47	Am always on the go.	0	0	0	0	0
48	Prefer to stick with things that I know.	0	0	0	0	0
49	Yell at people.	0	0	0	0	0
50	Do more than what's expected of me.	0	0	0	0	0
51	Rarely overindulge.	0	0	0	0	0
52	Seek adventure.	0	0	0	0	0
53	Avoid philosophical discussions.	0	0	0	0	0
54	Think highly of myself.	0	0	0	0	0
55	Carry out my plans.	0	0	0	0	0
56	Become overwhelmed by events.	0	0	0	0	0
57	Have a lot of fun.	0	0	0	0	0
58	Believe that there is no absolute right or wrong.	0	0	0	0	0
59	Feel sympathy for those who are worse off than myself.	0	0	0	0	0
60	Make rash decisions.	0	0	0	0	0
61	Am afraid of many things.	0	0	0	0	0
62	Avoid contacts with others.	0	0	0	0	0
63	Love to daydream.	0	0	0	0	0
64	Trust what people say.	0	0	0	0	0
65	Handle tasks smoothly.	0	0	0	0	0
66	Lose my temper.	0	0	0	0	0
67	Prefer to be alone.	0	0	0	0	0
68	Do not like poetry.	0	0	0	0	0
69	Take advantage of others.	0	0	0	0	0
70	Leave a mess in my room.	0	0	0	0	0
71	Am often down in the dumps.	0	0	0	0	0
72	Take control of things.	0	0	0	0	0
73	Rarely notice my emotional reactions.	0	0	0	0	0
74	Am indifferent to the feelings of others.	0	0	0	0	0
75	Break rules.	0	0	0	0	0
76	Only feel comfortable with friends.	0	0	0	0	0
77	Do a lot in my spare time.	0	0	0	0	0
78	Dislike changes.	0	0	0	0	0
79	Insult people.	0	0	0	0	0
80	Do just enough work to get by.	0	0	0	0	0
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate

M5-120 Questionnaire						Page 4
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate
81	Easily resist temptations.	0	0	0	0	0
82	Enjoy being reckless.	0	0	0	0	0
83	Have difficulty understanding abstract ideas.	0	0	0	0	0
84	Have a high opinion of myself.	0	0	0	0	0
85	Waste my time.	0	0	0	0	0
86	Feel that I'm unable to deal with things.	0	0	0	0	0
87	Love life.	0	0	0	0	0
88	Tend to vote for conservative political candidates.	0	0	0	0	0
89	Am not interested in other people's problems.	0	0	0	0	0
90	Rush into things.	0	0	0	0	0
91	Get stressed out easily.	0	0	0	0	0
92	Keep others at a distance.	0	0	0	0	0
93	Like to get lost in thought.	0	0	0	0	0
94	Distrust people.	0	0	0	0	0
95	Know how to get things done.	0	0	0	0	0
96	Am not easily annoyed.	0	0	0	0	0
97	Avoid crowds.	0	0	0	0	0
98	Do not enjoy going to art museums.	0	0	0	0	0
99	Obstruct others' plans.	0	0	0	0	0
100	Leave my belongings around.	0	0	0	0	0
101	Feel comfortable with myself.	0	0	0	0	0
102	Wait for others to lead the way.	0	0	0	0	0
103	Don't understand people who get emotional.	0	0	0	0	0
104	Take no time for others.	0	0	0	0	0
105	Break my promises.	0	0	0	0	0
106	Am not bothered by difficult social situations.	0	0	0	0	0
107	Like to take it easy.	0	0	0	0	0
108	Am attached to conventional ways.	0	0	0	0	0
109	Get back at others.	0	0	0	0	0
110	Put little time and effort into my work.	0	0	0	0	0
111	Am able to control my cravings.	0	0	0	0	0
112	Act wild and crazy.	0	0	0	0	0
113	Am not interested in theoretical discussions.	0	0	0	0	0
114	Boast about my virtues.	0	0	0	0	0
115	Have difficulty starting tasks.	0	0	0	0	0
116	Remain calm under pressure.	0	0	0	0	0
117	Look at the bright side of life.	0	0	0	0	0
118	Believe that we should be tough on crime.	0	0	0	0	0
119	Try not to think about the needy.	0	0	0	0	0
120	Act without thinking.	0	0	0	0	0
		Innacurate	Moderately Innacurate	Neither	Moderately Accurate	Accurate

APPENDIX I

Correlation Tables for Emotion Recognition Accuracy

Correlations between Schizotypy, Cannabis Use, Cannabis-Related Problems, and Emotion Recognition Accuracy

Schizotypy and Cannabis Variables	Total Accuracy Score	Sad Accuracy	Happy Accuracy	Neutral Accuracy	Disgust Accuracy	Angry Accuracy
Positive Schizotypy	-.147	.015	.244*	-.249*	-.082	-.149
Disorganized Schizotypy	-.095	.061	.364**	-.301*	-.041	-.098
Negative Schizotypy	-.065	.045	-.031	-.077	-.022	-.099
Total Schizotypy	-.133	.044	.262*	-.271*	-.066	-.144
Cannabis-Related Problems	-.009	.008	-.058	.036	-.048	-.017
Cannabis Use Frequency	.133	.076	-.027	.132	-.038	.109

* $p < .05$, ** $p < .01$

Correlations between Personality and Emotion Recognition Accuracy

Personality Domains and Facets	Total	Sad	Happy	Neutral	Disgust	Angry
Extraversion	-.127	-.165	-.038	-.038	.049	-.069
Friendliness	.004	-.078	.007	.063	.037	-.015
Gregariousness	-.013	-.075	-.008	.014	.017	.058
Assertiveness	-.082	-.099	-.020	-.084	.152	-.067
Activity	-.034	.078	-.027	-.107	.154	-.183
Excitement-Seeking	-.272*	-.236*	.042	-.110	-.164	-.136
Cheerfulness	-.099	-.250*	-.201	.109	-.007	.086
Agreeableness	.085	.085	-.060	.029	.106	.014
Trust	.109	-.104	-.072	.055	.245*	.263*
Morality	-.066	-.015	.067	-.075	-.075	-.023
Altruism	.095	.103	.032	-.025	.154	-.005
Cooperation	.126	.113	-.103	.164	-.042	.019
Modesty	-.059	.110	-.112	-.034	-.044	-.197
Tendermindedness	.166	.159	.017	.038	.172	.002
Conscientiousness	.204	-.058	-.189	.307**	.138	.204
Self-Efficacy	.242*	-.108	-.004	.331**	.211	.141
Order	.107	.072	-.171	.066	.113	.130
Dutifulness	.033	-.108	-.089	.138	-.083	.197
Achievement-Striving	-.008	-.172	-.053	.158	.009	.009
Self-Discipline	.180	-.110	-.310**	.360**	.151	.197
Cautiousness	.306*	.090	-.143	.302*	.167	.216
Neuroticism	-.035	.137	.018	-.100	-.028	-.158
Anxiety	.056	.239*	-.054	-.060	.065	-.150
Anger	.002	.051	-.107	.111	-.128	-.088
Depression	.031	.196	.156	-.181	.125	-.155
Self-Consciousness	-.006	-.045	-.147	.099	-.078	.069
Immoderation	-.186	-.037	.186	-.233	-.129	-.119
Vulnerability	-.074	.152	.067	-.186	.007	-.223
Openness to Experience	.139	.177	.141	.037	.037	-.090
Imagination	-.012	.003	.032	.007	.078	-.177
Artistic Interests	.153	.157	.064	.108	.078	-.128
Emotionality	.035	-.021	-.036	.075	.108	-.078
Adventurousness	.055	.036	.170	-.001	-.002	-.022
Intellect	.223	.330**	.089	.010	.152	-.112
Liberalism	.007	.100	.175	-.041	-.263*	.046

* $p < .05$, ** $p < .01$

APPENDIX J

Correlation Tables for Lateralization Preference

*Correlations between Schizotypy, Cannabis Use Frequency, Cannabis-Related Problems,
and Lateralization Preference*

Schizotypy and Cannabis Variables	Left Side Total Visit Duration	Right Side Total Visit Duration
Positive Schizotypy	.073	.047
Disorganized Schizotypy	.088	-.004
Negative Schizotypy	.118	.017
Total Schizotypy	.105	.028
Cannabis-Related Problems	-.229	-.037
Cannabis Use Frequency	-.235*	-.117

* $p < .05$, ** $p < .01$

Correlations between Personality and Lateralization Preference

Personality Domains and Facets	Left	Right
Extraversion	-.067	-.014
Friendliness	-.128	.023
Gregariousness	-.111	-.037
Assertiveness	.126	-.127
Activity	.005	.030
Excitement-Seeking	-.025	.096
Cheerfulness	-.137	-.034
Agreeableness	-.086	-.115
Trust	-.024	.024
Morality	-.141	-.044
Altruism	.036	-.296*
Cooperation	-.106	-.031
Modesty	-.016	-.159
Tendermindedness	-.070	.036
Conscientiousness	-.012	-.063
Self-Efficacy	.104	-.086
Order	-.104	-.070
Dutifulness	-.146	.025
Achievement-Striving	.005	-.115
Self-Discipline	-.048	-.019
Cautiousness	.115	.002
Neuroticism	-.039	-.087
Anxiety	-.124	-.016
Anger	-.008	-.084
Depression	.100	-.009
Self-Consciousness	-.021	-.031
Immoderation	-.004	-.156
Vulnerability	-.089	-.090
Openness to Experience	-.009	-.073
Imagination	-.080	.025
Artistic Interests	.028	-.046
Emotionality	.102	-.374**
Adventurousness	-.078	.134
Intellect	.031	-.093
Liberalism	-.035	.021

* $p < .05$, ** $p < .01$

APPENDIX K

Correlation Tables for Emotional Feature Fixations

Correlations between Schizotypy, Cannabis Use Frequency, Cannabis-Related Problems, and Facial Feature Fixation for Neutral and Happy Faces

Schizotypy and Cannabis-Related Variables	Neutral Faces				Happy Faces			
	Fixation Duration		Fixation Count		Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth
Positive Schizotypy	-.093	.094	-.044	.041	-.015	-.005	.018	-.087
Negative Schizotypy	.060	.094	.086	.084	.068	.017	.114	.012
Disorganized Schizotypy	-.038	.249*	.015	.233	.010	.199	.066	.145
Total Schizotypy	-.047	.173	.006	.136	.015	.079	.067	.014
Cannabis Use Frequency	-.217	-.012	-.175	.066	-.192	.017	-.174	-.022
Cannabis-Related Problems	-.255*	.128	-.266*	.211	-.250*	.125	-.252*	.101

* $p < .05$, ** $p < .01$

*Correlations between Schizotypy, Cannabis Use Frequency, Cannabis-Related Problems,
and Facial Feature Fixation for Angry and Disgust Faces*

Schizotypy and Cannabis-Related Variables	Angry Faces				Disgust Faces			
	Fixation Duration		Fixation Count		Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth
Positive Schizotypy	-.001	.150	.036	.122	-.048	.112	.010	.053
Negative Schizotypy	.139	.107	.191	.141	.110	.205	.115	.194
Disorganized Schizotypy	-.005	.258*	.043	.260*	.053	.274*	.073	.245*
Total Schizotypy	.036	.209	.089	.206	.026	.223	.065	.177
Cannabis Use Frequency	-.183	.053	-.097	.024	-.223	-.009	-.192	.031
Cannabis-Related Problems	-.188	.243*	-.160	.208	-.255*	.177	-.252*	.209

* $p < .05$, ** $p < .01$

*Correlations between Schizotypy, Cannabis Use Frequency, Cannabis-Related Problems,
and Facial Feature Fixation for Sad Faces*

Schizotypy and Cannabis-Related Variables	Sad Faces			
	Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth
Positive Schizotypy	-.120	.038	-.097	-.035
Negative Schizotypy	.091	.058	.064	.014
Disorganized Schizotypy	-.049	.259*	-.003	.216
Total Schizotypy	-.058	.137	-.035	.070
Cannabis Use Frequency	-.143	.034	-.126	.040
Cannabis-Related Problems	-.216	.228	-.247*	.200

* $p < .05$, ** $p < .01$

Correlations between Personality and Facial Feature Fixation for Neutral and Happy

Faces

Personality Domains and Facets	Neutral Faces				Happy Faces			
	Fixation Duration		Fixation Count		Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth
Extraversion	-.188	.018	-.231	.132	-.166	.061	-.131	.146
Friendliness	-.186	-.022	-.216	.052	-.176	-.014	-.200	.048
Gregariousness	-.126	-.105	-.196	-.032	-.094	-.042	-.058	.000
Assertiveness	-.115	.009	-.152	.097	-.064	-.031	-.002	.096
Activity	-.087	.076	-.021	.123	-.096	.106	-.076	.144
Excitement-Seeking	-.011	.214	-.040	.268*	-.043	.227	-.004	.223
Cheerfulness	-.217	-.111	-.270*	-.004	-.187	.002	-.200	.058
Agreeableness	-.033	-.177	.085	-.072	.107	-.040	.117	.017
Trust	-.042	-.072	-.114	-.055	-.045	-.024	-.081	-.038
Morality	-.044	-.192	.139	-.096	.140	-.011	.186	.023
Altruism	-.176	-.051	-.061	.046	-.126	-.015	-.036	.044
Cooperation	.017	-.181	.080	-.084	.079	-.119	.086	-.027
Modesty	.041	-.122	.185	-.071	.212	-.006	.207	.045
Tendermindedness	.055	-.055	.088	-.014	.104	.014	.062	-.004
Conscientiousness	-.019	-.258*	-.023	-.168	-.030	-.203	.036	-.122
Self-Efficacy	-.026	-.096	-.002	.008	-.038	-.041	.046	-.015
Order	-.099	-.176	-.086	-.070	-.052	-.105	.003	-.018
Dutifulness	.015	-.278*	.022	-.193	.005	-.269*	.064	-.227
Achievement-Striving	-.185	-.104	-.069	-.052	-.073	.008	.035	.024
Self-Discipline	.028	-.280*	-.041	-.170	-.036	-.274*	-.056	-.150
Cautiousness	.171	-.189	.085	-.228	.057	-.204	.070	-.165
Neuroticism	.000	-.028	.028	-.125	.107	-.025	.047	-.105
Anxiety	.055	-.079	.050	-.152	.136	-.005	.051	-.093
Anger	-.025	-.021	.064	-.050	.007	-.043	.067	-.036
Depression	.150	.078	.185	-.003	.224	.052	.187	-.017
Self-Consciousness	.068	-.203	.051	-.309**	.168	-.161	.103	-.264*
Immoderation	-.200	.144	-.231	.049	-.089	.102	-.170	.029
Vulnerability	-.060	-.016	-.016	-.063	.017	-.031	-.038	-.059
Openness to Experience	.080	-.043	.022	-.089	.133	.034	.073	-.104
Imagination	.036	-.074	.049	-.055	.153	.027	.079	-.001
Artistic Interests	.129	-.010	.022	-.035	.168	.082	.085	-.063
Emotionality	-.085	-.021	.013	.075	-.030	-.097	.015	-.024
Adventurousness	.046	.037	-.004	-.021	-.009	.071	.026	-.058
Intellect	.066	-.049	-.110	-.196	.067	.004	-.049	-.137
Liberalism	.075	-.058	.097	-.062	.110	.019	.129	-.050

* $p < .05$, ** $p < .01$

Correlations between Personality and Facial Feature Fixation for Disgust and Angry

Faces

Personality Domains and Facets	Disgust Faces				Angry Faces			
	Fixation Duration		Fixation Count		Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth	Eyes	Mouth
Extraversion	-.158	.013	-.186	.082	-.251*	.058	-.299*	.093
Friendliness	-.184	-.084	-.178	-.023	-.216	-.012	-.266*	-.016
Gregariousness	-.100	-.097	-.148	-.050	-.185	-.070	-.215	-.073
Assertiveness	-.119	.080	-.134	.160	-.142	.031	-.150	.126
Activity	-.087	.047	-.032	.045	-.202	.087	-.179	.096
Excitement-Seeking	.013	.200	-.032	.206	-.068	.246*	-.095	.245*
Cheerfulness	-.131	-.106	-.187	-.033	-.182	-.071	-.244*	-.020
Agreeableness	-.061	-.116	.103	-.134	-.017	-.176	-.018	-.124
Trust	-.033	-.140	-.047	-.124	-.053	-.082	-.101	-.101
Morality	.042	-.117	.107	-.116	-.066	-.227	-.018	-.133
Altruism	-.166	-.082	-.075	-.045	-.180	-.056	-.154	-.013
Cooperation	.099	-.161	.089	-.100	.065	-.183	.047	-.109
Modesty	.155	-.046	.181	-.060	.086	-.057	.150	-.057
Tendermindedness	.087	-.095	.107	-.064	.047	-.083	-.032	-.065
Conscientiousness	-.027	-.225	-.027	-.174	-.100	-.277*	-.114	-.205
Self-Efficacy	-.026	-.102	.012	-.061	-.072	-.124	-.086	-.051
Order	-.035	-.059	-.047	-.029	-.172	-.170	-.178	-.088
Dutifulness	-.058	-.360*	-.081	-.310*	-.092	-.312*	-.092	-.279
Achievement-Striving	-.096	-.052	-.045	-.040	-.212	-.129	-.146	-.077
Self-Discipline	-.051	-.287*	-.069	-.192	-.049	-.303*	-.089	-.235
Cautiousness	.104	-.181	.081	-.174	.131	-.190	.076	-.186
Neuroticism	-.001	-.042	.055	-.090	.057	-.013	.096	-.053
Anxiety	.015	-.116	.053	-.183	.046	-.074	.041	-.115
Anger	-.043	-.060	.081	-.035	-.005	-.038	.128	-.019
Depression	.115	.111	.149	.060	.263*	.129	.244	.102
Self-Consciousness	.101	-.188	.091	-.249*	.086	-.208	.108	-.243*
Immoderation	-.147	.132	-.156	.075	-.151	.150	-.128	.077
Vulnerability	-.044	-.028	.008	-.034	-.003	.080	.016	-.016
Openness to Experience	.175	-.028	.086	-.129	.132	.009	-.020	-.062
Imagination	.169	-.003	.136	-.029	.165	.060	.092	.0039
Artistic Interests	.164	-.038	.061	-.143	.137	.046	-.038	-.012
Emotionality	-.049	-.080	.009	-.029	-.041	-.037	.016	-.013
Adventurousness	.105	.039	.048	-.029	-.002	.015	-.098	-.061
Intellect	.123	-.018	-.068	-.143	.116	.004	-.153	-.115
Liberalism	.108	-.047	.101	-.138	.084	-.077	.080	-.080

* $p < .05$, ** $p < .01$

Correlations between Personality and Facial Feature Fixation for Sad Faces

Personality Domains and Facets	Sad Faces			
	Fixation Duration		Fixation Count	
	Eyes	Mouth	Eyes	Mouth
Extraversion	-.166	.030	-.086	.114
Friendliness	-.191	.039	-.183	.082
Gregariousness	-.090	-.092	-.040	-.034
Assertiveness	-.107	-.068	-.048	.016
Activity	-.117	.108	-.033	.162
Excitement-Seeking	-.017	.217	.023	.218
Cheerfulness	-.113	-.089	-.041	-.003
Agreeableness	.028	-.054	.109	-.004
Trust	-.023	-.141	-.013	-.070
Morality	.015	-.010	.102	-.034
Altruism	-.136	.082	.005	.109
Cooperation	.085	-.123	.134	-.076
Modesty	.031	.012	.022	.039
Tendermindedness	.130	-.022	.200	.008
Conscientiousness	.022	-.207	.081	-.151
Self-Efficacy	.085	-.045	.205	.018
Order	-.069	-.117	-.026	-.067
Dutifulness	-.026	-.292*	-.023	-.255*
Achievement-Striving	-.090	-.011	-.023	-.255*
Self-Discipline	.051	-.258*	.076	-.159
Cautiousness	.137	-.198	.110	-.191
Neuroticism	.005	.011	-.039	-.047
Anxiety	.034	-.053	-.004	-.103
Anger	.062	.010	.125	.040
Depression	.104	.107	.062	.046
Self-Consciousness	.127	-.199	.064	-.240*
Immoderation	-.230	.148	-.309**	.081
Vulnerability	-.085	.051	-.129	-.013
Openness to Experience	.141	.110	.089	.032
Imagination	.095	.043	.067	.034
Artistic Interests	.165	.130	.087	.045
Emotionality	-.018	.020	.051	.054
Adventurousness	.028	.138	-.006	.085
Intellect	.105	.033	.004	-.082
Liberalism	.128	.012	.146	-.047

* $p < .05$, ** $p < .01$