The Relationship between Cannabis Experience, Schizotypy, and Psychosis

Kimberly Alexandra Igirio

Follow this and additional works at: https://scholarsrepository.llu.edu/etd

Part of the Psychology Commons

Recommended Citation
The Relationship between Cannabis Experience, Schizotypy, and Psychosis

by

Kimberly Alexandra I girio

A Dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Psychology

October 2020
Each person whose signature appears below certifies that this dissertation in his/her opinion is adequate, in scope and quality, as a dissertation for the degree Doctor of Philosophy.


Colleen A. Brenner, Associate Professor of Psychology

Bridgette Peteet, Associate Professor of Psychology

David Vermeersch, Professor of Psychology

Elizabeth Wolpern, Assistant Professor of Family Medicine
ACKNOWLEDGEMENTS

Para mi familia. Mami y Papi, lo que he logrado ha sido posible por Dios y por ustedes. Agradezco que me enseñaron a tener sueños y metas grandes y a mantener la motivación para perseverar. Igualmente, thank you Ken and Alex for navigating life with me and being such bright lights in my life. Jordan and Bear, for your unconditional love. Thank you for reminding me of my “why” and having faith in me.

Next, I would like to express my deepest and most sincere gratitude to my advisor and committee chair, Dr. Colleen Brenner. Thank you for extending so much patience toward me. Without your guidance, support, and encouragement, this PhD study would not exist. Additionally, to the remaining members of my committee—Dr. Bridgette Peteet, Dr. David Vermeersch, and Dr. Elizabeth Wolpern—each of you contributed an instrumental piece and perspective to this dissertation. Thank you all for carving time out of your busy schedules to bring this project to fruition!

Dr. Wolpern, working with you allowed me to find my passion and fostered in me a desire to always continue learning and to use education as a tool to give back the community. Thank you for sharing your knowledge and support with me, as I developed my clinical and personal identity. Also, Dr. Holly Morrell, since my first year in graduate school, your warm words of encouragement always helped keep me moving forward.

Finally, there are countless other individuals who have shaped my academic and personal development throughout my years at Loma Linda University. Though I cannot name and thank each of you, I remember you, and am deeply grateful to have had you join me on this journey!
# CONTENTS

Approval Page i
Acknowledgements ii
Contents iii
List of Figures v
List of Tables vi
List of Abbreviations vii
Abstract viii

Chapter

1. Introduction 1

2. Literature Review 5
   Schizotypy 5
   Social Functioning 6
   Relationships and Socialization Impairments 7
   Work and Independent Living Impairments 10

Cannabis Experience 12
Relationships between Schizotypy, Social Functioning, and Cannabis Experience 13
   Schizotypy (SPQ) and Social Functioning (SAS-SR) 13
   Schizotypy (SPQ) and Cannabis Experience (CEQ/CEQ-I) 17

3. Study One 19
   Methodology 20
   Participants 20
   Measures 21
   Measure of Schizotypy 21
   Measure of Social Functioning 21
   Measure of Cannabis Experience 22
   Study One Results 22
   Statistical Analysis 22
   Results 23
   Relationships between CEQ, SPQ, and SAS-SR 23
   Combined Effects of Cannabis Experiences and Schizotypy 24

v
Traits on Social Functioning
Correlations of Cannabis Experience Questionnaire 24
Subscales
Moderation Analyses using Cannabis Experience Subscales 25
Study One Discussion 26

4. Study Two 33
   Methodology 35
   Participants 35
   Measures 36
     Measure of Cannabis Experience 36
     Positive and Negative Syndrome Scale 37
   Study Two Results 37
     Statistical Analysis 37
     Results 38
   Study Two Discussion 39

5. Conclusions 43

References 46
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Figure Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1</td>
<td>Moderating Effects of Cannabis Experience on Relationship between Schizotypy and Social Functioning</td>
<td>76</td>
</tr>
<tr>
<td>Figure 1.2</td>
<td>Moderating Effects of Paranoid-Dysphoric Effects on Relationship between Schizotypy and Social Functioning</td>
<td>77</td>
</tr>
<tr>
<td>Figure 1.3</td>
<td>Moderating Effects of Unpleasant After-Effects on Relationship between Schizotypy and Social Functioning</td>
<td>78</td>
</tr>
<tr>
<td>Figure 2.1</td>
<td>Reported Reasons for Using Cannabis</td>
<td>82</td>
</tr>
<tr>
<td>Figure 2.2</td>
<td>Mean Scores of Schizotypy Symptoms Reported by Non-Users and Cannabis Users</td>
<td>83</td>
</tr>
<tr>
<td>Figure 2.3</td>
<td>Mean Scores of Schizotypy Symptoms Reported by CEQ-I Groups</td>
<td>84</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Table Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1.1</td>
<td>Study One Demographics and Frequencies</td>
<td>70</td>
</tr>
<tr>
<td>Table 1.2</td>
<td>Descriptive Statistics and Correlations for Social Functioning, Schizotypy, and Cannabis Experience Measures</td>
<td>71</td>
</tr>
<tr>
<td>Table 1.3</td>
<td>Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Cannabis Experiences</td>
<td>72</td>
</tr>
<tr>
<td>Table 1.4</td>
<td>Descriptive Statistics and Correlations for Social Functioning, Schizotypy, and Cannabis Experience Subscales</td>
<td>73</td>
</tr>
<tr>
<td>Table 1.5</td>
<td>Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Paranoid-Dysphoric Experiences</td>
<td>74</td>
</tr>
<tr>
<td>Table 1.6</td>
<td>Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Unpleasant After-Effects</td>
<td>75</td>
</tr>
<tr>
<td>Table 2.1</td>
<td>Study Two Demographics and Frequencies</td>
<td>79</td>
</tr>
<tr>
<td>Table 2.2</td>
<td>One-Way Analysis of Variance in PANSS Score Means between Non-Users and Cannabis Users</td>
<td>80</td>
</tr>
<tr>
<td>Table 2.3</td>
<td>One-Way Analysis of Variance in PANSS Score Means between Non-Users, Low CEQ-I Users, and High CEQ-I Users</td>
<td>81</td>
</tr>
</tbody>
</table>
## LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>AE</td>
<td>Unpleasant After Effects</td>
</tr>
<tr>
<td>BMC</td>
<td>Behavioral Medicine Center</td>
</tr>
<tr>
<td>CBD</td>
<td>Cannabidiol</td>
</tr>
<tr>
<td>CBG</td>
<td>Cannabigerol</td>
</tr>
<tr>
<td>CBN</td>
<td>Cannabinol</td>
</tr>
<tr>
<td>CEQ</td>
<td>Cannabis Experiences Questionnaire</td>
</tr>
<tr>
<td>CEQ-I</td>
<td>The Cannabis Experience Questionnaire-Intoxication Checklist</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>EI</td>
<td>Emotional Intelligence</td>
</tr>
<tr>
<td>PANSS</td>
<td>Positive and Negative Syndrome Scale</td>
</tr>
<tr>
<td>PD</td>
<td>Paranoid-Dysphoric Effects</td>
</tr>
<tr>
<td>SAS-SR</td>
<td>Social Adjustment Scale-Self Report</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SMI</td>
<td>Severe Mental Illness</td>
</tr>
<tr>
<td>SPD</td>
<td>Schizotypal Personality Disorder</td>
</tr>
<tr>
<td>SPQ</td>
<td>Schizotypal Personality Questionnaire</td>
</tr>
<tr>
<td>SZ</td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>THC</td>
<td>Tetrahydrocannabinol</td>
</tr>
</tbody>
</table>
ABSTRACT OF THE DISSERTATION

The Relationship between Cannabis Experience, Schizotypy, and Psychosis

by

Kimberly Alexandra Iginio

Doctor of Philosophy, Graduate Program in Clinical Psychology
Loma Linda University, October 2020
Dr. Colleen Brenner, Chairperson

A number of genetic and environmental vulnerabilities precipitate the clinical expression of schizophrenia and related psychotic disorders. Schizotypy and cannabis use are identified risk factors for the development of these disorders (Vaucher et al., 2018; Debanné et al., 2015). Schizotypy is defined as a set of personality characteristics and experiences that fall along the schizophrenia spectrum (Debbané et al., 2015). Individuals with schizotypy exhibit traits that are similar to, but less severe than, those of psychosis including marked differences in characteristic patterns of thinking, feeling, and behaving (Esterberg, 2010). An increase in severity of symptoms also correlates to impairment in social functioning, as seen by difficulty with socialization, occupational responsibilities, and relationships (Robustelli et al., 2017). The majority of individuals who report cannabis dependency also endorse elevated occurrence of psychotic symptoms and social impairment similar to those who have a clinical diagnosis of psychotic disorders (Guloksuz et al., 2019; Marconi et al., 2016; Schultz et al., 2019). Relationships between quantity of cannabis used (Solowij, 2018), age of initial use (Albertella et al., 2017; Raynal and Chabrol, 2016), and expression of schizotypy symptoms exist. However, previous research has not been directed toward further understanding the effects of an
individual’s experience when using cannabis. This is the first study to investigate the relationships between schizotypy, cannabis experience, and social functioning. The overarching goal was that findings from this study would create a deeper understanding of how cannabis experiences affect individuals—specifically their ability to function in social capacities and how they perceive and interact with the world. Study one established that individuals who report paranoid/dysphoric or unpleasant after effects of cannabis also experience greater social functioning impairment. While both adverse cannabis experiences and schizotypy contribute to social functioning problems, higher levels of schizotypy have a larger, direct impact on a person’s ability to function in their social environment. Study two did not yield significant results. However, it showed a trend consistent with what is established in the current literature—that individuals with schizophrenia who use cannabis report more severe symptoms of psychosis compared to non-users.
CHAPTER ONE

INTRODUCTION

The identification of etiology, susceptibility, and risk factors for psychosis is necessary to provide informed lifestyle recommendations for individuals who may have existing vulnerabilities or who already express mild symptoms of psychosis (Kelley, 2010). Additionally, knowing what contributes to a heightened expression of psychotic symptoms may support preventative efforts to delay or bypass progression to psychopathology (Debanné, 2015).

Many individuals who use cannabis endorse experiences that are similar to those along the psychosis spectrum (Barkus, 2009), and individuals on the psychosis spectrum have an increased rate of cannabis use (Bechtold, 2016). However, the precise relationship between cannabis, symptoms of psychosis, and their impact on social functioning remains unclear. Therefore, the aim of this study was to investigate the relationship between symptoms of psychosis, social functioning and cannabis use in those who endorse a range of experiences along the psychosis spectrum.

First, I will provide an overview of schizotypy and psychosis, and review their purported relationship. Next, I will define social functioning, describe its importance in day-to-day life, and discuss how psychotic traits impact this facet of human behavior. Lastly, I will define cannabis experience and indicate why it is significant to explore the subjective effects of cannabis in individuals with psychotic symptoms. Schizotypy is the expression of psychotic-like personality traits in which individuals report differences in the way they perceive, sense, and experience their surroundings (Linscott, 2012). Some individuals with schizotypy may endorse symptoms that meet criteria for a psychotic
disorder, whereas most reported symptoms are subthreshold (Mason, 2015; Harper, 2004). Of note, endorsing symptoms of schizotypy does not necessarily mean an individual has a psychotic disorder, however, it does increase their vulnerability of developing one later in life (Barrantes-Vidal et al., 2015). Individuals who endorse more severe symptoms of schizotypy can have similar cognitive, emotional, and behavioral patterns and deficits as those diagnosed with schizophrenia (Barrantes-Vidal et al., 2013). Studies show that individuals who score high on measures of schizotypy demonstrate higher degrees of impairment in social functioning, neurocognitive measures, and prefrontal cortex activation (Vollema, 2012).

Schizophrenia (SZ) is a severe mental illness (SMI); individuals who are diagnosed with schizophrenia have difficulty understanding reality and often exhibit abnormal social behavior (WHO, 2020). Symptoms of SZ are categorized into negative, positive, disorganized/cognitive dimensions (Kemp, Gross, Barrantes-Vidal, & Kwapi, 2018; Schultze et al., 2019). Some of the most commonly reported symptoms are delusions, disorganized thinking, auditory and visual hallucinations, lack of motivation (avolition) and interest (apathy), and reduced emotional expression (blunted affect) (NIMH, 2016). Living with SZ makes it challenging to appropriately engage with others and contributes to impairment in social functioning (Atkinson et al., 2018; Wang et al., 2014).

Social functioning is defined as an individual’s interaction with their surroundings and their ability (or inability) to fulfill their role in varying environments such as work, social activities, and their relationships with friends and family (Bosc, 2000). How well an individual is able to perform in different settings also impacts their quality of life,
overall manifestation of symptoms, and their ability to cope with their disorder
(Cernovsky, 2017; Stain et al., 2012; Sundermann et al., 2014). Due to the pervasive
texture and extent of the disorder, impairments in social functioning result in added
distress, contribute to strained relationships, and add overall difficulty in day-to-day life.
(Lysaker et al., 2006; Cohen et al., 2015; Leede-Smith et al., 2017; Cohen & Davis,
2009).

Drug misuse has shown to be prevalent among those diagnosed with
schizophrenia and psychotic disorders (Degenhardt, 2013; Steffens et al., 2018; Barkus,
2007). The relationship between illicit drugs, alcohol, and psychotic disorders has been
researched extensively and results have shown interactions that have lasting negative
effects (Macleod et al., 2004).
With cannabis becoming more acceptable for medicinal and recreational purposes,
researchers are shifting their attention to the effects cannabis has on mental health
(Colizzi et al., 2015). Previous studies focus on relationships between cannabis use, onset
of SMI, severity of psychotic symptoms, and use of the drug among populations of
individuals who have existent SMI diagnoses (Hall, 2008). Heavy, long-term, and early
age cannabis use are all identified as predisposing risk factors for development of
psychotic symptoms (Radhakrishnan, 2014; Gage et al., 2016; Kraan et al., 2016).
However, little is known about how people think and feel when using cannabis and the
after-effects that may persist for hours or days after use. A cannabis user’s subjective
 perceptual and/or cognitive understanding can elucidate if certain cannabis experiences
mimic or intensify existing psychotic-like symptoms. Furthermore, it would be
interesting to note if there is a link between specific experiences when using cannabis and
schizotypy symptoms. Measuring cannabis experience is complex and multifaceted. The Cannabis Experiences Questionnaire (CEQ) attempts to address subjective experiences by asking about three different aspects of use: pleasurable experiences, psychosis-like experiences, and after-effects (Barkus et al., 2005). This study will fill the aforementioned gaps with a framework derived from the CEQ—it will serve as a foundation to understand if cannabis experiences relate to schizotypy, psychosis, and symptomatology.
CHAPTER TWO

LITERATURE REVIEW

Schizotypy

Schizotypy is the subclinical expression of inherited, psychotic-like personality traits (Ettinger et al., 2015; Grant et al., 2018). Within the general population, schizotypy is comprised of polygenetic and environmental factors which represent an underlying vulnerability to schizophrenia and related psychopathology (Grant et al., 2018; Claridge et al., 1985). The phenotypic presence of psychotic-like traits presents to varying degrees in cognitive, behavioral, and emotional domains, globally affecting an individual’s personality (Kwapil et al., 2018; Nelson, Pantelis, & Philips, 2013).

A number of schizotypy models exist—some attempt to standardize the definition of this psychological construct and others focus on theories of etiology, structure, or dimensions (Grant, Green, & Mason, 2018; Cohen, Chan, & Debbané, 2018; Meehl, 1962; Fonseca-Pedrero et al., 2018). Disregarding model differences, most theorists agree that schizotypy is a useful and unifying framework that provides better understanding of SZ and related psychotic disorders (Kwapil & Barrantes-Vidal, 2015). Schizotypy represents a number of multidimensional personality traits that are genetic and epigenetic (Meehl, 1962; Claridge, 1984; Raine, 2006; Cohen et al., 2015). These traits are expressed as neurodevelopmental differences which may have clinical and functional impacts for the individual—depending on the symptoms endorsed and their respective severities (Kwapil & Barrantes-Vidal, 2015).

Schizotypy traits mirror those of schizophrenia and are categorized as positive (excesses), negative (deficits), and disorganized (disruptions)/cognitive symptoms
Lenzenweger & Dworkin, 1996; Ettinger et al., 2015; Kemp et al., 2018; Najolia, Buckner, & Cohen, 2012). Positive symptoms are paranoia, suspiciousness, disruptions in thought content (odd beliefs, magical ideation, delusions) and perceptual oddities (illusions and hallucinations). Negative symptoms are characterized as a marked disinterest in the world and outward experiences these include: avolition, anhedonia, flattened affect, anergia, and alogia. Disorganized/cognitive symptoms are identified as difficulties to organize and express thoughts and behaviors (Kwapil & Barrantes-Vidal, 2015; Lien et al., 2010; Cohen et al., 2010).

The quantity, category, and level of severity of traits expressed determine whether an individual’s personality will be marked by pervasive disturbances and/or functional impairment (Claridge, 1997; Raine et al., 2006; Lenzenweger, 2010). The degree of trait expression ranges from mild to severe, with more severe cases resulting in clinically significant psychopathology (Cohen et al., 2015; Schultze-Lutter et al., 2019). While schizotypy is an identifiable risk factor for the onset of schizophrenia and related psychotic disorders, it does not imply that experiencing some schizotypy symptoms always results in the progression or future diagnosis of a psychotic disorder (David et al., 2010; Gooding, Tallent, Matts, 2005; Chapman et al., 1994). According to Meehl’s model of schizotypy, only 10% of the general population have schizotypy traits and 10% of that subgroup go on to develop schizophrenia (prevalence rate of 1%) (Meehl, 1962).

Social Functioning

Social functioning is defined as a person’s ability to fulfill their role in different areas such as work, social activities, and relationships with partners and family (Bosc, 2000; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Kwapil & Barrantes-Vidal, 2015).
Social functioning domains include, but are not limited to, self-care skills such as: maintaining proper hygiene, taking required medications, and managing finances; performance at work or school such as: meeting deadlines and staying on task; social skills such as: behaviors in social interactions and engaging in leisure activities; and relational skills such as: communicating appropriately and maintaining healthy relationships with family, friends, and romantic partners (Cohen et al., 2006; Hooker & Park, 2002; Weismann, 1976).

The manner in which people experience and address life stages and stressors is largely attributed and mediated by internal and external factors. These factors affect an individual’s capacity to “engage in social interactions, interpersonal relationships, and activities of independent living” (Oltmanns, 2002; Meyer, 2001). Social dysfunction is characterized by pervasive deficits in behavior or cognition that affect an individual’s ability to perform adequately in social roles (Abu-Akel, Baxendale, Mohr, & Sullivan, 2018). Inability to attend to responsibilities, emotional lability, and instability with relationships are some examples of social dysfunction (Thompson & Bland, 1995; Porcelli et al., 2019).

Relationships and Socialization Impairments

Whether at work, school, or at home, socialization is typically unavoidable and characteristic of daily life. How well an individual interacts with another determines the quality of connections they create (Lewandowski, Cohen, Öngur, 2019). Studies show that individuals with psychotic spectrum features, those who score high on measures of schizotypy, and people diagnosed with Schizotypal Personality Disorder (SPD), Schizophrenia (SZ), or other psychotic disorders report increased social dysfunction
Unusual and bizarre experiences, intense social anxiety, disorganized thoughts, and transient psychosis make it hard for people living with SPD to relate with others (Veras, 2011). To strangers, people with SPD appear to be nervous and socially awkward individuals (Stanfield, 2017). Positive and negative symptoms of schizotypy are associated with a reduced likelihood of creating healthy relationships and fostering secure attachments in close relationships (Chau, Zhu, & So, 2019). People who experience elevated clinical levels of schizotypy face functional impairment challenges and many barriers when trying to form significant connections with others, some examples include suspiciousness, mistrust, impulsivity, and complications with straightforwardness (Park et al., 2013; Eisenberg, 2006; Ross et al., 2002; Van Beilen, 2003).

More often than not, people who experience pathological levels of cognitive and perceptual disruptions often express themselves in ways that perpetuate cycles of social and internalized stigma (Kao et al., 2016; Firmin et al., 2019). Internalized stigma occurs when a person attributes negative judgments or biases commonly believed by others to themselves (Yanos et al., 2008; Vass et al., 2015). Unfortunately, paranoia, peculiar speech mannerisms, and incorrect interpretation of social cues contribute to strained social interactions which in turn add to an already existent schema of inadequacy and poor self-esteem (Torgersen et al., 2002; Premkumar, Dunn, Onwumere, & Kuipers, 2019; Kállai et al., 2019). As a result, people who endorse these symptoms learn to expect rejection from others and routinely avoid social interactions (Jetha, 2013; Blakely, 2007). Internalized stigma correlates with reduced levels of relational self-efficacy, satisfaction, and esteem in people who endorse high levels of schizotypy (Hill & Startup,
These individuals are commonly critical of themselves and tend to demonstrate a reduced capacity of relational assertiveness and success (Sarisoy et al., 2013). Consequently, depressive and anxious distress are hallmark characteristics of their relationships (Altamirano & Weisman de Mamani, 2018). Symptoms of depression, particularly hopelessness, most significantly correlate to a reduction in relationship cohesion (Bedwell et al., 2019; Holmes et al., 2005; Sharaf et al., 2012; Boyd, Otilingam, & DeForge, 2014) and often result in a number of tumultuous and failed relationships (Berry et al., 2009).

The ability to appropriately respond to another person’s affective state and to emotionally self-regulate are valuable empathy skills that are needed for healthy relationship dynamics (Yoon, Kang, & Kwon, 2008). Empathy is subdivided into affective and cognitive domains (Henry, Bailey, & Rendell, 2007). Affective empathy is the ability to accurately express an emotional response to a situation or someone else’s emotional state and cognitive empathy is the ability to understand another’s expressed or implied emotion(s) (Henry et al., 2007; Ang & Goh, 2010). People with severe schizotypy and related psychopathology exhibit difficulties with both forms of empathy (Ripoll et al., 2013; Asai, Mao, Sugimori, & Tanno, 2011). Struggles with affective empathy partially mediate the relationship between perceived relationship quality and negative symptoms of schizotypy (Wang et al., 2013; Li, Fung, Moore, & Martin, 2019). This means that people who endorse greater impairment due to negative symptoms (severity or quantity), perceive poor relationship quality, partially due to their personal difficulties with emotional expression. Lacking the emotional intelligence that is required to create and maintain friendships, intimate relationships, or interactions with close
family members creates more discomfort and distress—often leading to progressive changes in behaviors of introversion and isolation (Aguirre, Sergi, & Levy, 2008; Wickline, Nowicki, Bollini, & Walker, 2011; Williams, Henry, & Green, 2007; Fonseca-Pedrero, Lesmos-Giráldez, Paino, & Muñiz, 2011).

Work and Independent Living Impairments

In most occupational settings, workers are required to show up at a specific time, stay on task, appropriately address responsibilities, and often, participate in collaborative tasks. Schizotypy traits, specifically negative symptoms, may prevent individuals from meeting their employers’ expectations and result in frustrations from both parties (Blanchard, Mueser, & Bellack, 1998; McGurk et al., 2013; Fischler & Booth, 1999; Rosell, Futterman, & McCaster, 2014; Harvey & Jones, 2019). Individuals who endorse many and/or severe traits of schizotypy report extreme difficulty finding employment, express boredom with monotonous tasks, and are dismissed or demoted more often than co-workers (Hengartner et al., 2013; McGurk et al., 2013). Research also suggests that they endorse elevated rates of job turnover compared to asymptomatic individuals because of poor performance evaluations and workplace tension—usually maintaining employment for a maximum of one year (Harvey et al., 2007; Norman et al., 2007; McGurk et al., 2013). Occupational instability is a stressor that exacerbates schizotypy symptoms and serves as a feedback loop, thus perpetuating already existent difficulties to access and sustainability of employment opportunities (Skodol, Pagano, Bender, & Shea, 2005; Rosell et al., 2015). As a result of financial hardships, a large number of individuals with severe schizotypy report an inability to live independently and a constant
struggle to provide for their basic needs (Cohen & Davis, 2009; Aghvinian & Sergi, 2018; McClure et al., 2013).

Self-care and basic life skills are necessary for successful cohabitation or independent living (Mata et al., 2003). Unfortunately, a person’s capacity to initiate and perform independent living skills is greatly determined by the type and severity of schizotypy traits expressed (Harvey & Jones, 2019). When compared to disorganized or positive symptomatology, the negative symptoms of avolition and apathy result in higher levels of functional impairment and distress (Green, 1996; Harvey et al., 2007). Avolition is the decrease or absence of motivation needed to perform self-directed behaviors (DSM 5, 2013) and apathy is a marked lack of interest (Cohen & Matthews, 2010; Dinn et al., 2002). These two negative symptoms of schizotypy and related psychopathology are chronic and severely debilitating—they are also the most commonly endorsed symptoms among individuals with severe schizotypy (Richards & Clarke, 2007; Rabin et al., 2014). They exist as identifiable barriers that deplete the individual from feeling motivated, energized, or having the desire to execute household tasks (i.e., cleaning, buying groceries, paying bills, etc.) (Kwapil et al., 2012; Pulay et al., 2009; Roché, Silverstein, & Lenzenweger, 2015; Harvey & Jones, 2019). In the context of independent living, a severe expression of avolition makes it challenging for them to engage in basic self-care behaviors such as showering, brushing teeth, and feeding themselves (Barch, 2005; Blanchard et al., 2005). Elevated levels of impairment, in turn, limit housing options for these individuals—the most common solution to this problem is living at an assisted facility for people with disabilities or living with a family member who is willing to take them in (Emmerson et al., 2009; Leede-Smith, 2017).
Cannabis Experience

Review of the literature focuses on the psychoactive effects of cannabis and the relationship these effects have on mental health conditions, specifically, schizotypy and related psychopathology. Legalization of medical and recreational cannabis is quickly increasing worldwide and with it so have the number of studies focusing on its health impacts (Katz & Shoenfeld, 2016; Wilkinson et al., 2019; Karila et al., 2014). The majority of studies analyze the relationship between cannabis use and its effects on cognitive functions, modes of administration and related medical implications, and using isolated cannabinoids (i.e., CBN, CBD, CBG, etc.) for specific medical diagnoses (Volkow, Baler, Compton, & Weiss, 2014; Sznitman & Zolotov, 2015; Hall, 2006; Shrivastava, Johnston, Tsuang, 2011). Interestingly, studies that explore the effects of cannabis use on mental health are yielding mixed results (Memedovich et.al, 2018; Pedersen et al., 2015). Some point out lasting psychological, behavioral, and cognitive impacts (Favrat et al., 2005; Hall & Degenhardt, 2008; Leung, Leung, & Kumar, 2014) while others highlight therapeutic utility in microdosing for mood and trauma-related disorders (Sznitman & Zolotov, 2015; Winkelman & Sessa, 2019; Shaw, 2018). To better understand how cannabis impacts mental health, it is necessary to explore commonly experienced effects reported by users and then identifying these effects as positive or negative contributors to health behaviors and outcomes.

Cannabis experience is a lesser studied variable that can best be defined as the user’s subjective report (including but not limited to sensations, perceptions, thoughts, emotions, dysregulation of homeostatic drives, etc.) resulting from the psychoactive effects of the drug (Verdoux, Findre, Sorbara, & Tournier, 2003; Hides et al., 2009).
Very few existing studies explore the subjective interpretation and recollections individuals describe while using and shortly after using cannabis.

Emma Barkus and colleagues conducted analyses on the relationship between cannabis experience and its relation to expression of psychotic traits. Barkus and colleagues administered a questionnaire measuring subjective experiences of cannabis use to 137 healthy participants, 72% of the sample endorsed cannabis use. The questionnaire focused on three subscales of participant’s subjective perceptions—pleasurable experiences, psychosis-like experiences, and after-effects (Barkus et al., 2006). Results suggested that individuals who scored high on measures of schizotypy were more likely to experience negative effects associated with cannabis use such as psychosis-like phenomena and unpleasant after-effects (Barkus et al., 2006).

In a 2008 study, Barkus hypothesized that schizotypy would account for subjective experiences occurring after cannabis use. This study administered questionnaires measuring schizotypy traits (SPQ) and cannabis related experiences (CEQ) to 532 participants who reported having used cannabis at least once in their lifetime. Results from this study supported previous research (Stirling et al., 2008) and additionally suggested that individuals who scored high on the SPQ also endorsed higher levels of pleasurable experiences when smoking cannabis. Barkus and colleagues also found a relationship between psychosis-like items and varying degrees of schizotypy occurring both during and after cannabis use (Barkus et al., 2008).

**Relationships between Schizotypy, Social Functioning, and Cannabis Experience**

Schizotypy (SPQ) and Social Functioning (SAS-SR)
Even though individuals with schizotypy have subthreshold symptoms of psychosis, many report significant difficulties in one or more domains of social functioning (Statucka & Walder, 2017; Morrison et al., 2013). Their social dysfunction is present to a lesser degree than those with clinical levels of psychosis, but greater than healthy individuals with an absence of psychotic traits (Mitropoulou et al., 2002). Results of these studies were gathered using the Schizotypal Personality Questionnaire (SPQ). The SPQ is a screener used to identify individuals in the general population who endorse psychotic-like traits at subclinical levels (Raine, 1991).

People who endorse greater levels of schizotypy, as demonstrated by quantity and severity, manifest cognitive and emotional intelligence impairments similar to those seen in individuals with psychotic disorders (Bang, 2017). Emotional intelligence (EI) includes the ability to identify, facilitate, understand, and manage emotions (Albacete et al., 2016). Without the ability to accurately perform in the EI-identified criteria, individuals often have difficulty communicating effectively, forming relationships, initiating interactions, and with self-other boundaries (Cowen et al., 2019). A study examining emotional intelligence in people with high levels of schizotypy suggest the presence of interpersonal challenges—including peer and family relationships because of their reduced ability to perceive and manage emotions (Aguirre et al., 2008). More specifically, positive schizotypy results in an increase of relationship troubles whereas negative schizotypy commonly results in decreased prosocial behavior (Abu-Akel et al., 2018). Even when controlling for cognitive and emotional intelligence skills, high scoring schizotypes report greater levels of impairment in friendship and family relations, interpersonal engagement, and participation in recreational activities (Aghvinian & Sergi,
These findings indicate greater interpersonal conflict and isolation, perceived low social support, and emotional closeness (Aghvinian & Sergi, 2018).

Interactions between individuals rely heavily on the ability to understand and respond to cues appropriately. If this process is inaccurately performed or disrupted, socialization is negatively impacted (Miller & Lenzenweger, 2014). To develop interpersonal skills and become socially adjusted individuals, people must be aware of interpersonal sensitivity—this can be a learned behavior, but it is most commonly an innate trait (Hall, Andrzejewski, & Yopchick, 2009). Understanding of humor, along with sarcasm and irony, is an important component in social communication. Individuals with high schizotypy exhibit some degree of deficits in humor comprehension and expression—significantly affecting their ability to perceive and respond to humor in social settings (Liu et al., 2019). Studies also show correlates between negative and depressed emotion endorsed in schizotypy and reduced social interactions (Lewandowski et al., 2006). People who report experiencing salient negative emotions (sadness, anxiety, anger, guilt, etc.) and have greater difficulty with emotional expression tend to seclude themselves and avoid social associations (Rey, Jouvent, & Dubal, 2009). This learned preference for introversion leads to reduced opportunities for friendships—this poor, reduced quality of socialization then feed into increased levels of social awkwardness (Hurst et al., 2007).

A study using the Social Adjustment Scale-Self Report (SAS-SR) demonstrated that greater endorsement of schizotypy symptoms predict reduced levels of employment and inability to maintain occupations for long periods of time (usually less than a year) (Poreh & Schullen, 1998). The SAS-SR is a self-report questionnaire that assesses how
an individual describes their self-efficacy in social functioning areas of their life (Weismann, 2000). Studies show that individuals high on schizotypy tend to have jobs that require less social contact and that are less cognitively demanding (Mcgurk et al., 2013). A study exploring the relationship between symptom severity and cognitive abilities explains that in people who exhibit higher levels of schizotypy there is a marked decline in performance as the information processing load increases. Further supporting, the notion that impairment in vocational functioning is heavily mediated by the effects of cognitive impairment (Xavier et al., 2014). Difficulties obtaining and keeping work often results in financial strain which then increases levels of stress and also contributes to an increase in both negative and positive psychotic symptoms (Soliman et al., 2011; Horan, Brown, & Blanchard, 2007; Barrantes et al., 2013). Another result of occupational instability is lower socioeconomic status (Cohen et al., 2008; Boyda, Shevlin, Mallet, Murphy, & Houston, 2013). Socioeconomic status impacts an individual’s quality of life, access to healthcare, and ability to engage in healthier behaviors or self-care (Dickey et al., 2005)—all commonly observed characteristics within this population.

It is reported that, individuals who endorse high levels of schizotypy have difficulties with daily living tasks and activities that involve hygiene, organization, and often struggle to maintain a clean environment at home (Kwapil et al., 2012; Barrantes-Vidal, Chun, Myin-Germeyys, & Kwapil, 2013). For example, individuals who experience negative symptoms of psychosis find it challenging to cook, pay bills, remember appointments, shop for groceries, and engage in rudimentary actions of living in a home, either alone or with others (Carrigan, 2017). In high-scoring schizotypy individuals, the self-care aspect of social functioning is thought to be primarily affected by depressive
symptoms, specifically avolition. When high scoring schizotypes receive intervention targeting motivation and depression, their ability to focus on health behaviors is better managed and as a result, an improvement in health markers occurs (Rice, 2018).

Schizotypy (SPQ) & Cannabis Experience (CEQ/CEQ-I)

Individuals who use cannabis, especially during their adolescent and young adult years, are at risk for psychosis and report psychotic-like symptoms at significantly higher rates than those who do not use cannabis (Hall, 2008). Chronic cannabis users report experiencing psychotic-like experiences to a greater degree than non-users and they also endorse greater levels of schizotypy (Fridberg et al., 2011). A 2012 study showed that people with high schizotypy who reported being heavy cannabis users also reported experiencing greater levels of anxiety, social anxiety, depression, and additional cannabis-related problems (Najolia, Buckner, & Cohen, 2012).

Early studies show that elevated levels of anandamide, an endogenous cannabinoid, has been found in the cerebral spinal fluid of individuals with psychotic disorders (Leweke, 1999). Subsequent studies have analyzed cannabis effects on neurotransmitter functioning, and most have noted that the increased risk is thought to be largely attributed to the effects of cannabinoids on dopaminergic systems. The dopamine hypothesis of psychosis states that disturbance of dopamine quantity and overactivation of dopamine receptors contributes to the expression of psychotic-like symptoms (Carlson, 2013). Neurochemical implications indicate that cannabis’ main psychoactive component, Δ9-tetrahydrocannabinol (THC), has both acute and chronic effects. When analyzing neurotransmitter activity right after use, dopamine and neuronal activity levels
spike. Yet, chronic use studies indicate that THC blunts endogenous synthesis of this neurotransmitter (Volkow et al., 2016).

Cannabinoids affect the metabolic rates and processes of other neurotransmitters, can upregulate neurotransmitter availability, and act as agonists or antagonists of catecholamines (Caspi et al., 2005; Dean, 2001; Bilder et al., 2004). Results of a 2004 double-blind placebo study conducted by D’Souza et al. showed that the intravenous administration of THC increased both positive and negative symptoms of psychosis in both healthy controls and individuals with schizophrenia in remission (D’Souza et al., 2004). This study provided further evidence that the psychoactive effects of cannabis act as a catalyst for the expression of psychotic-like symptoms through neurochemical activation (Os et al., 2002; Degenhardt et al., 2003). In summary, prolonged, heavy, and/or early cannabis use leads to the expression of psychotic symptoms, even in individuals with no established psychopathology or previous history of severe mental illness (Radhakrishnan, Wilkinson, & D’Souza, 2014; SAMHSA, 2012).
CHAPTER THREE

STUDY ONE

To date there are no studies that have specifically explored the relationship between cannabis experience and social functioning. A related study by Schnakenberg and Lysaker (2019) analyzed the lasting effects of cannabis on various functional domains in a population of individuals with psychosis. Results indicated that individuals with SZ who endorsed lifelong use of cannabis demonstrated deficits in emotional expressivity, ability to anticipate pleasurable experiences, and exhibited significant reduction in prosocial activities compared to non-using participants with schizophrenia (Schnakenberg & Lysaker, 2019).

It is important to note that cannabis use is not comparable to cannabis experience. Cannabis use simply states whether or not an individual has used or currently uses the drug (smoked or ingested) (Anthony, Lopez-Quintero-Alshaarawy, 2017; Carliner et al., 2018). Cannabis experience is defined as what a person thinks, feels, or perceives while intoxicated and/or the effects experienced hours or days after use (Stirling et al., 2018; Barkus et al., 2006). Two highly reliable and valid questionnaires that measure an individuals’ experiences when using cannabis are: The Cannabis Experience Questionnaire (CEQ) and The Cannabis Experience Questionnaire-Intoxication Checklist (CEQ-I).

Studies of subjective cannabis experiences may clarify if those experiences affect social functioning and whether or not they vary by schizotypy traits. One preliminary study suggested that individuals with high schizotypy traits and unusual experiences while using cannabis demonstrated similar underlying neural processing associated with
facial encoding compared to those who used cannabis but did not report unusual experiences and healthy controls (Brooks & Brenner, 2017). The current study examined subjective experiences of cannabis use in the categories of emotions, sensations, and thoughts that range from common (depressed, ecstatic, fearful) to unusual (paranoid, enhanced perceptual awareness, feeling threatened by an unknown force) (Quinn et al., 2017; Barkus et al., 2005; Barkus et al., 2008).

Overall, the goal of Study One was to use participants’ self-report measures as a way of determining if a relationship exists between cannabis experiences, social functioning, and symptoms of schizotypy. More specifically, this study’s hypotheses were identified as: (1) Individuals who score higher on the CEQ measure will endorse more schizotypal traits as measured by the SPQ, (2) Individuals who score higher on the CEQ measure will show greater impairments in social functioning as measured by the SAS-SR, and (3) Individuals who endorse more schizotypal traits as measured by the SPQ will show greater impairment in social functioning as measured by the SAS-SR, through the indirect effects of cannabis experience as measured on the CEQ.

**Methodology**

**Participants**

Individuals who participated in this survey study were Canadian college students and Americans from the general population (N = 1333). There were 723 females (37.4%) and 1210 males (41.6%) who took the survey with the mean age of participants being 30 years (Mage = 30.28, SD = 11.51). (Table 1.1)

These individuals completed three self-report questionnaires measuring cannabis experience, schizotypy, and social functioning.
Measures

**Measure of Schizotypy**

One of the most used and highly validated measures of schizotypy is the Schizotypal Personality Questionnaire (SPQ) developed by Adrian Raine in 1991. The SPQ is based on the *DSM-III-R* criteria of schizotypal personality disorder (SPD) (Raine, 1991). Studies have shown that the SPQ is a screener that identifies individuals in the general population who endorse psychotic-like traits at a subclinical level (Fonseca-Pedrero, 2009). These individuals are more likely to have an increased susceptibility to psychotic disorders (Vollema, 2002). Results of Raine’s initial study indicated that 55% of individuals who scored within the top ten percent of SPQ scores had a clinical diagnosis of SPD (Raine, 1991).

The scale is comprised of 74 true-false items, separated by subscales, that measure all nine schizotypal traits: ideas of reference, excessive social anxiety, odd beliefs or magical thinking, unusual perceptual experiences, odd or eccentric behavior, no close friends, odd speech, constricted affect, and suspiciousness (Raine, 1991). Raine’s 1991 study found that the SPQ has high sampling validity, high internal reliability ($\alpha = .91$), test-retest reliability (kappa = .82), convergent validity (0.59 to 0.81), discriminant validity (0.63), and criterion validity (0.68).

**Measure of Social Functioning**

The Social Adjustment Scale: Self-Report (SAS-SR) is a 54-item measure used to assesses an individual’s level of satisfaction with their social situation as well as their reported efficacy in certain functional areas (Weismann, 2000). The measure is
commonly used in a clinical setting to guide treatment options so that the individual’s performance in various roles may improve.

Individuals are asked to report their experiences at work such as how many days they miss, if they are able to perform work functions, their emotional status while at work, if they find pleasure or enjoy the work they do, and if they have had any arguments with co-workers or management while at work. If an individual does not have an occupational related position, school domain questions can be answered instead. These questions address whether or not the individual can perform well in that setting, turn in assignments on time, and if they are interested in what they are studying. Other areas included in the measure are family unit, primary relationship, and social/leisure engagement (Weismann, 2000).

**Measure of Cannabis Experience**

The Cannabis Experience Questionnaire (CEQ) was developed to capture an individual’s subjective experiences of cannabis use both during and after intoxication. The questionnaire has three subscales: Pleasurable Experiences, Psychosis-Like Experiences, and After-Effects. Participants are to indicate how often they experience each item by using a five-point Likert scale ranging from “never” to “always” (Barkus et al., 2006). The CEQ exhibits good internal reliability as determined by a Cronbach’s $\alpha = .70$ (Barkus & Lewis, 2008).

**Study One Results**

**Statistical Analysis**

Pearson correlations were used to explore relationships between the three measures used in this study. Then, data were analyzed using PROCESS macro (Hayes,
2013) to explore cannabis experience as a moderator variable between schizotypy trait endorsement and social functioning impairment. Additional moderations using PROCESS macro were performed to further define relationships between specific subscales of the CEQ (paranoid-dysphoric and unpleasant after-effects) and the two other measures included in this study (SPQ, SAS-SR).

Results

There were 1933 participants who responded to the questionnaires. Of those participants 600 (31%) did not complete the cannabis experience questionnaire (CEQ), leaving 1333 cases to be included in the analysis. Most common reason for refusal to complete CEQ was not having used cannabis.

**Relationships between CEQ, SPQ, and SAS-SR**

Results of Pearson correlations indicated that there were statistically significant, positive relationships between the cannabis experience questionnaire, the schizotypy personality questionnaire, and the social adjustment scale self-report measure. Results of this study supported existent literature and indicated a positive association with large effect size between schizotypy traits per the SPQ and social functioning as measured by the SAS-SR, \(r(1637) = .498, p < .001\). As consistent with hypothesis one, there was a positive association with medium effect size between endorsed cannabis experience per the CEQ and schizotypy traits as measured by the SPQ, \(r(1331) = .365, p < .001\). Similarly, hypothesis two was also supported, as correlations yielded a positive association with small effect size between endorsed cannabis experience per the CEQ and social functioning as measured by the SAS-SR, \(r(1108) = .225, p < .001\). (Table 1.2)
**Combined effects of cannabis experience and schizotypy traits on social functioning**

A PROCESS macro moderation analysis was used to predict social functioning impairment based on endorsement of schizotypy traits, cannabis experiences, and the interaction between endorsement of schizotypy traits and cannabis experiences (Figure 1.1). Overall, the moderation model accounted for a significant proportion of the variance in social functioning, such that the linear combination of predictor variables accounted for 26.03% of the variance in social functioning impairment, $\Delta R^2 = .019$, $F(3, 1106) = 129.738$, $p < .001$. Endorsement of schizotypy traits was a significant independent predictor of social functioning impairment such that as mean of traits endorsed increased, so did social functioning impairment ($B = .015$, $t = 17.646$, 95% CI [.013, .017], $p < .001$). Cannabis Experience was also a significant predictor of social functioning impairment such that as the measure of cannabis experience increased, social functioning impairment increased ($B = .001$, $t = 2.729$, 95% CI [.000, .002], $p = <.01$). Next, analysis of the interaction demonstrated that as reported cannabis experiences increased, the strength of the relationship between schizotypy trait endorsement and social functioning impairment decreased ($B = -.001$, $t = -5.321$, 95% CI [-.0002, -.0001], $p = <.001$). While all three predictors were statistically significant, the strength of their impact on social functioning impairment scores differed. (Table 1.3)

**Correlations of Cannabis Experience Questionnaire Subscales**

Pearson correlations between subscales of the cannabis experience questionnaire (pleasurable, paranoid-dysphoric, and unpleasant after-effects) and the social functioning measure indicated that unpleasant after-effects ($r(1108) = .275$, $p < .001$) and paranoid-dysphoric effects ($r(1140) = .252$, $p < .001$) were associated with greater social
functioning impairment. Similarly, unpleasant after-effects \((r(1331) = .343, p < .001)\) and paranoid-dysphoric effects \((r(1369) = .334, p < .001)\) were associated with an increase of schizotypy traits. The correlation between pleasurable effects and social functioning was not statistically significant \((r(1142) = -.002, p = .935)\), therefore it was not included in subsequent moderation analyses. (Table 1.4)

**Moderation analyses using cannabis experience subscales**

The paranoid-dysphoric (Figure 1.2) and unpleasant after-effects (Figure 1.3) subscales were further explored using PROCESS macro moderation analyses. The first moderation model analyzing the paranoid-dysphoric subscale accounted for a significant proportion of the variance in social functioning, such that the linear combination of endorsement of schizotypy traits, paranoid-dysphoric experiences, and the interaction between schizotypy traits and paranoid-dysphoric experiences accounted for 27.44% of the variance in social functioning impairment, \(\Delta R^2 = .023, F(3, 1138) =143.453, p < .001\). Endorsement of schizotypy traits was a significant independent predictor of social functioning impairment such that as traits endorsed increased, social functioning impairment increased as well \((B = .015, t = 18.009, 95\% \text{ CI } [.013, .016], p < .001)\). The cannabis paranoid-dysphoric effects subscale was also a significant predictor of social functioning impairment such that as the measure of paranoid-dysphoric experiences increased, so did social functioning impairment \((B = .004, t = 4.947, 95\% \text{ CI } [.002, .005], p = <.001)\). Next, analysis of the interaction demonstrated an inverse relationship such that levels of reported paranoid-dysphoric experiences increased, the strength of the relationship between schizotypy trait endorsement and social functioning impairment decreased \((B = -.0002, t = -6.027, 95\% \text{ CI } [-.0002, .0000], p = <.001)\). (Table 1.5)
Similarly, the second moderation model analyzing the unpleasant after-effects subscale accounted for a significant proportion of the variance in social functioning, such that the linear combination of endorsement of schizotypy traits, cannabis unpleasant after-effects, and the interaction between schizotypy traits and cannabis unpleasant after-effects accounted for 25.97% of the variance in social functioning impairment, $\Delta R^2 = .009$, $F(3, 1106) = 129.322$, $p < .001$. Endorsement of schizotypy traits was a significant independent predictor of social functioning impairment such that as traits endorsed increased, social functioning impairment increased ($B = .014$, $t = 16.574$, 95% CI [.012, .016], $p < .001$). The unpleasant after-effects subscale was also a significant predictor of social functioning impairment such that as the measure of unpleasant after-effects increased, so did the measure of social functioning impairment ($B = .006$, $t = 4.644$, 95% CI [.003, .008], $p < .001$). Next, analysis of the interaction demonstrated that as reported unpleasant after-effects experiences increased, the strength of the relationship between schizotypy trait endorsement and social functioning impairment decreased ($B = -.0003$, $t = -3.660$, 95% CI [-.0004, -.0001], $p < .001$). (Table 1.6)

**Study One Discussion**

The current study focused on schizotypal traits, the subjective experiences people have as a result of cannabis use, and how these experiences impact social functioning. Correlational analyses were consistent with the literature demonstrating significant, positive relationships between social functioning impairment, schizotypal traits, and unusual cannabis experiences (Robustelli, 2017; Esterberg, 2010; Barkus et al., 2008). Subsequent moderation analyses indicated that cannabis experiences moderated the relationship between the presence of schizotypal traits and social functioning impairment.
such that as individuals reported greater occurrence of unusual cannabis experiences, the relationship between schizotypy and social functioning was weakened. When exploratory CEQ subscale moderations were performed, results detailed that unpleasant after-effects and paranoid dysphoric experiences, but not pleasurable experiences, were the CEQ subscales driving the moderation effect. Our study filled in significant gaps in the literature by analyzing the effects of cannabis experiences since they had not previously been evaluated as contributing factors to the existent relationship between schizotypy and social functioning impairment.

The relationship between the symptoms associated with disorders along the schizophrenia spectrum and impairments in social functioning is well-established. Longitudinal studies have identified social dysfunction as a precursor for schizophrenia and related disorders on the schizophrenia spectrum (Wang et al., 2018; Dragt et al., 2011). One of the core determinants required for a clinical diagnosis of schizophrenia is an objective measure of functioning impairments in several social domains (Aghvinian & Sergi, 2018). Findings have also consistently evidenced a strong relationship between social functioning impairment and schizotypy, (Minor et al., 2020; McCleery et al, 2012; Dickie et al., 2011; Lee et al., 2011; Yasuyama et al., 2017) and suggest that different dimensions of positive and negative schizotypy traits contribute to specific impairments (Abu-Akel et al., 2018; Velthorst et al., 2016). Negative traits reduce social interest and contact, impair empathic responses, and decrease the perception of pleasure related to daily activities (Wang et al., 2013; Kwapisil et al., 2012). In turn, positive traits are associated with an increase in negative affect and beliefs, suspiciousness, abnormal thought processes, and social anxiety (Henry, Bailey, & Rendell, 2007; Li et al., 2019).
Along with the supportive evidence of previous studies, our results also revealed a robust association between severity of schizotypy traits and social functioning impairment. Specifically, higher levels of schizotypy may manifest as increased occurrences of perceptual aberrations, difficulties maintaining close relationships, and disorganized lifestyle behaviors that often lead to difficulties in social functioning.

Currently, there are very few studies investigating the relationship between schizotypy and cannabis experience. The vast majority of studies examined the relationship between cannabis use and schizotypy trait endorsement. Some variables identified in these studies were age, gender, characteristics of use (frequency and duration), and exacerbation of symptoms due to use. Associations between age and schizotypy expression over time showed that the younger individuals began using cannabis, the more commonly they would report experiencing negative schizotypy symptoms (Albertella et al., 2018). Also, studies revealed that females who used cannabis were more likely to endorse introvertive anhedonia compared to males (Albertella, Le Peley, & Copeland, 2017). Results of previous studies also depicted greater conversion rates from subclinical psychosis levels to schizophrenia in individuals who use cannabis (Hjorthøj et al., 2018). A study by Barkus et al. (2006) found that individuals who score high on measures of schizotypy frequently experience negative aspects of cannabis use—particularly unpleasant after-effects and psychotic-like phenomena (Barkus et al., 2006). Subsequently, Barkus repeated this study both with subclinical and clinical populations. This follow-up study replicated their original findings and reported that aversive cannabis experiences contribute to the expression of schizotypy traits (Barkus & Lewis, 2008; Barkus, 2008).
While few studies have investigated the relationship between cannabis experience and schizotypy, to our knowledge no study has explored the relationship between cannabis experience and social functioning impairment. Studies focusing on cannabis use and social functioning found a strong relationship between use and an increase in depressive symptoms. They also found relationships between use and increased rates of substance abuse and dependence. These factors all resulted in social functioning deficits that could best be explained by alexithymia, frontal lobe dysfunction, and increased impulsivity (Lyvers, Jamieson, & Thorberg, 2013). To add, studies also demonstrated significant negative effects of cannabis use on interpersonal relationships, psychosomatic symptoms, and psychological distress—all contributing components of social functioning (Tuner et al., 2018). Using cannabis and cannabis experiences are not interchangeable constructs. However, given that those who use cannabis have experiential responses to its neurobiological impact, it is likely that their negative experiential responses would impact social functioning. When repeated exposure to predominantly unusual and/or paranoid/dysphoric experiences occur, it can result in lasting effects (Barkus et al., 2008). These long-term, and often recurring effects, may lead to a pattern of maladaptive social functioning.

Our study confirms and expands on the findings reported above by delving further into the facets of cannabis experience. Other studies had not analyzed the relationship between social functioning and cannabis experience. Consequently, we drew from the common factor between the two variables—endorsement of schizotypy traits—to interpret the meaning behind trends highlighted in the results. The dampening effect of schizotypy traits brought on by cannabis experiences may exist due to overlapping
unusual reported symptoms that are components of schizotypy as well as adverse cannabis effects. The paranoid-dysphoric effects of cannabis that mirror the positive symptom traits of schizotypy include anxiety, delusions, odd beliefs, magical ideation, illusions, auditory and/or visual hallucinations, and paranoia/suspiciousness. Similarly, the unpleasant after-effects of cannabis experience mirror the negative symptom schizotypy traits such as avolition, anergia, and alogia. As consistent with the literature, our study confirmed that expression of psychotic traits contributed to increased experience of negative effects associated with cannabis use (Barkus et al., 2006; Stirling et al., 2008). Social dysfunction is a common factor among individuals with psychosis—increasing proportionally as individuals report an increase of traits and trait severity (Statucka & Walder, 2017; Morrison et al., 2013; Mitropoulou et al., 2002). Aspects of schizotypy indicative of social functioning impairment include cognitive and emotional intelligence deficits, exhibiting low tolerance for emotional distress, depression, and avolition (Rice, 2018; Kwapis et al., 2012; Barrantes-Vidal, Chun, Myin-Germeys, & Kwapis, 2013; Miller & Lenzenweger, 2014). To summarize, the symptoms of both schizotypy and unusual cannabis experiences mimic each other so closely that their deleterious effects on social functioning produce similar behavioral impairments.

Another interpretation for the eclipsed effect of schizotypy traits by cannabis experiences is an increased overlap in the neurochemical activation and neurobiological processes identified in both (Carlson, 2013; Leweke, 1999; Bloomfield et al., 2016; D’Souza et al., 2004; Os et al., 2002; Degenhardt et al., 2003). This interpretation is supported by studies that report cannabis use preceding the emergence of psychotic symptoms (Henquet et al., 2005; Stefanis et al., 2013) and consistent activation of
neurochemical pathways resulting in severity and expression of traits (Lenzenweger, 2018; Wijayendran et al., 2018). Neuronal deficits and disruption of sensory processing is evidenced in individuals who use cannabis (Skosnik et al., 2006). Studies focusing on the neurobiology have identified aberrant patterns of information processing in individuals who have psychosis (Kapur, 2003; Howes & Kapur, 2009). When unifying the interpretation of neurochemical and neurobiological systems of both cannabis use and psychosis, the commonalities exhibited by both phenomena are more clearly understood. Therefore, it is possible that shared underlying neurobiology leads to both the expression of schizotypy traits and unusual experiences while using cannabis, and this common third variable is why cannabis experience is a negative moderator between schizotypy and social functioning.

While the interaction effect between cannabis experiences and schizotypy traits on social functioning was unexpected, our study replicated and confirmed several other findings reported in the literature. A strong, positive relationship between social functioning impairment and schizotypy was observed (Statucka et al., 2017; Skodol, 2005; Henry et al., 2008; Addington, 1999). Our study added to the present literature by being the first to show that individuals who report paranoid/dysphoric or unusual aftereffects of cannabis also experience more social functioning difficulties. However, it is noteworthy that even though the relationship between unusual cannabis experiences and the interaction between unusual cannabis experiences and schizotypy were statistically significantly related to social functioning impairments, the effect for schizotypy traits alone was by far the strongest. Overall, the results of this study indicate that while both contribute to social functioning problems, higher levels of endorsed
schizotypy have a large, direct impact on a person’s ability to function in their social environment (Fridberg et al., 2011; Najolia, Buckner, & Cohen, 2012). Results from this current study have expanded our understanding of how these variables interact with one another. Specifically, this study has (1) established a relationship between social functioning and cannabis experiences, (2) identified how cannabis experiences impact the existing relationship between social functioning and presence of schizotypy traits, and (3) identified which factor(s) contribute the most to outcomes in social functioning impairment scores.
CHAPTER FOUR
STUDY TWO

Present research indicates cannabis use as an etiological consideration in some individuals who develop SZ and other related psychotic disorders (Diviant, Vigil, & Stith, 2018; Ortiz-Medina et al., 2018). In addition, the relationship between cannabis use and high levels of schizotypy indicate cannabis use as a risk factor for psychosis (Degenhardt et al., 2003; Van Os et al., 2002). A study by Skosnik et al. (2001) demonstrated a correlation between elevated levels of cannabis use and endorsement of positive symptoms on the SPQ. Other studies report similar findings and also indicate that both cannabis use and schizotypy are risk factors for the development of SZ. Altogether, findings support the premise that cannabis use and schizotypy, among other variables, are contributing factors to an individual’s probability of expressing clinical levels of a psychotic disorder (Davis et al., 2013). To date, researchers have identified that individuals who are more prone to psychotic-like traits indicate more abnormal experiences when using cannabis (Barkus & Lewis, 2008; Barkus et al., 2006). However, little research has been done exploring cannabis experience and psychosis.

The number of studies detailing the relationship between cannabis use and schizophrenia are vast (McGrath et al., 2010; Moore et al., 2007; Morrison et al., 2009; Van Os et al., 2002). Evidence suggests that cannabis use can sometimes result in brief psychotic-like symptoms, even in healthy individuals. It is also evident that those who use cannabis and have SZ or other related psychotic disorders often experience an increase in symptoms, relapse of increased symptom severity, and worsened prognosis (D’Souza, Sewell, & Ranganathan, 2009). There is a significant genetic correlation
between SZ and cannabis use (Verweij et al., 2017). The relationship between the two has often been understood as bidirectional; cannabis use in adolescence increases risk of psychosis (Casadio et., 2011) and a SZ diagnosis predicted both lifetime cannabis use and quantity of use (Verweij et al., 2017). Additionally, cannabis use disorder occurs in up to 42% of individual’s diagnosed with SZ and significantly worsen the progression of the diagnosis (Fischer et al., 2014). Some research suggests this relationship is in part due to a dysregulated brain reward circuit in those who use cannabis and have SZ (Fisher et al., 2014). While we may understand many aspects of the relationship between cannabis use and psychosis, little is known about the subjective experience of users who also have a psychotic disorder.

This study explored the self-reported subjective experiences of individuals who use cannabis and who have a psychotic disorder diagnosis. It focused on whether cannabis experiences contribute to the expression of psychotic symptoms and if they have an effect on symptom severity. Understanding the factors that contribute to the presentation of psychotic symptoms or frequency of symptom expression can supplement the existent understanding of risks associated with cannabis use in populations of individuals who have psychotic disorders and in non-clinical populations, as well.

Overall, the goal of Study Two was to evaluate the association between reported psychotic symptoms and varying levels of cannabis experiences endorsed by participants with a psychotic disorder diagnosis. This study’s hypotheses were identified as: (1) Individuals who score high on the CEQ-I will endorse more symptoms on the PANSS than those who score low on the CEQ-I or those who are non-users and (2) Individuals
who score low on the CEQ-I will endorse more symptoms on the PANSS than those who are non-users.

Study Two Methodology

Participants

This study was conducted as part of a larger study of Loma Linda’s Brain Potential Lab. Participants were recruited through the FOCUS program at Loma Linda University Behavioral Medicine Center (BMC). Once patients from the FOCUS program indicated an interest in the study, they were contacted by phone for a brief screening. Criteria for eligibility included participant’s age, illicit and prescription substance use/abuse, and/or diagnoses of learning disability or mood disorders. Additionally, individuals who had a neurological condition or had experienced traumatic brain injury or related injury that resulted in loss of consciousness were excluded from the study.

Participants were then contacted to schedule an initial 3-hour session and two 2 to 3-hour follow-up sessions (a total of ~7 to 9 hours). These sessions included a neurocognitive battery, an EEG portion, semi-structured interviews, and various questionnaires.

Participants who did not complete the entire study were removed from statistical analyses. This achieved a sample of 14.

Demographic data of participants were collected. Psychiatric illnesses reported were schizoaffective disorder (21.4%), schizophrenia (42.9%), brief psychotic disorder (7.1%), and unspecified schizophrenia spectrum and other psychotic disorder (28.6%). There were 4 females (28.6%) and 10 males (71.4%) who participated in this study with a mean age of 32 years ($M_{age} = 32.10$, $SD = 10.81$). It is significant to note that participants indicated a mean age of first cannabis use at 21 years ($M_{age} = 21.00$, $SD = 9.59$).
Ethnicities represented in this sample population were Caucasian (42.9%), Latino (21.4%), African American (7.1%), Other (28.6%; East African and Caucasian/Latino). 14.3% of participants indicated left-hand dominance, 64.3% were right hand dominant, 7.1% endorsed being ambidextrous, and 14.3% chose not to respond. (Table 2.1)

Measures

In addition to the CEQ-I, study two incorporated the Positive and Negative Syndrome Scale (PANSS).

Measure of Cannabis Experience

The Cannabis Experience Questionnaire-Intoxication checklist (CEQ-I) was developed to measure the effects of cannabis intoxication including paranoid-dysphoric and euphoric experiences. This questionnaire is also available in an abbreviated form as the Cannabis Experience Questionnaire-Intoxication Checklist (CEQ-I) short form, which consists of 13 items. The CEQ-I short form aids in the identification of young cannabis users who are at an increased risk for psychotic like and paranoid-dysphoric intoxication experiences (Quinn et al., 2017). Items are answered using a five-point Likert scale ranging from “rarely or never” to “almost always or always” (Pauselli et al., 2017). The CEQ-I short form exhibits good internal reliability with a Cronbach’s $\alpha > 0.80$. The CEQ-I was created as an abbreviated form of Barkus’ original CEQ. It was adapted for this study because it assessed all the same three cannabis experiences as the original CEQ and maintained strong reliability and validity consistent with the original measure. Since the participants of this study were a part of a larger study, the abbreviated version of the CEQ was given in order to reduce testing fatigue and increase the likelihood of participants completing the questionnaire.
**Positive and Negative Syndrome Scale (PANSS)**

The Positive and Negative Syndrome Scale (PANSS) is a semi-structured interview that assesses symptom severity in patients diagnosed with schizophrenia and other psychotic disorders (Opler, 2017; Kay, 1991). The PANSS discusses the presence and severity of psychotic symptoms within three categories: positive symptoms, negative symptoms and general symptoms (Kay, Fiszbein, & Opler, 1987).

The positive scale includes delusions, conceptual disorganization, hallucinations, excitement, grandiosity, suspiciousness/persecution, and hostility. The negative scale includes blunted affect, emotional withdrawal, poor rapport, passive/apathetic social withdrawal, difficulty in abstract thinking, and lack of spontaneity and flow of conversation. The general psychopathology scale consists of 16 items that assess somatic concerns, mannerisms and posturing, disturbance of volition, active social avoidance, poor impulse control, and others (Kay, 1991). Internal consistency for subscales were: positive ($\alpha = 0.73$), negative ($\alpha = 0.83$), and general psychopathology ($\alpha = 0.79$) (Van de Oord, 2006).

**Study Two Results**

Statistical Analysis

Selected cases were filtered to only run analyses with individuals who were part of a clinical population diagnosed with a psychotic disorder. Data were analyzed using SPSS version 27 to conduct a one-way ANOVA comparing scores on the PANSS for individuals categorized into non-users and users. Next, the CEQ-I total score continuous variable was recoded into a categorical variable separating CEQ-I scores into levels of non-users (1), low CEQ-I score users (2), and high CEQ-I score users (3). Participants
were distributed using a median split to create group ranges. Those with scores of 0 were non-users, scores between 18 (minimum) and 30 (median) were assigned the low CEQ-I category and scores between 31 (median + one) and 44 (maximum) were assigned the high CEQ-I category. An additional ANOVA was performed to further explore the relationships between specific groups of CEQ-I scores (non-users, low CEQ-I, and high CEQ-I) and PANSS score means.

Results

There were 14 participants who responded to all of the questionnaires. Of those participants, four (28.6%) were non-users, four (28.6%) were in the low CEQ-I group, and six participants (42.8%) were in the high CEQ-I group. Participants indicated strains of cannabis used and results indicated four (28.6%) used an indica strain, one (7.1%) used a sativa strain, two (14.3%) used a hybrid strain, and four (28.6%) did not know what strain they used; three (21.4%) participants chose not to respond to this item. Individuals were also instructed to indicate reason(s) for using cannabis (i.e., “Check all that apply”); this format allowed for participants to submit more than one response to this item. Answers included using cannabis to fall asleep ($n = 3, 23\%$), to help with concentration ($n = 3, 23\%$), for pain reduction ($n = 5, 36\%$), anxiety reduction ($n = 3, 23\%$), and relief from other psychological symptoms ($n = 4, 29\%$). There was also an option for participants to indicate “other” reasons for use in a free response format. Participant responses included: “recreational use”, “smoking cannabis socially in a party setting”, “contempt for others,” “to forget my problems,” “just to smoke pot,” and “to relax me.” (Figure 2.1)

Results from the first ANOVA indicated a non-significant trend in the predicted direction (Figure 2.2) indicating greater symptom severity for those who reported using
cannabis ($M = 66.60, SD = 15.55$) compared to non-users ($M = 55.67, SD = 21.55$), ($F(1,11) = 0.977, p = .34$) (Table 2.2). Additionally, there were no statistically significant differences between symptom severity (Figure 2.3) as determined by the one-way ANOVA between non-users ($M = 55.67, SD = 21.55$), the low CEQ-I group ($M = 72.75, SD = 15.46$), and the high CEQ-I group ($M = 62.50, SD = 15.54$, ($F(2,10) = .925, p = .428$). (Table 2.3)

**Study Two Discussion**

This study explored the relationship between cannabis experiences and symptoms of schizophrenia as measured by the CEQ-I and PANSS, respectively. Questionnaires were administered to individuals who had a clinical diagnosis of schizophrenia or other related psychotic disorders. Despite using a group with mixed diagnoses, symptom severity levels were consistent with that typically reported in the literature using stable outpatients with schizophrenia (Wang et al., 2018; Kozma et al., 2010; Ortiz et al., 2013). While the results from this study were not significant, data trends were in the expected direction.

Our results showed a trend for individuals with schizophrenia who used cannabis to have more severe symptoms of psychosis compared to non-users. This trend is consistent with the literature and findings that cannabis use exacerbates symptoms in individuals with schizophrenia (Ringen et al., 2016; Hosseini & Oremus, 2018; Marconi et al., 2016; Murray et al., 2016). Cannabinoids increase dopamine, reduce GABA, and reduce glutamatergic transmission, resulting in negative, positive, and cognitive symptoms in individuals with schizophrenia and related psychotic disorders (D’Souza, Sewell, & Ranganathan, 2009; Englund et al., 2012). Evidence of previous studies
indicate that heavy and prolonged cannabis use, particularly of synthetic and high-potency strains, has been associated with an increase in manic symptoms and suicide (Sideli et al., 2019; DiForti et al., 2019; Gage, Hickman, & Zammit, 2016; Gage, 2019). While the results of this study were not significant, likely due to the small sample size, the overall pattern of the data was in the expected direction.

Interestingly, our data was not as consistent with respect to CEQ-I and severity of psychotic symptoms. While we expected that individuals with psychosis who used cannabis and reported low amounts of unusual experiences from cannabis would endorse fewer psychotic symptoms than individuals with schizophrenia who use cannabis and reported high amounts of unusual experiences from cannabis, this was not the case. Our data suggest that individuals with low amounts of unusual cannabis experiences on cannabis endorse greater psychotic symptom severity than users who report high levels of unusual experiences on cannabis. While not statistically significant, this pattern was unexpected and likely due to the small sample size of the group comparisons.

The present findings were interpreted keeping in mind potential methodological limitations. The paramount limitation to this study was the small sample size. Recruitment of participants in the clinical sample was effective, but in certain instances attrition was the deterrent of complete data collection. Unfortunately, recruitment and data collection came to a halt in March of 2020 due to COVID-19. At that time, participation of the FOCUS program at the BMC was also suspended. Future study of the CEQ in clinical populations could help identify relationships with psychosis. As study one results indicated an increase of schizotypy symptoms in individuals who endorsed
more unusual cannabis experiences, this study explored whether the presence and severity of psychotic symptoms also increased along with unusual cannabis experiences.

Another possible limitation to the study was that participants were asked to complete items on the cannabis experience questionnaire based on previous, not current use. Individuals from the study who completed both questionnaires were all actively engaged in treatment. Their participation in their treatment group required that they abstain from using any substance not prescribe to them by their physicians. Response accuracy was not assessed in this study, but cognitive deficits in individuals with psychosis (memory problems in particular) are well-documented (Henquet et al., 2005; Coulston, Perdices & Tennant, 2007; Helle et al., 2017; Ortiz-Medina et., 2018). Therefore, it is possible that poor self-report accuracy of their past experiences with cannabis use impacted the results. An area that should be further explored is the possibility that unusual experiences while using cannabis may influence the expression of schizophrenia symptom severity.

Additionally, participants of this study demonstrated limited knowledge of certain characteristics or descriptive identifiers of their cannabis use. For example, more than 20% of participants indicated that they did not know what strain of cannabis they used—they were unable to identify between indica, sativa, or hybrids, but were able to identify whether the strain they used elicited a psychoactive response or not. Similar patterns are noted within the literature, most commonly with individuals reporting THC use for recreational and anxiolytic effects vs. CBD for analgesic effects (Chiou et al., 2013; Verweij et al., 2017; Callaghan et al., 2020; Hall & Degenhardt, 2007; Zalesky et al., 2012). Next, patient report regarding quantity of use was approximated and therefore can
only be identified as a subjective measure. Unless participants bought cannabis in the flower form and had recollection of grams purchased (e.g., not in pre-rolled cigarettes, blunts, or cartridges), there was no highly accurate manner to account for grams used per week. However, results were consistent with the literature in that participants of this study reported inhalation as the most common route of administration (Volkow, 2014; Hashibe et al., 2006; Callaghan et al., 2020).

In conclusion, this study was the first to examine unusual cannabis experiences and their relationship with symptom severity in psychosis. Study one was conducted with a subclinical population and demonstrated that as schizotypy symptoms increased so did endorsement of adverse cannabis experiences. Similarly, we paralleled this study in a clinical sample with mixed diagnoses. Methodology and findings allowed us to examine whether the presence and severity of psychotic symptoms increased along with unusual cannabis experiences. Our findings showed a trend toward more severe symptoms in users compared to non-users. There was no strong evidence to support the pattern of unusual cannabis experiences that we hypothesized, reflecting the need to increase sample size in order to address the absence of power in this study. Ultimately, the lack of evidence supporting expected relationships between unusual cannabis experiences and psychotic symptom expression warrants ongoing data collection.
CHAPTER FIVE

CONCLUSIONS

Cannabis experience is complex and multifaceted, consequently, very little is known about during- and after-use effects. Review of schizotypy and psychosis literature indicates that cannabis experience is a lesser explored contributory factor in comparison to cannabis use. How people “experience” cannabis can best be conceptualized as subjective perceptual and/or cognitive events. Our study aimed to reduce gaps in the literature by exploring cannabis experiences in individuals on the schizophrenia spectrum (schizotypy, schizophrenia, and other schizophrenia-related disorders). It was of great interest to investigate whether cannabis experiences mimic or intensify an individual’s endorsement of schizotypy traits and symptoms of psychosis. Consistent with previous research, study one demonstrated significant, positive relationships between schizotypal traits, the subjective experiences people have as a result of cannabis use, and social functioning (Barkus et al., 2008; Foglia, 2020; Quinn et al., 2017).

Additionally, study one moderation analyses indicated that cannabis experiences moderated the relationship between the presence of schizotypal traits and social functioning impairment. When individuals reported greater occurrence of unusual cannabis experiences, the relationship between schizotypy and social functioning was eclipsed. The major contributor of this moderation was due to unpleasant after-effects and paranoid dysphoric experiences, but not pleasurable experiences resulting from cannabis use. Since study one demonstrated significant relationships and strong support of previous results, we predicted similar effects of cannabis experience in a clinical sample for study two. Measures of cannabis experience and positive and negative
symptoms of schizophrenia were administered to individuals who had a clinical diagnosis of schizophrenia or other related psychotic disorders. Study two explored the relationship between cannabis experiences and symptoms of schizophrenia. Due to a small sample size, symptom severity levels were not significantly related to unusual cannabis experiences. However, study two results were consistent with trends typically reported in the literature using stable outpatients diagnosed with schizophrenia (Wang et al., 2018; Kozma et al., 2010; Ortiz et al., 2013).

In an effort to understand the effects of cannabis experiences on the schizophrenia spectrum and performance in daily life, this study analyzed these relationships in both subclinical and clinical populations. When taken as a whole, the results of this two-part study provide evidence of an association between unusual cannabis experiences and the schizophrenia spectrum. Unusual cannabis experiences may be acute or can result in chronic effects that have lasting impact on an individual’s affective, cognitive, and perceptual expression. Our study, in tandem with previous literature, also provides evidence of the harmful impacts that increased schizotypy have on social functioning. This is especially meaningful because mental health outcomes are intrinsically related to an individual’s physical health, quality of life, and social functioning. Not only is this interpretation salient to those who have been clinically diagnosed with a severe mental illness, but its utility applies to other mental health conditions and healthy individuals, as well.

Cannabis is a widely used substance—commonly used recreationally or in efforts to self-medicate (Patton et al., 2002; Hall & Degenhardt, 2009; Hasin, 2018). Due to its indiscriminate consumption, our overarching goal was to create a deeper understanding
of what cannabis experiences are. Also, we attempted to identify whether these experiences contribute to the expression and/or severity of psychotic traits. Present results and continued efforts of this study are specifically important for individuals who either have underlying vulnerabilities to psychotic disorders or who already live with a clinical diagnosis of schizophrenia or related conditions. A strong association exists between schizotypy and an individual’s performance in social capacities (e.g., work, school, interpersonal relationships, social activities). As a result, it would benefit clinicians and especially medical providers to broaden their use of screening measures. Incorporating questionnaires that address schizotypy, social functioning, and cannabis use/experience would allow early-identification and continued monitoring throughout a patient’s life. As this study emphasized, endorsement of schizotypy traits does not always translate into development of full-threshold psychosis, but there is not sufficient evidence to preclude the possibility of conversion. Consequently, cannabis experiences and related long-term effects of cannabis should be further explored to guide future direction of behavioral recommendations to individuals who use cannabis—even among healthy individuals. Longitudinal studies are necessary to educate the public on the extensive effects of cannabis experiences on mental health and behavioral implications. Hopefully, future adaptations of this study will promote public health initiatives for the general population and contribute to biopsychosocial interventions for clinical populations.
References


Ang, R. P., & Goh, D. H. (2010). Cyberbullying among adolescents: The role of affective...


negative symptoms: Is there a distinct subtype of negative symptom schizophrenia? Schizophrenia Research, 77(2–3), 151–165. https://doi.org/10.1016/j.schres.2005.03.022


people: the risk for schizophrenia. Neuroscience & Biobehavioral Reviews, 35(8),
1779-1787.

Caspi, A., Moffitt, T. E., Cannon, M., Mcclay, J., Murray, R., Harrington, H., & Craig,
psychosis by a functional polymorphism in the catechol-O-methyltransferase
gene: longitudinal evidence of a gene X environment interaction. Biological
psychiatry, 57(10), 1117-1127.

doi:10.4081/mi.2017.7052

Putatively psychosis-prone subjects 10 years later. Journal of abnormal
psychology, 103(2), 171.

meta-analysis on positive psychotic experiences and a meta-analysis on negative
psychotic experiences. International Review of Psychiatry, 31(5-6), 471-490.


considerations and the measurement of schizotypy. Personality and Individual
Differences, 5(6), 633-648.

Claridge, G. S., Bentall, R. P., & Slade, P. D. (1989). The multidimensional nature of
schizotypal traits: A factor analytic study with normal subjects. British Journal of
clinical psychology, 28(4), 363-375.

Press.

Findings from a large nonclinical adult sample. Comprehensive Psychiatry, 50(5),

Psychometrically Sound Brief Measure of Schizotypal Traits: Introducing the
doi:10.1521/pedi.2010.24.4.516

deficits and differential domains of social functioning impairment in
schizophrenia. Schizophrenia research, 81(2-3), 227-238.


Davis, M. C., Lee, J., Horan, W. P., Clarke, A. D., McGee, M. R., Green, M. F., &
Marder, S. R. (2013). Effects of single dose intranasal oxytocin on social cognition in schizophrenia. Schizophrenia research, 147(2-3), 393-397.


Diagnostic and Statistical Manual of Mental Disorders: Diagnostic and Statistical Manual


Foglia, E., Appiah-Kusi, E., Wilson, R., Colizzi, M., Klamerus, E., Caldwell, A., ... &
Bhattacharyya, S. (2020). Childhood trauma and being at-risk for psychosis are associated with higher peripheral endocannabinoids. Psychological Medicine, 50(11), 1862-1871.


Green, M. F. (1996). What are the functional consequences of neurocognitive deficits in schizophrenia? The American journal of psychiatry.

psychopathology. Psychological Medicine, 45(11), 2389-2401.
doi:10.1017/s0033291715000380


positive link between executive function and lifetime cannabis use in schizophrenia is not explained by current levels of superior social cognition. Psychiatry Research, 250, 92-98.


positive, negative, and disorganized schizotypy dimensions with affective symptoms and experiences. Psychiatry Research, 270, 1143-1149.


Lenzenweger, M. F. (2010). Current status of the scientific study of the personality


Linscott, R. J., & Van Os, J. (2012). An updated and conservative systematic review and meta-analysis of epidemiological evidence on psychotic experiences in children and adults: on the pathway from proneness to persistence to dimensional expression across mental disorders. Psychological medicine, 43(6), 1133-1149.


Lyvers, M., Jamieson, R., & Thorberg, F. A. (2013). Risky cannabis use is associated
with alexithymia, frontal lobe dysfunction, and impulsivity in young adult cannabis users. Journal of Psychoactive Drugs, 45(5), 394-403.


Rabin, S. J., Avidan, M., Rozencwaig, S., & Shalev, H. (2014). Metacognition in schizophrenia and schizotypy: relation to symptoms of schizophrenia, traits of schizotypy and Social Quality of Life


Sarısoy, G., Kaçar, Ö. F., Pazvantoğlu, O., Korkmaz, I. Z., Öztürk, A., Akkaya, D., &


Sündermann, O., Onwumere, J., Kane, F., Morgan, C., & Kuipers, E. (2013). Social networks


World Health Association. https://www.who.int/news-room/fact-sheets/detail/schizophrenia


Yasuyama, T., Ohi, K., Shimada, T., Uehara, T., & Kawasaki, Y. (2017). Differences in social functioning among patients with major psychiatric disorders: interpersonal communication is impaired in patients with schizophrenia and correlates with an increase in schizotypal traits. Psychiatry Research, 249, 30-34.


Table 1.1

*Study One Demographics and Frequencies*

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>%</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>723</td>
<td>37.4%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1210</td>
<td>62.6%</td>
<td></td>
</tr>
<tr>
<td>Participant Age</td>
<td>30.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(11.51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handedness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>207</td>
<td>10.7%</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>1726</td>
<td>89.3%</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>365</td>
<td>18.9%</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>1336</td>
<td>69.1%</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>85</td>
<td>4.4%</td>
<td></td>
</tr>
<tr>
<td>Aboriginal</td>
<td>14</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>133</td>
<td>6.9%</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 7 to 12</td>
<td>14</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>Graduated High School</td>
<td>365</td>
<td>18.9%</td>
<td></td>
</tr>
<tr>
<td>Part College</td>
<td>697</td>
<td>36.1%</td>
<td></td>
</tr>
<tr>
<td>Graduated 2-year college</td>
<td>219</td>
<td>11.3%</td>
<td></td>
</tr>
<tr>
<td>Graduated 4-year college</td>
<td>442</td>
<td>22.9%</td>
<td></td>
</tr>
<tr>
<td>Part graduate School</td>
<td>65</td>
<td>3.4%</td>
<td></td>
</tr>
<tr>
<td>Completed graduate School</td>
<td>131</td>
<td>6.8%</td>
<td></td>
</tr>
</tbody>
</table>
Table 1.2
Descriptive Statistics and Correlations for Social Functioning, Schizotypy, and Cannabis Experience Measures

<table>
<thead>
<tr>
<th>Variable (Measure)</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Social Functioning (SAS-SR)</td>
<td>1639</td>
<td>1.89</td>
<td>0.44</td>
<td>.498*</td>
<td>.225**</td>
<td></td>
</tr>
<tr>
<td>2. Schizotypy (SPQ)</td>
<td>1933</td>
<td>20.60</td>
<td>14.54</td>
<td>.498*</td>
<td></td>
<td>.365**</td>
</tr>
<tr>
<td>3. Cannabis Experiences (CEQ)</td>
<td>1333</td>
<td>111.2</td>
<td>28.75</td>
<td>.225*</td>
<td>.365*</td>
<td></td>
</tr>
</tbody>
</table>

*Note: SAS-SR = Social Adjustment Scale Self-Report, SPQ = Schizotypal Personality Questionnaire, CEQ = Cannabis Experience Questionnaire. ** p < 0.001.
Table 1.3  
*Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Cannabis Experiences*

<table>
<thead>
<tr>
<th>Predictor (Measure)</th>
<th>B</th>
<th>95% CI</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Functioning (SAS-SR)</td>
<td>1.886</td>
<td>[1.8623, 1.9088]</td>
<td>0.012</td>
<td>159.027</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Schizotypy (SPQ)</td>
<td>0.015</td>
<td>[.0132, .0165]</td>
<td>0.001</td>
<td>17.646</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Cannabis Experiences (CEQ)</td>
<td>0.001</td>
<td>[.0003, .0020]</td>
<td>0</td>
<td>2.729</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Schizotypy (SPQ) X Cannabis Experiences (CEQ)</td>
<td>-0.0001</td>
<td>[-.0002, -.0001]</td>
<td>0</td>
<td>-5.321</td>
<td>p &lt; .001</td>
</tr>
</tbody>
</table>

Note: $R^2 = .2603$, $F(3, 1106) = 129.738$, p < .001; $\Delta R^2 = .019$. 
<table>
<thead>
<tr>
<th>Variable</th>
<th>(Measure)</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Social Functioning</td>
<td>(SAS-SR)</td>
<td>1639</td>
<td>1.89</td>
<td>0.44</td>
<td></td>
<td>.498**</td>
<td>.252**</td>
<td>.275**</td>
<td>-0.002</td>
</tr>
<tr>
<td>2. Schizotypy</td>
<td>(SPQ)</td>
<td>1933</td>
<td>20.6</td>
<td>14.54</td>
<td></td>
<td>.498**</td>
<td>1</td>
<td>.334**</td>
<td>.343**</td>
</tr>
<tr>
<td>3. Paranoid-Dysphoric</td>
<td>(PD)</td>
<td>1371</td>
<td>45.71</td>
<td>15.86</td>
<td></td>
<td>.252**</td>
<td>.334**</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>4. Unpleasant After-Effects</td>
<td>(AE)</td>
<td>1333</td>
<td>23.55</td>
<td>9.77</td>
<td></td>
<td>.275**</td>
<td>.343**</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>5. Pleasurable Effects</td>
<td></td>
<td>1371</td>
<td>42.07</td>
<td>12.15</td>
<td>-0.002</td>
<td>.161**</td>
<td>—</td>
<td>—</td>
<td>1</td>
</tr>
</tbody>
</table>

Note: SAS-SR = Social Adjustment Scale Self-Report, SPQ = Schizotypal Personality Questionnaire, PD = Paranoid-Dysphoric Effects Subscale, AE = Unpleasant After-Effects Subscale, PE = Pleasurable Effects. Subscales of CEQ were not correlated with each other, indicated by —. ** p < 0.001.
Table 1.5
Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Paranoid-Dysphoric Experiences

<table>
<thead>
<tr>
<th>Predictor (Measure)</th>
<th>B</th>
<th>95% CI</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Functioning (SAS-SR)</td>
<td>1.89</td>
<td>[1.8670,1.9124]</td>
<td>0.012</td>
<td>163.275</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Schizotypy (SPQ)</td>
<td>0.015</td>
<td>[.0131, .0163]</td>
<td>0.001</td>
<td>18.009</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Paranoid-Dysphoric</td>
<td>0.004</td>
<td>[.0023, .0052]</td>
<td>0</td>
<td>4.947</td>
<td>$p &lt; .001$</td>
</tr>
<tr>
<td>Schizotypy (SPQ) X Paranoid-Dysphoric Experiences (PD)</td>
<td>-0.0002</td>
<td>[-.0002, .0000]</td>
<td>0</td>
<td>-6.027</td>
<td>$p &lt; .001$</td>
</tr>
</tbody>
</table>

Note: $R^2 = .2744$, $F(3, 1138) = 143.453$, $p < .001$; $\Delta R^2 = .023$. 
Table 1.6  
*Moderation Analysis of Social Functioning predicted by Schizotypy moderated by Unpleasant After-Effects*

<table>
<thead>
<tr>
<th>Predictor (Measure)</th>
<th>B</th>
<th>95% CI</th>
<th>SE</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Functioning (SAS-SR)</td>
<td>1.881</td>
<td>[1.8575, 1.9044]</td>
<td>0.012</td>
<td>157.311</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Schizotypy (SPQ)</td>
<td>0.014</td>
<td>[.0122, .0155]</td>
<td>0.001</td>
<td>16.574</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Unpleasant After-Effects (AE)</td>
<td>0.006</td>
<td>[.0034, .0083]</td>
<td>0.001</td>
<td>4.644</td>
<td>p &lt; .001</td>
</tr>
<tr>
<td>Schizotypy (SPQ) X</td>
<td>-0.003</td>
<td>[-.0004, -.0001]</td>
<td>0</td>
<td>-3.66</td>
<td>p &lt; .001</td>
</tr>
</tbody>
</table>

Note: $R^2 = .2597$, $F(3, 1106) = 129.322$, $p < .001$; $\Delta R^2 = .009$. 

75
Figure 1.1

Moderating Effects of Cannabis Experience on Relationship between Schizotypy and Social Functioning

Note: Simple slopes of schizotypy (SPQ) predicting social functioning (SAS-SR) for 1 SD below, at, and above the mean of Cannabis Experiences (CEQ).
Figure 1.2

*Moderating Effects of Paranoid-Dysphoric Effects on Relationship between Schizotypy and Social Functioning*

*Note:* Simple slopes of schizotypy (SPQ) predicting social functioning (SAS-SR) for 1 SD below, at, and above the mean of the Paranoid-Dysphoric (PD) experiences subscale of the CEQ.
Figure 1.3
*Moderating Effects of Unpleasant After-Effects on Relationship between Schizotypy and Social Functioning*

*Note:* Simple slopes of schizotypy (SPQ) predicting social functioning (SAS-SR) for 1 SD below, at, and above the mean of the Unpleasant After-Effects (AE) subscale of the CEQ.
Table 2.1
*Study Two Demographics and Frequencies*

<table>
<thead>
<tr>
<th>Variables</th>
<th>n</th>
<th>%</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>4</td>
<td>28.6%</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>10</td>
<td>71.4%</td>
<td></td>
</tr>
<tr>
<td><strong>Participant Age</strong></td>
<td></td>
<td></td>
<td>32.1 (10.81)</td>
</tr>
<tr>
<td><strong>Age of First Cannabis Use</strong></td>
<td></td>
<td></td>
<td>21.0 (9.59)</td>
</tr>
<tr>
<td><strong>Handedness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Left</td>
<td>2</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>9</td>
<td>64.3%</td>
<td></td>
</tr>
<tr>
<td>Ambidextrous</td>
<td>1</td>
<td>7.1%</td>
<td></td>
</tr>
<tr>
<td>No Response</td>
<td>2</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>6</td>
<td>42.9%</td>
<td></td>
</tr>
<tr>
<td>Latino</td>
<td>3</td>
<td>21.4%</td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>1</td>
<td>7.1%</td>
<td></td>
</tr>
<tr>
<td>Other (East African &amp; Caucasian/Latino)</td>
<td>4</td>
<td>48.6%</td>
<td></td>
</tr>
<tr>
<td><strong>Psychiatric Diagnosis</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schizoaffective Disorder</td>
<td>3</td>
<td>21.4%</td>
<td></td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>6</td>
<td>42.9%</td>
<td></td>
</tr>
<tr>
<td>Brief Psychotic Disorder</td>
<td>1</td>
<td>7.1%</td>
<td></td>
</tr>
<tr>
<td>Unspecified Schizophrenia Spectrum and other psychotic disorder</td>
<td>4</td>
<td>28.6%</td>
<td></td>
</tr>
</tbody>
</table>
Table 2.2
One-Way Analysis of Variance in PANSS Score Means between Non-Users and Cannabis Users

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>1</td>
<td>275.86</td>
<td>275.86</td>
<td>.977</td>
<td>.344</td>
</tr>
<tr>
<td>Within Groups</td>
<td>11</td>
<td>3105.07</td>
<td>282.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>3380.92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2.3
One-Way Analysis of Variance in PANSS Score Means between Non-Users, Low CEQ-I Users, and High CEQ-I Users

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>2</td>
<td>528.01</td>
<td>264.00</td>
<td>.925</td>
<td>.428</td>
</tr>
<tr>
<td>Within Groups</td>
<td>10</td>
<td>2852.92</td>
<td>285.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>3380.92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 2.1
Reported Reasons for Using Cannabis

Note: Participants indicated using cannabis to fall asleep \((n = 3, 23\%)\), to help with concentration \((n = 3, 23\%)\), for pain reduction \((n = 5, 36\%)\), anxiety reduction \((n = 3, 23\%)\), and relief from other psychological symptoms \((n = 4, 29\%)\). There was also an option for participants to indicate “other” reasons for use in a free response format. Participant responses included: “recreational use”, “smoking cannabis socially in a party setting”, “contempt for others,” “to forget my problems,” “just to smoke pot,” and “to relax me.”
Figure 2.2
Mean Scores of Schizotypy Symptoms Reported by Non-Users and Cannabis Users

Note: Reported schizotypy symptoms were measured by the Positive and Negative Syndrome Scale (PANSS). Data were analyzed using SPSS version 27 to conduct a one-way ANOVA comparing scores on the PANSS for individuals categorized into non-users and users. Results from the ANOVA indicated a non-significant trend in the predicted direction, indicating greater symptom severity for those who reported using cannabis ($M = 66.60, SD = 15.55$) compared to non-users ($M = 55.67, SD = 21.55$).
Figure 2.3
Mean Scores of Schizotypy Symptoms Reported by CEQ-I Groups

Note: Reported schizotypy symptoms were measured by the Positive and Negative Syndrome Scale (PANSS). This ANOVA was performed to further explore the relationships between specific groups of CEQ-I scores (non-users, low CEQ-I, and high CEQ-I) and PANSS score means. There were no statistically significant differences between symptom severity as determined by the one-way ANOVA between different user groups—non-users ($M = 55.67, SD = 21.55$), the low CEQ-I group ($M = 72.75, SD = 15.46$), and the high CEQ-I group ($M = 62.50, SD = 15.54$, ($F(2,10) = .925$, $p = .428$).