

Creativity and psychosis vulnerability:

An examination of similarities and differences in factors associated with early psychosis, professional creative and non-creative populations.

Thesis by compilation

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Doctorate of Philosophy

University of Technology

Graduate School of Health

2020

Word count: 77088

Pages: 331

i) CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Julie Crabtree declare that this thesis is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Graduate School of Health at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise reference or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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ii) Thesis by compilation

This is a thesis by compilation, which is structured as a single manuscript that comprises a combination of chapters and four published/publishable works (i.e. papers). While the four papers are incorporated into the manuscript, PDF versions of the published manuscripts are also included as addendum.

The thesis is presented as seven chapters, incorporating the four papers and including linking text to establish the relationship between one chapter/paper and the next. There is a discussion chapter and conclusion to the research, which includes a comment on how the research contributes to the field.

iii) List of papers/publications included

Chapter Two (Paper 1)

Crabtree, J. M., & Green, M. J. (2016). Creative cognition and psychosis vulnerability: what's the difference? *Creativity Research Journal*, 28(1), 24-32.

Submitted June 2015

Chapter Four (Paper 2)

Crabtree, J. M., & Newton-John, T. R. O. (2018). Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants. *Psychosis*, 1-13.
doi:10.1080/17522439.2018.1542021

Submitted May 2017

Chapter Five (Paper 3)

Crabtree, J. M., Hudson, J. L., Brockman, R., & Newton-John, T. R. O. Spatial working memory rather than IQ or executive function discriminates early psychosis and 'at risk' creative individuals *Early Intervention in Psychiatry*, submitted for publication

Submitted May 2019, published December 2019

Chapter Six (Paper 4)

Crabtree, J. M., Hudson, J. L., & Newton-John, T. R. O. Anxiety, paranoia and trauma in early psychosis and creative populations. *Journal of Affective Disorders*, submitted for publication.

Submitted August 2019, resubmitted Psychiatry November 2019, currently under review.

iv) List of additional publications/presentations produced by the PhD candidate

2015

1. Crabtree, J. M. Managing creative employees; ANZ: presentation to ANZ digital and marketing team; Melbourne 15 April 2015

2. Crabtree, J. M., & Green, M. J. (2015). Creative Cognition offers fresh insights for early psychosis. *INPSYCH Bulletin of Australian Psychological Society, June*, 12-13.

2016

3. 'Understanding the creative artist', Crabtree, J.M.; Crabtree, J.R.

Crabtree, J. M., & Crabtree, J. R. (2016). Understanding the creative artist. In M. Miner & M. Dowson (Eds.), *Creativity and Spirituality: A multidisciplinary perspective*. Charlotte, NC: Information Age Publishing.

4. Crabtree, J.M. Panel on Mental Health and Music Bigsound: (Music Industry showcase) Judith Wright Centre Performance Space, Brisbane, 7 September 2016:

5. Crabtree, J.M. Surviving pilot season in LA: Understanding Mental Health issues for actors over pilot season. Media Entertainment and Arts Alliance, Sydney: July 8 2016
Melbourne: July 15 2016

2017

6. Crabtree, J.M. Living with a Creative Mind; Developing a positive culture for creative arts Presentation to academic staff UCQ: Strategic Day University of Central Queensland School of Education and Arts, Brisbane Queensland, 14 August 2017.

2018

7. Crabtree, J.M. Living with a creative mind: **Media Entertainment and Arts Alliance Graduation Day for Actors**, Eternity Theatre, Sydney, 24 August 2018.

8. Crabtree, J.M. 'Shared Vulnerability Between Creative and Psychosis Populations: How to Develop Resiliency' **19th International Mental Health Conference**, Gold Coast Queensland, 9 August 2018.

2019

9. Crabtree, J.M. Keynote address: Living with a Creative Mind: Equity Foundation: **Ways to Wellness Conference**: 4 March 2019, Victorian Arts Centre, Melbourne.

10. Crabtree, J.M. 'Spatial working memory rather than IQ or executive function discriminates early psychosis and 'at risk' creative individuals' **GSH Student Research Presentations**, UTS, 29 March 2019

11. Crabtree, J.M. Living with a creative mind: **Media Entertainment and Arts Alliance Graduation Day for Actors**, Eternity Theatre, Sydney, 16 August 2019

12. Crabtree, J.M. 'If studying artistic creativity is a risk factor for psychosis, how do we screen for vulnerability?' **Society for Mental Health Research conference**: Melbourne 28-29 November, abstract submitted.

v) Acknowledgements

I would like to thank my participants for the privilege of asking many questions but principally for their interest in the research. In particular the early psychosis and creative sample expressed keen interest in the study and findings. Many expressed a desire to see greater understanding and support for those who are highly creative. I hope I have done justice to their voice.

I would like to thank my supervisors:

Melissa Green – for her willingness to accept me as a student and her initial interest in the research and guidance during the early stages

Rob Brockman – for his willingness to discuss the research at UTS and for all his subsequent assistance

Toby Newton-John – for agreeing to take me on as a primary supervisor and for being such a calm and steady influence throughout the process

Jennie Hudson – thank you for being a part of the supervision team in the last year and for bringing your experience and guidance in the last stages. I really don't know how I can thank you enough.

I would particularly like to thank my highly creative family. Jeff, my husband for his support and encouragement over the natural ups and downs of completing a thesis. For my daughters Jess and Maddy (and partners) who remind me how important it is to understand the creative mind.

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A

ARCC At risk creative control

ATTA Abbreviated Torrance Test for Adults

B

BWAS Baron Welsh Art Scale

C

CAARMS Comprehensive Assessment of At-risk Mental State

CANTAB Cambridge Neuropsychological Test Automated Battery

CAQ Creative Achievement Questionnaire

CC Creative control

D

DASS Depression, Anxiety and Stress scale

DIP Diagnostic Interview for Psychiatry

E

EP Early psychosis population

F

FEP First episode psychosis

I

IED Intra-extra dimensional shift

M

MINI Plus Mini international neuropsychiatric interview

N

NEO- FFI-R	Five factor personality inventory
NCC	Non creative control
O	
O-LIFE	Oxford-Liverpool Inventory of Feelings and Experiences
OPCRIT	algorithm (an electronic system used for psychiatric diagnosis)
P	
PANSS	Positive and Negative Syndrome Scale for Schizophrenia
PSQ	Paranoid and suspiciousness questionnaire
S	
SWM	Spatial Working Memory
T	
TEMPS A	Temperament Evaluation of the Memphis, Pisa, Paris, and San Diego Autoquestionnaire
TDF	Test of Divergent Feeling
U	
UHR	Ultra high risk
V	
VVIQ	Vividness of Mental imagery Questionnaire
W	
WASI	Wechsler Abbreviated Scale of Intelligence

ix) Abstract

In a recent large case-control study, MacCabe and colleagues (2018) identified students studying creative subjects, as having significantly higher odds of developing schizophrenia and bipolar disorder than non-creative students. They assert that, it is this creativity that predates the onset of psychosis and advocate for further research. Given the aforementioned emerging research, the question of what enables an imaginative, sensitive, creative individual to continue on a productive path rather than a trajectory of delusions and psychosis is of increasing importance. Research into what distinguishes the clinical from creative and non-creative populations will be presented in this thesis. Research from a diverse sample of participants, including individuals with an experience of early psychosis (EP), creative professionals with subclinical psychotic symptoms (at-risk creative control ARCC), creative professionals with no psychotic symptoms (creative controls CC) and a non-creative control (NCC) population were examined. In three studies, measures of creativity, personality, schizotypy, cognition, anxiety and stressful life events were undertaken to determine what factors may differentiate the early psychosis (EP) from the creative population. On measures of creativity, personality, anxiety and schizotypy, the creative control (CC, ARCC) and early psychosis (EP) groups recorded significantly higher scores than those of the NCC group. In particular, the EP and ARCC groups were more closely aligned than expected. In terms of cognitive assessment the only difference recorded

between the ARCC and EP cohorts was significantly higher results on spatial working memory (SWM) (but not IQ, executive function or negative priming) recorded by the ARCC. A further differentiating factor was the EP's incidence of early childhood trauma and measures of perceived hardship compared to ARCC, CC and NCC. These results provide further evidence for the close association between creative professionals and those with psychosis.

Furthermore it illustrates the need for careful mental health assessment and targeted psychological intervention for creative populations. A *prodrome model of vulnerability* is proposed to illustrate the differences between the two (ARCC and EP) populations. This model is suggested to form the basis for further longitudinal research and future assessment models. This research refines our understanding of the vulnerabilities and protective factors that differentiate early psychosis and creative individuals. Moreover it introduces innovative therapeutic approaches for intervention within clinical populations.

Introduction

Humankind has been curious about the association between creativity and psychopathology since the time of Aristotle (Rybakowski, Klonowska, Parrzala, & Jaracz, 2008). This curiosity was given a 'call to arms' in 1967, when Guilford, a respected theorist and researcher of creativity (Guilford, 1967), used his presidential address to the American Psychological Association to highlight both the importance of research into creativity along with the paucity of studies. However, despite almost fifty years of formalised research into creativity and this association, we are still searching to understand these mechanisms.

Within Australia, a recent extensive survey into the health and wellbeing of 2407 creative professionals highlighted a population where 40.8% of performers have been diagnosed with one or more mental illnesses, where rates of depression and anxiety were five times the national average and suicide attempts more than double that of the general population (Van den Eynde, Fisher, & Sonn, 2015a). Moreover less than 20% of participants who accessed psychological services in the survey found these services significantly helpful for their mental health. This survey points to the need for targeted and tailored clinical interventions with this vulnerable population (Van den Eynde, Fisher, & Sonn, 2016).

Alongside this research into creative populations, Patrick McGorry and colleagues have highlighted the social and economic burden of those with

affective and psychotic disorders (McGorry, Purcell, Hickie, & Jorm, 2009).

According to the recent Mental Health Services 2018 report 64,000 people (18-64 years) within Australia experience psychotic disorders (Markus, 2018). When schizophrenia, bipolar I disorder, and schizoaffective disorder are combined it results in an enormous economic burden due to the loss of productivity, in addition to the direct costs of health care and individual suffering (Morgan & Jablensky, 2010). The recent Australian National Survey of High Impact Psychosis highlighted that the most important factors affecting people with psychotic disorders include financial difficulties (affecting approximately 43%), loneliness (37%), and lack of employment (35%) (Morgan & Jablensky, 2010). Targeted, early intervention is currently regarded as the most promising strategy to attenuate, delay or even avert psychosis, and has recently received federal funding initiatives to improve youth mental health services throughout the nation (McGorry, Purcell, et al., 2009).

In this context, there has been recent support for the utility of individualised vocational rehabilitation in young individuals experiencing a first-episode of psychosis (FEP). There is a need to augment these attempts with parallel efforts to improve cognitive capacities and strengths that may assist these individuals in gaining meaningful and secure long-term employment (Killackey, 2010). One of these strengths is the creative capacity inherent in psychosis-proneness (Carson, Peterson, & Higgins, 2003; Schuldberg, 2001), as supported in several lines of accumulating evidence (Nettle, 2006; Srivastava et al., 2010). Targeted enhancement of the creative capacity of young individuals at-risk of developing

psychotic disorders may provide one means of improving perceived self-efficacy and vocational outcomes.

It is for these reasons that research is needed into identifying and defining not just the similarities but also the cognitive and personality differences between creative and psychosis populations. This understanding is urgently required to develop innovative, targeted resilience, remediation and vocational programmes for these populations. However, empirical investigations of creativity and psychosis have been plagued by methodological inconsistencies in the definition of creativity and psychotic disorder. These methodological problems have created confusion and possibly hampered the clinical application of the research to date (Richards, 2001; Rybakowski et al., 2008). This research has been designed in an attempt to address these methodological issues, which relate to both how a creative and psychosis population are defined and what distinguishes these populations. In clarifying these issues, it is anticipated that it may pave the way for the development of evidence based remediation and resilience programmes for these vulnerable populations.

1.1 History of research into creativity and psychopathology

Early research into creativity and psychopathology took the form of investigating the creative person by studying renowned creative individuals. In an analysis of the biographies of 291 eminent scientists, artists and politicians,

Post (1994) found 72% of writers experienced depression whereas 28% and 29% of artists suffered from alcoholism. Andreasen (1987) in her seminal work in which she observed writers over a fifteen year period reported how 80% of them were found to meet the diagnostic criteria for affective disorders with 43% diagnosed with manic-depressive disorder (now referred to as bipolar disorder). Schildkraut, Hirschfeld and Murphy (1994) analyzed the psychopathology of fifteen expressionist painters from the New York School of Modern Art. They found a similar profile to the Andreasen and Post studies, with the artists within this small group experiencing significant mental illness such as affective disorder, suicidal features, alcoholism and early death (Schildkraut et al., 1994). Alongside this research, an influential book entitled, "Touched with Fire" by Kay Jamison (1994) argued for the strong association between the artistic temperament and manic-depressive illness. Within this school of thought Andreason (1987) and Jamison (2011) were the strongest proponents of this association. However, parallel to these studies a second school of thought emerged, which proposed that creativity is associated with schizotypy and schizophrenia. In particular two early, adopted offspring studies supported this association. The first by Heston (1966) found the adopted offspring of mothers with a diagnosis of schizophrenia who were raised in families without psychopathology, had an increased rate of creative expression, compared to adoptive children of mothers without psychopathology. Similarly McNeil (1971) examined the mental health of adopted offspring who pursued creative occupations and found 30% of the highly creative probands were noted to have some type of mental illness, often given the broad diagnosis of

“constitutional psychopathology”. Respected researchers in the field such as Sass (2001) and Richards (2001) argued that creativity is more closely associated with schizophrenia spectrum disorder and psychotic-like thought disorder.

This early research was directed at identifying those in creative occupations within small adoptive offspring studies or an examination of prominent creative individuals who were largely writers or artists. These studies of eminent creative individuals used small samples that were non-randomized with no attempt to control for bias and case study research methods. Certainly these early studies highlight some of the abovementioned methodological issues that confront research into creativity and psychopathology. Namely, how creativity is defined.

1.2 What is Creativity: Defining creativity and determining how creativity is measured

In a meta-analysis, that examined the variables associated with creativity, (Ma, 2009), the author analysed creativity according to *person* (personality and demographical characteristics, intelligence, cognitive ability and background experiences); *creative product* (ideas, solutions, performances or products generated by the creative process) and *creative processes* which focus on the problem -solving component of creative thinking. The author identified the following factors as critical to creativity: openness to new experiences and ideas along with a unique perceptual and problem solving ability to generate new

solutions in an environment that encourages these attributes. Her results lend support for the following definition of creativity: “The ability to reorganise the available knowledge, information, cues, facts and/or skills in a person’s reservoir to generate new ideas or useful solutions.” This definition was later refined (Runco & Jaeger, 2012) to include the qualifying statement that implicates that creativity must also have effectiveness and value. Therefore creativity is commonly defined as “the ability to create new ideas that are effective and have value in society” (Runco & Jaeger, 2012) and this definition has been adopted for the purposes of this research.

In the aforementioned meta-analysis, the effect size of thirty-six psychopathological traits was also calculated. Psychopathology was strongly associated with higher creative thinking (effect size of 0.5). Those with high creativity also demonstrated unique cognitive and temperament features such as superior problem solving ability in finding problems (0.93), retrieving knowledge (0.86) and openness to experience (0.71), affective sensibility (0.65) and creative personality (0.61). For these reasons, aspects of cognition, affect and personality are the focus of the present study.

Whose creativity is measured?

In the meta-analysis described above, the author (Ma, 2009) raised concerns about the different methodologies used in creativity research. As outlined earlier, studies of creative individuals can include an examination of eminent creative individuals present or can be studied posthumously; those engaged in

formal creative engagement, training and study, alongside populations of generic students who have been given a standard creativity measure. Kaufman and Beghetto (2009) outlined some of these issues and posed the question: *From a positive psychology perspective, is everyone creative and is therefore the identification of the creative participant merely a matter of degree of creativity (i.e. the often studied university student population assessed for creative thinking)?* Alternatively the authors' argued, to research the association between negative health outcomes and creativity, do we need to research a specific vulnerable sub group who is prone to mental health issues?

In response to these questions, Kaufmann and Beghetti (2009) proposed a classification system for describing the nature of creativity that addresses these questions. Based on this four-part classification system (described below), it identifies the individual is identified as exhibiting mini c creativity, everyday creativity; professional level (Pro C creativity) and big C creativity. They argue that by identifying a classification of creativity, it follows that the method of measuring creativity can be readily determined. The authors provide examples of different assessment approaches based on the particular designation under investigation i.e. self assessments are appropriate for everyday creativity whereas metrics associated with independently awarded prizes and honours (creative achievement) are needed for assessing *Pro C (professional creativity)* and *Big C (eminent creativity)*.

The four-part classification of creativity is outlined below:

Big C creativity: which consists of an eminent creative contribution;

Pro C creativity: professional level creative individuals who have not reached eminent status;

Mini C creativity: creativity inherent in the learning process and includes novel and personally meaningful interpretation of experiences, actions, and events;

Everyday creativity: in which creativity and innovation are demonstrated in everyday activities such as novel approaches to recipes.

This framework delineates eminent creative artists from professional creative individuals and those who engage with everyday creativity. Professional creative individuals are those with implied creative talent who, have trained in some form of creative expression (either formally or informally) and who earn a living from creative pursuits. This is distinct from those who have no implied creative talent but engage in novel and innovative expressions of everyday creativity. It may be hypothesised that the often-researched university student with little, formal, creative talent or training may generally fall into the Mini C and Everyday creativity delineation (Kaufman & Beghetto, 2009). The authors proposed the above framework, to further study creativity and its association with mental illness. As these authors noted, research has not supported a connection between Mini c and Everyday creativity and mental illness (Kaufman & Beghetto, 2009) although there is substantial evidence for a connection between eminent creativity and mental illness (Andreasen, 1987). Kaufmann

and Beghetto (2009) also highlighted the absence of research into creative professional populations.

Studies that define creativity according to Mini c and Everyday creativity (using for example a general university student sample) may not sufficiently discriminate the relationship between creativity and mental illness. After the development of this framework, two studies examined and highlighted the relationship between professional creative artists and mental illness (MacCabe et al., 2018; Van den Eynde et al., 2015a). Furthermore these studies advocated for further targeted research with these populations. It was for these reasons that it was decided to limit the study of creative individuals to those defined as professional level creative individuals (Pro C). Given that the research question investigates creativity and psychosis vulnerability, the classification system described above was useful in identifying the type of creative individual (pro c designation of creative individual) who would be best examined within the framework of this hypothesis. Moreover in deciding to examine the Pro C creative individual and based on the ideas outlined in this classification system, an assessment of professional level creativity (ProC) would need to include a measure of creative achievement.

In considering how to define creative achievement and professional creativity, it is noteworthy that many successful creative individuals have no formal training and may only reach prominence after their death. The Outsider Art Movement is indicative of this as it is made up of naïve or self-taught artists who have little

or no contact with art institutions and main stream art (Cardinal, 2019). While an examination of these self-taught artists is worthwhile, it was not the focus of this current research.

1.3 Defining psychotic and mood disorder and research on shared genetic markers

Alongside this confusion into how creativity is defined, research into creativity and psychosis and mood disorder has been beset with how psychopathology is defined and measured (Claridge, 1993). Bipolar and schizophrenia spectrum disorders also known as psychosis spectrum disorders have included investigation into schizotypy, schizophrenia, schizoaffective and bipolar 1 disorder populations. Moreover emerging research has examined shared psychosis phenotypes¹ between schizophrenia and bipolar 1 disorder, rather than the distinct disorders. To examine this literature these delineations will be considered separately.

Schizotypy

Schizotypy refers to a collection of traits associated with schizophrenia, but in attenuated form. It is generally defined as a cluster of schizophrenia-like beliefs and perceptions, present to a limited degree in the general population and particularly associated with first-degree relatives of those with psychosis

¹ Phenotypes are the observable physical or biochemical characteristics of an organism, as determined by both genetic makeup and environmental influences. It is the expression of a specific trait, such as stature or blood type, based on genetic and environmental influences.

(Cochrane, Petch, & Pickering, 2012; Debbane & Barrantes-Vidal, 2015).

According to DSM-5 (American Psychiatric Association, 2013) schizotypy is characterised by cognitive disorganisation and distortions of perception, behavioural eccentricities and a reduced ability to engage with close relationships. It is considered a vulnerability factor for schizophrenia (Debbane & Barrantes-Vidal, 2015; Folley & Park, 2005).

Several studies have suggested an association between schizotypy and heightened creativity in areas of genetics, brain structure and cognition (Folley & Park, 2005; Sass & Schuldborg, 2001; Wang et al., 2017). Typical studies into creativity and schizotypal populations have used a non-clinical population such as a university or artist population who are tested for schizotypy using a measure such as the Oxford-Liverpool Inventory of Feeling and Experiences (O-Life) (Claridge & Blakey, 2009; Nettle, 2006). This measure has been designed to examine features of schizotypy within a predominantly non-clinical population (Mason, Claridge, & Jackson, 1995). These studies define positive schizotypy (within a non-clinical population) as more commonly associated with creative populations (Batey & Furnham, 2008; Nelson & Rawlings, 2010).

Within a clinically diagnosed schizotypal population, a recent meta-analysis into the neuropsychological correlates of schizotypy, found that positive schizotypal traits are correlated with different cognitive and psychosocial features compared to negative schizotypal features (Siddi, Petretto, & Preti, 2017).

Despite these distinctions, working memory deficits (both verbal and

visuospatial working memory) characterised both positive and negative schizotypy, compared to the control population (Siddi et al., 2017). Research evidence is equivocal whether these cognitive deficits found in clinical schizotypal samples may have implications for similar working memory deficits in creative populations who report elevated symptoms of positive schizotypy.

As implicated in the above discussion, much of the research in schizotypy and creativity raises questions rather than answers. Specifically those questions relate to whether schizotypy is measured within a normal population who present with schizotypal features or a population with a stable personality disorder who present with clear psychosocial and cognitive deficits. With respect to the association between creativity and schizotypy, many researchers in the field who have used a normal population tested for schizotypy (Claridge & Blakey, 2009; Ottemiller, Elliott, & Tania, 2014) in their findings extrapolate non-clinical data and propose similar presentations within psychosis populations (Claridge & Blakey, 2009; Ottemiller et al., 2014). This has led to some conflicting opinions about the association between schizophrenia and creativity (Richards, 2001). One recent study has attempted to address these issues and found creativity differed significantly in schizophrenia populations when compared to schizotypal and healthy controls (Wang et al., 2017). This study raises serious questions about the existing literature linking schizotypal and creativity associations, which can be extrapolated to those with schizophrenia.

Schizophrenia

Schizophrenia is included as one of the disorders defined as schizophrenia spectrum and other psychotic disorders within DSM 5 (American Psychiatric Association, 2013). It is a complex and frequently researched disorder defined by abnormalities in one or more of the following domains: delusions, hallucinations, disorganised thinking (speech) and grossly disorganised and negative symptoms. The lifetime prevalence of schizophrenia is 0.3%- 0.7% and there is a higher incidence of schizophrenia found in males who report more negative symptoms and longer duration of the illness (American Psychiatric Association, 2013). Schizophrenia in the literature it is often divided into three symptom subtypes: positive, negative, and mixed schizophrenia. Positive symptoms of schizophrenia are characterised by prominent delusions, hallucinations, positive formal thought disorder, and persistently bizarre behaviour (Andreasen, 2007). Whereas, negative symptoms of schizophrenia are identified by affective flattening, alogia, avolition, anhedonia, and attentional impairment (Andreasen, 1984) and mixed is a combination of the two symptom groups.

Challenges exist when evaluating the literature on cognition and personality in the schizophrenia population as sample characteristics need to account for age at onset; stage of the disorder; the method to determine the diagnosis, inpatient vs. outpatient, medication vs. no medication, age and gender. These issues have been raised by those conducting meta-analyses in the area (Bora et al., 2014; Bora, Yucel, & Pantelis, 2009; Hill, Harris, Herbener, Pavuluri, &

Sweeney, 2008) and in order to address these issues, specific exclusion criteria were used in these studies i.e. excluding studies with significant male bias (Hill et al., 2008). As the onset of the illness usually occurs between 18 and 25 years (Kessler et al., 2007), cognition, personality and global functioning deteriorate as patients' age and with chronic schizophrenia, therefore comparing a chronic, ageing patient with a first episode participant may give conflated results (Fucetola et al., 2000). It is for these reasons that age, onset of psychosis, stage of condition and medication were all controlled in the current study.

Particularly as vocational remediation in this population was one of the proposed clinical implications of the research, therefore young people with an experience of early psychosis, accessing an outpatient program and taking medication defined our sample characteristics. This will be discussed further in chapter three.

Bipolar 1 Disorder

According to DSM 5 (American Psychiatric Association, 2013), the concept of bipolar disorder involves the current or past occurrence of at least one episode of mania or hypomania or a mixed episode, which is usually, but not necessarily, preceded or followed by a depressive episode, cyclic changes between mood states, and eventually psychotic symptoms, which are assumed to be a marker of the severity of the episode. The twelve month prevalence of bipolar 1 disorder ranges from 0.0%-0.6% and the male to female ratio is 1.1:1 (American Psychiatric Association, 2013). Only bipolar 1 disorder (rather than bipolar 2) only was investigated in the present study as the association between

with creativity has only been examined in the bipolar 1 disorder cohort and implicates reported associated psychosis symptoms. Any reference to bipolar disorder in the thesis is therefore specific to bipolar 1.

As specified in the literature, clinical features such as mood state at the time of testing are important to control for in sample selection as the clinical phase at the time of testing affects cognition and mood (Bora, Yücel, & Pantelis, 2010; Soeiro-de-Souza, Dias, Bio, Post, & Moreno, 2011). Therefore, it was decided to include a psychiatric measure of positive and negative symptoms to assess for current mood state (Montoya et al., 2011). As discussed in more detail in chapter three, active psychosis and current mania were exclusion criteria (Montoya et al., 2011).

Shared phenotypes

An emerging area of research into the study of psychosis has been the investigation of the shared or allied phenotypes that may contribute to both schizophrenia and bipolar 1 disorder. Phenotypes are observable biochemical or physical characteristics based on both genetic and environmental influences. While both bipolar disorder and schizophrenia are complex disorders, increasing evidence points to their shared genetic risk at several points along the loci ² (Hill et al., 2008; Purcell et al., 2009; Schizophrenia Working Group of the Psychiatric Genomics Consortium, 2014). Conceivably as a result of these shared genetic loci, there are also common patterns of neurobiological and

² A loci is a specific, fixed position on a chromosome where a particular gene or genetic marker is located

cognitive deficits in both groups. In a meta-analysis (Hill et al., 2008) shared deficits in attention regulation, episodic and working memory along with emotion processing were identified as common allied phenotypes for schizophrenia and bipolar disorder. In the context of this discourse, the first paper included in this thesis: “Creative cognition and psychosis vulnerability: what’s the difference”(Crabtree & Green, 2016), introduced the term, psychosis spectrum disorder. This was a term adopted in response to the considerable neuroscience research published over the last decade, which provides support for the fluidity of the boundaries between schizophrenia, schizoaffective disorder and bipolar disorder. As the psychotic disorders working group for DSM 5 noted, the existing criteria for mood and psychotic disorders does not fully capture the variability of symptoms profile, response to treatment and outcome (Parker, 2014). Although there was pressure to move to a dimensional approach to psychotic and mood disorder, DSM 5 retained the traditional diagnostic nomenclature. Therefore although the term psychosis spectrum disorder was adopted in the first paper, in response to traditional diagnostic delineations being retained by DSM 5, this thesis will not continue to use this descriptor beyond the first paper (chapter two).

Shared phenotypes and creativity

Concurrently, there has been some exploration of these shared genetic links and an association with creativity. In a comprehensive review of creativity and psychopathology (Rybakowski et al., 2008), the authors report that both

hypomania and psychotic thought disorder have been associated with creativity. Furthermore the authors argue that there have been studies into molecular-genetic research, particularly with regard to the genetic basis of the dopaminergic system that underpins both the creative process and clinical features of bipolar disorder and schizophrenia (Rybakowski et al., 2008). These findings indicate that both disorders share some genetic risk and a similar pattern of neurobiological and cognitive deficits (Soeiro-de-Souza et al., 2011; Son et al., 2015). Similar cognitive deficits have also found to be present in creative populations (Carson, 2011; Schmajuk, Aziz, & Bates, 2009). Although there is some evidence for shared genetic links (Lichtenstein et al., 2009), there appear to be differences between bipolar and schizophrenia cohorts in how their creative potential is transformed into creative achievement. A large consortium based in Sweden has published a nested case-control study analysing 1,742,684 Swedish records over thirty years. This study found that those with bipolar disorder (OR=1.35, 95% CI 1.22–1.48) and the family members of those with schizophrenia (OR_{Parents} = 1.55, 95% CI 1.43–1.67; OR_{Siblings} = 1.36, 95% CI 1.26–1.48) were over-represented in artistic and visually artistic occupations. When only artistic occupations were examined, those with schizophrenia were found to have significantly higher odds of being engaged in a visually artistic occupation (OR=1, 95% CI 1.13–1.49), than that of the control group (Kyaga et al., 2011). These epidemiological analyses have been published alongside a recent investigation, which provide support for the assertion that polygenetic risk for schizophrenia and bipolar disorder predicts

creativity (Power et al., 2015). These studies will be discussed in more detail later in the thesis their results will not be elaborated here.

In summary

Research evidence supports an association between creativity and psychopathology: namely schizophrenia, bipolar disorder and schizotypy. Despite methodological problems in researching these populations, prominent researchers in the field have moved beyond conjecture to recognising clear associations. Specifically it has been asserted that there are apparent associations in both mood and personality between creativity and bipolar disorder. Furthermore there are similarities in thought disorder between the creative and those with schizophrenia. There is emerging evidence that this may be due to common polygenic risk. Methodological issues specific to how these populations are identified continue to dominate the field of research.

The following section will discuss the research aims and how these aims will be addressed in the following chapters.

1.4 Aims

The research outlined in this thesis aims to investigate professional creative individuals (CC) and those with early psychosis (EP) with the intention of more closely determining similarities and distinctions between these populations, compared to non-creative controls (NCC). This study aims to improve the quality of evidence for this association, and will investigate the similarities and differences in personality, cognitive features, anxiety, paranoid tendencies and exposure to stressful life events within professional creative (CC) and early psychosis individuals (EP) , compared to non-creative controls (NCC).

Within an early psychosis population

The idea that creativity and those with early psychosis share common cognitive and personality features is not new, but interestingly the same features are viewed positively in accounting for creative thinking and are simultaneously being viewed as ‘deficits’ within the context of the clinical literature i.e. divergent thinking, low latent inhibition. Within an early psychosis population, the specific aim of this research is to delineate features of early psychotic illness that may be worth targeting to enhance the creative potential in young individuals with an emerging disorder, to ultimately improve the prospects of vocational and functional outcomes in this population.

Within a professional creative population

The professional creative population is anecdotally viewed as a more vulnerable occupational group, yet there has been little attempt by practitioners to provide targeted resilience training or intervention for individuals engaged in the performance and creative industries. By distinguishing shared cognition, anxiety, exposure to trauma and personality vulnerabilities the present study aims to identify factors for amelioration. From the findings of the research, the thesis provides an evidence-based framework for developing specific clinical intervention programmes for this creative occupational group.

In summary therefore, the research question under examination is:

What differentiates creativity and psychosis vulnerability?

In a comparison between an early psychosis, professional creative and non-creative cohort, what aspects of personality, cognition, anxiety and adverse life events differentiate the early psychosis, professional creative and non-creative cohort.

It is hypothesised that the early psychosis and professional creative cohort will record significant differences, compared to the non-creative cohort on openness, unusual experiences, impulsive non-conformity, anxiety, overall suspiciousness/paranoia and overall incidence of adverse life events.

It is hypothesised that the early psychosis cohort will record significant differences compared to the professional creative and non-creative population

on intensity of neuroticism, spatial working memory, aspects of paranoia and incidence of childhood trauma associated with adverse life events.

The following section represents an overview of how these aims will be achieved throughout each chapter of the thesis.

1.5 Overview of thesis

Chapter Two

The following chapter, chapter two, presents a review of the literature regarding the similarities and differences between creative and bipolar/schizophrenia populations. It will examine aspects of personality and cognition that may differentiate the creative and clinical populations and will propose a *spectrum model of shared vulnerability* to provide a theoretical model from which to examine similarities and differences between the populations. Following the publication of the paper, “*Creative cognition and psychosis vulnerability: what’s the difference*” in 2016 (Crabtree & Green, 2016), a number of significant studies were published. Chapter two therefore concludes with an addendum which forms a summary of relevant research published post 2016 and invites a revised direction of research focus compared to the research direction introduced in the publication.

In summary, following the publication of “*Creative cognition and psychosis vulnerability: what’s the difference*” (Crabtree & Green, 2016) the focus of the research has been revised to examine an early psychosis population rather than a distinct bipolar and schizophrenia population. The rationale for this redirection is based on emerging evidence that found psychosis polygenic risk was the common variant associated with professional creativity (Power et al., 2015). Therefore it was decided to examine the presence of psychosis in a population at the early stage of disease presentation.

The addendum to chapter two elaborates on this evidence and includes additional relevant literature not addressed in the paper, *“Creative cognition and psychosis vulnerability: what’s the difference”* (Crabtree & Green, 2016), due to publication limitations. It also includes more recent research published after to this paper, which are relevant to the discourse associated with the risk of psychosis and the transition to psychosis. These factors have also emerged as key issues within professional creative populations. It is for these reasons that the literature associated with anxiety, paranoia and stressful life events within psychosis and artistic populations is introduced at the conclusion of the chapter two - addendum.

Chapter Three

Chapter three presents an overview of the methodology. As a section on methodology is included in each published research paper (chapters four, five, six), the methodology discussed in chapter three forms a more detailed rationale for the methodological approach. This chapter will also introduce the ‘at risk’ creative cohort, identified from a subgroup of creative participants with subclinical levels of hypomania and psychotic thinking (as measured by the MINI neurocognitive measure of psychiatry). The ‘at risk’ group were included in studies examined in chapter five and six. Additionally and specifically to address these methodological criticisms, the chapter will examine how creativity was measured in the study and include examples of creative cognition from each of the cohorts. Furthermore the journals selected

to submit each of the three research papers had word count limitations that precluded a thorough examination of measures. Therefore methodology chapter three includes a detailed examination of the validity and reliability of the measures used in the study.

Chapter Four

Chapter four presents the first examination into personality factors that may differentiate an early psychosis and professional creative population. On measures of personality, schizotypy and paranoia, professional creative and early psychosis participants were significantly similar compared to non – creative participants. The early psychosis cohorts only differed from the creative controls on significantly elevated neuroticism and aspects of paranoia.

Chapter Five

Chapter five reports on an examination of cognitive factors, namely IQ, executive function, pre-attentive filtering and spatial working memory. Vividness of mental imagery was also included as a possible differentiating factor. The only difference between the early psychosis and ‘at risk’ creative controls was on aspects of spatial working memory. In all other areas of cognition, the early psychosis cohort recorded no differentiation from the three control groups.

Chapter Six

The prelude to chapter six introduces a revised model of shared vulnerability, based on the two former studies. The chapter also examines three factors associated with transition to psychosis that may differentiate the early psychosis and professional creative groups. Paranoia is a factor associated with the transition to psychosis and is associated with both anxiety and stressful life events. As it had not been examined in the four-group cohort, it was included in this study, alongside an investigation of anxiety and stressful life events. The 'at risk' group recorded similarly high levels of anxiety and overall stressful events in comparison to the early psychosis cohort. Of these three factors, only aspects of paranoia 'perceived hardship' and elevated early childhood sexual and physical trauma distinguished the early psychosis from the 'at risk' cohort.

Chapter Seven

Chapter seven examines the combined findings from the three studies. It delineates the similarities and differences between the 'at risk' creative cohort and the early psychosis group and proposes a *prodrome model of shared vulnerability*. Based on this model this chapter discusses a number of clinical implications of the research for an early psychosis and vulnerable creative population. With respect to the early psychosis cohort, the commentary will propose avenues for harnessing the implied creative potential of the early psychosis group in order to improve vocational and psychosocial outcomes. Similarly for the 'at risk' creative group, a clinical pilot programme is proposed to address personality and affect vulnerabilities identified through the

research. Alongside this discourse, the chapter outlines how this thesis has made a unique contribution to the examination of the creativity/psychopathology association. It concludes with an examination of the limitations of the research and future directions for this field of study.

Prelude to Chapter two and addendum

The following paper is a review of the literature into the association between creativity and bipolar disorder/schizophrenia up until the time of publication. Rather than a systematic review, this paper sought to propose a model of shared vulnerability which identifies not only shared vulnerability factors between the highly creative and those with bipolar/schizophrenia; it also sought to propose factors that may protect the highly creative from these disorders.

Specifically the paper sought to examine to what extent the creative population demonstrates some but not all symptoms associated with these disorders, and investigate cognitive or other protective traits that may safeguard this population from further deterioration. It is proposed that clinical monitoring of this population may also mitigate the development of further psychopathology.

The chapter concludes with an addendum, which examines recent, relevant research not included in the publication of the theoretical review to the present. It also provides underpinning evidence and a discussion of the rationale for the redirection of research focus.

Chapter Two

Creative cognition and psychosis vulnerability: what's the difference?

Authors: Julie Crabtree

Melissa Green

Journal: Creativity Research Journal

Published: May 2016

This manuscript is exactly as it appears in the following published article:

Crabtree, J., & Green, M. J. (2016). Creative cognition and psychosis vulnerability: what's the difference? *Creativity Research Journal*, 28(1), 24-32.

Authorship Declaration

The author, Melissa Green, has made a significant intellectual and scholarly contribution through her role as primary supervisor at the time of publication.

This can be determined as

1. assisting with conception and design;
2. contribution of knowledge; and
3. drafting parts of the research output and revising it critically so as to contribute to the interpretation.

According to this definition, the authors of the review paper titled:

Creative Cognition and Psychosis vulnerability: what's the difference?

Authors: Julie Crabtree, Melissa Green

submitted to... Creativity Research Journal, published June 2016.

Name: Melissa Green



Signed:

2.0 Abstract

Evidence from experimental psychology provides unequivocal support for enhanced creativity among individuals who are prone to psychotic and mood disorders. At the same time, there is strong epidemiological evidence for greater incidence of creative achievement among those diagnosed with bipolar disorder (but not schizophrenia). This review examines the evidence for common factors predisposing an individual to creativity and psychosis, as well as factors that distinguish the capacity for creative achievement from the creative potential that may be inherent in psychosis vulnerability. Factors implicated as common to creative potential and psychosis vulnerability include enhanced divergent thinking, reduced latent inhibition and pre-attentive filtering mechanisms; on the other hand, greater cognitive flexibility, motivation, and openness to experience tend to be associated with creative achievement, but not psychosis. This evidence is considered with respect to the utility of tailored vocational interventions to effectively harness creative potential, which may be useful for young individuals in the early stages of illness or their unaffected family members.

2.1 Introduction

Creativity has traditionally been defined as the ability to generate new and original ideas that have value or effectiveness in a particular context (Barron, 1955; Runco & Jaeger, 2012; Stein, 1953; Torrance, 1993). The creative process thus implicates unique cognitive abilities that enable innovation and problem solving, for which accurate measurement has remained elusive in terms of fully encapsulating 'creativity'. At the same time, creative processes have become recognised as important for societal and organisational value (Basadur & Basadur, 2011); adaptive creative qualities are necessary for the development human mental capital, now understood as one of the most important economic resources of our time (Beddington et al., 2008; Centre for International Economics, 2009).

Perhaps ironically in this context, creative processes have traditionally been associated with "madness". Recent epidemiological evidence of greater creative potential (higher prevalence of creative occupations) in individuals with bipolar disorder, and the *psychologically well offspring* of patients with schizophrenia or bipolar disorder (Kyaga et al., 2011) follows several decades of research in experimental psychology that has provided incontrovertible evidence for common cognitive processes among creative capacity and psychosis vulnerability (Claridge & Blakey, 2009; Eysenck, 1994; Jamison, 2011; Rybakowski et al., 2008). Yet, there has been little empirical investigation of the adaptive utility of the predisposition to creative thinking for the early

treatment of young individuals who are vulnerable to developing psychotic and mood disorders, and who may be displaying signs of emergent cognitive and temperamental features of illness. This may reflect insufficient study of *differential features* of cognition or temperament that may separate the capacity for creative *achievement* from the propensity for creative *thinking* (while the latter is strongly associated with vulnerability to psychosis, the former appears to be limited to those without severe expression of psychosis). It is therefore possible that neurocognitive and/or motivational factors associated with chronic forms of psychotic disorder impede the potential for creative achievement, despite shared information processing styles among psychosis-prone and psychotic individuals that facilitate creative thinking. These ideas are explicated with reference to the available literature in this review.

The particular cognitive style associated with creativity has been described as over-inclusive and characterised by obscure, remote, or 'divergent' associations (Carson et al., 2003; Eysenck, 1993a, 1993b; Mednick, 1962), and more recently has implicated cognitive flexibility among other domains of cognition traditionally associated with intellectual ability (Carson et al., 2003; Travis, Harung, & Lagrosen, 2011). The majority of research on the similarities between creative cognition and psychosis vulnerability has thus focused on the common feature of 'defective' filtering (inhibitory) processes (Beech, Baylis, Smithson, & Claridge, 1989) within the a limited capacity information processing system. The defective filtering process ironically affords an

increased flow of information into preconscious awareness (such that otherwise unlikely associations between elements may be made, in line with enhanced performance on creative tasks; (Peters, Pickering, & Hemsley, 1994). This model is supported by evidence from two parallel streams of experimental psychology which show that faulty filtering mechanisms are associated with both the predisposition to psychosis and with enhanced divergent thinking (Claridge & Blakey, 2009; Ottemiller et al., 2014) and that the most commonly employed definition of creative cognition (“divergent thinking”) is enhanced in psychosis-prone individuals (Dykes & McGhie, 1976).

However, an important question remains as to whether the ‘adaptive’ cognitive features of psychosis vulnerability offer creative advantage only in the context of other specific cognitive or personality features (which, incidentally, may be found to play a preventative role in relation to psychosis transition). This proposal suggests that fulfilment of creative potential may be dependent on specific cognitive features that are not necessarily related to psychosis-proneness. Alternatively, the *absence* of particular cognitive impairments that are usually associated with illness (and are therefore not present in *unaffected biological relatives* of patients) may be important for creative potential to be expressed in creative achievement. The aim of this review was thus to review available evidence in relation to distinguishing those ‘adaptive’ cognitive features associated with creativity that may simultaneously represent vulnerability to psychotic-spectrum conditions (i.e., bipolar disorder, schizoaffective disorder, schizophrenia) and creative

information processing, from those cognitive features which are required to achieve creative outputs (i.e., creative productivity).

2.2 Creativity as an adaptive endophenotype for schizophrenia and bipolar disorder?

In recent years it has been acknowledged that schizophrenia and bipolar disorder share some genetic vulnerability (Lichtenstein et al., 2009; Purcell et al., 2009) and demonstrate stable deficits in common cognitive domains (including verbal ability, memory, motor performance, attention, and executive function) (Bora et al., 2010; Frommann et al., 2011). Notably, these are *not* the cognitive domains usually associated with the creative processes, but it is of interest that *impairment* in cognitive capacities that are associated with increased creativity have been noted in both disorders. Creative cognition might thus plausibly represent an *adaptive* endophenotype for psychotic and mood disorders, consistent with previous proposals (Claridge, 1997; Kinney et al., 2001), which may be influenced by independent mediating factors (potentially associated with familial liability to psychosis) to contribute to creativity and pathology (Richards, 2001).

The association between creativity and psychosis-vulnerability has been unequivocally demonstrated in recent epidemiological evidence from a large Swedish study of the professional occupations of family members of

individuals with schizophrenia, bipolar disorder or unipolar depression (who received inpatient care between 1973 and 2003); this study showed significant over-representation of creative professions among individuals with bipolar disorder, as well as the unaffected siblings of people with *either* schizophrenia or bipolar disorder, relative to healthy controls (Kyaga et al., 2011).

Interestingly, individuals with a diagnosis of schizophrenia did not have an increased rate of overall creative professions, suggesting that severe psychotic illness impedes creative expression (notably, this could have been confounded by other illness factors contributing to the ability to maintain employment); in addition, there was no evidence of greater rates of creative professions among individuals with unipolar depression or their unaffected relatives. These recent findings may be seen to concur with previous studies suggesting that severe psychosis may impede creative achievement. In this vein, it is interesting to note that the *adoptees* of biological parents diagnosed with schizophrenia have demonstrated higher levels of vocational and non-vocational creativity in association with higher schizotypal personality features, compared to healthy control participants (Kinney et al., 2001); here, the schizophrenia probands showed greater social anxiety and non-vocational creativity (for example, realising their creativity in non-professional areas). It has therefore possible that more severe social anxiety (and/or introversion) in schizophrenia may limit creative potential, unlike in bipolar disorder who tend to show a greater degree of extraversion (Akiskal et al., 2006; Barnett et al., 2011).

In summary, the familial co-segregation of both schizophrenia and bipolar disorder with creativity suggests that the very vulnerability to these conditions confers a tendency toward creative endeavour that may be inherent in the shared genetic predisposition to these disorders (Lichtenstein et al 2009), but at the same time suggests that the adaptive expression of this potential may be inhibited by other mechanisms of full-blown (schizophrenic) psychosis. Related studies of *'trait-creativity'* and psychosis-proneness (Brod, 1997), or those using actual creative achievement to index creativity in healthy individuals (Andreasen, 1987; Barron, 1993; Richards, 1993) have also provided consistent evidence of a link between artistic talent and vulnerability to (but not the expression of) psychosis.

2.3 Evidence from Experimental Psychology-I: "Divergent thinking" and inhibition

'Divergent thinking' describes a loosening of boundaries between concepts and a consequent widening of the associative horizon to form new and useful associations. The most widely accepted definition of divergent thinking encompasses several forms of creative thought, involving (a) fluency, (b) flexibility, (c) originality, and (d) elaboration (Guilford, 1967; Torrance, 1993). Divergent thinking has been proposed as a necessary but not sufficient causal mechanism for creative achievement (Eysenck, 1993b), and has been the most frequently adopted construct to characterise the defining features of creative potential in the majority of experimental studies to date. This type of research

has provided substantial evidence of increased schizophrenia-proneness (schizotypy) in association with greater divergent thinking capacities (Brod, 1997; Burch, Hemsley, Pavelis, & Corr, 2006; Claridge & Blakey, 2009; Green & Williams, 1999; Ottemiller et al., 2014). Notably, it is the 'unusual perceptual experiences' and 'antisocial/non-conformity' aspects of schizotypy that have been most strongly associated with greater divergent thinking, while the 'cognitive disorganisation' aspects of schizotypy have shown negative associations with divergent thinking (Batey & Furnham, 2008; Claridge & Blakey, 2009).

Reduced pre-attentive filtering

The cognitive processes underlying 'divergent thinking' have been explored in relation to poor attentional filtering mechanisms associated with 'cognitive inhibition', which may form the basis of creative thinking by providing the individual with a larger sample of ideas (Eysenck, 1993a, 1993b). Cognitive inhibition refers to the process of inhibiting irrelevant stimuli that is a concomitant of selective attention (Neill & Westberry, 1987; Tipper, 1985); faulty inhibitory processes may result in an individual being inundated with an increased array of precepts' or 'loose' associative links. Reduced cognitive inhibition has been shown to be associated with both creativity (Dykes & McGhie, 1976) as well as schizotypy (Brod, 1997).

In experimental studies of reduced cognitive inhibition, Tipper's (Tipper, 1985) 'negative priming' paradigm has typically been used to investigate pre-

attentive inhibitory (filtering) processes. This paradigm usually employs a modified version of the Stroop colour-word ink-naming task, in which the target colour hue corresponds to the colour word (i.e., distractor, to-be-ignored) on the previous trial; under these priming conditions, longer response latencies are observed in normal subjects, and this effect is referred to as 'negative priming' (Neill, 1977). Normally, healthy individuals show *longer* response latencies under these specific conditions of the Stroop task (i.e., negative priming effect), but a lack of negative priming has been consistently demonstrated in schizophrenia patients (Beech, Powell, McWilliam, & Claridge, 1989; Laplante, Everett, & Thomas, 1992) and highly schizotypal individuals (Beech, Baylis, et al., 1989; Beech & Claridge, 1987; Ferraro & Okerlund, 1996; Moritz & Mass, 1997; Steel, Hemsley, & Jones, 1996). That is, psychosis-prone (and overtly psychotic) individuals show shorter latencies under conditions of negative priming, relative to healthy controls, owing to the increased availability of unfiltered information for faster retrieval on subsequent trials. The mechanism at play here is the 'inability' to successfully inhibit distractor (colour word) stimuli on preceding trials, which makes the distracting information available for immediate use on the subsequent trial (whereas healthy individuals take time to retrieve previously inhibited stimuli, and hence demonstrate the negative priming effect). This reversal of the usual negative priming effect has been interpreted as evidence of reduced cognitive inhibition in individuals with schizophrenia or schizotypal features, and in creative individuals (Dykes & McGhie, 1976). Comparatively few studies fail to report a significant association between high schizotypy and reduced cognitive

inhibition (Bullen, Hemsley, & Dixon, 1987; Green & Williams, 1999; Laplante et al., 1992; Lipp, Siddle, & Arnold, 1994), potentially attributable to the use of relatively small student samples. Interestingly, on a standard Stroop colour-word task, healthy individuals display longer reaction times to name the ink colour of word stimuli when the words displayed are colour-words (e.g., GREEN, RED) compared to task-unrelated (XXX) stimuli. This is due to interference of the automatic processes involved in reading the colour-word, which must be actively inhibited to perform the task (Tipper, 1985). On this task, professional musicians have demonstrated significantly less colour-word interference than amateur musicians (Travis et al., 2011).

Reduced Latent inhibition

Another type of inhibitory deficit associated with both creativity and psychosis refers to the integration of previous information stored about contingencies between events in the execution of current goal-directed behaviour, demonstrated by reduced Latent Inhibition (LI) (Gray, Feldon, Rawlins, Hemsley, & Smith, 1991; Hemsley, 1994). The term latent inhibition refers to the effect of a previously unattended (or purposefully irrelevant) stimulus as less effective in establishing new learned associations than a novel stimulus, as is evident in psychosis and psychosis-prone populations (Burch, Hemsley, et al., 2006; Carson et al., 2003; Gray et al., 1995; Lubow, Ingberg-Sachs, Zalstein, & Gewirtz, 1992); thus, the LI effect is "latent" in that it is a dormant effect noticeable only in the test phase, and "inhibition" here connotes that the effect is expressed in terms of inhibiting new learning. Interestingly, reductions

in latent inhibition (LI) can result in the capacity to *more effectively* utilise stimuli previously learned to be irrelevant. Investigation of the effects of learned 'irrelevance' on original thinking include meta-analysis of two available studies conducted in youth samples (aged under 21 years), which demonstrated that high lifetime creative achievers had significantly lower LI scores than low creative achievers ($d = .31$); moreover, those with unusually high scores in a single domain of creative achievement were seven times more likely to have low LI scores (Carson et al., 2003).

Collectively, these studies from experimental psychology point to the existence of a cognitive style that may be associated with both creative propensity and the predisposition to psychosis (Brod, 1997). Only two previous studies have attempted to directly address this hypothesis; that is, that high levels of schizophrenia proneness and greater divergent thinking are both associated with reduced cognitive inhibition (Green & Williams, 1999; Stavridou & Furnham, 1996). However, neither study confirmed this prediction; in the former, levels of psychosis-proneness were related to reduced inhibition, but divergent thinking scores were not significantly associated with cognitive inhibition; in the latter, levels of psychosis-proneness were related to increased divergent thinking, but schizotypy scores were not significantly associated with cognitive inhibition. These null results are likely due to the sampling characteristics of these studies, including small sample sizes, and the use of ostensibly healthy individuals assessed for psychosis-proneness and divergent thinking rather than clinical and/or highly creative populations. Future studies which specifically address sampling issues is needed to enrich

the qualities of cognition under investigation, in order to delineate both similarities and differences in among creative individuals with different styles of artistic expression (i.e., among musicians, visual artists, designers).

2.4 Evidence from Experimental Psychology-II: The role of temperament

In addition to cognitive processes, increasing evidence suggests that features of temperament (i.e., enduring personality style) may modulate the expression of creative potential conferred by the cognitive processes described above. Similarities of temperament among people diagnosed with bipolar disorder, in particular, and the creative artist are well established (Claridge, Robinson, & Birchall, 1983; Rybakowski & Klonowska, 2011). These include tendencies toward increased openness to experience (e.g., novelty seeking) and neuroticism, alongside decreased conscientiousness with respect to assessment of personality features in bipolar disorder (Nowakowska, Strong, Santosa, Wang, & Ketter, 2005). For example, one study of bipolar participants using the Revised Art Scale (RAS) and the 'inventiveness' part of the Berlin Intelligence Structure Test (BIS) to index creativity, showed higher creativity (on the BIS, but not the RAS) in bipolar patients, and further demonstrated significant positive relationships between the Unusual Experiences and Impulsive non-conformity subscales of the O-LIFE and creativity in bipolar disorder (Rybakowski & Klonowska, 2011).

While these similarities of temperament between bipolar disorder probands and highly creative individuals are well researched, the interaction of temperament in creative cognition is not well understood. Several recent studies have begun to investigate this potential *interaction* between affective temperament (Akiskal, Akiskal, Haykal, Manning, & Connor, 2005) and creative cognition in clinical populations. For example, two recent studies have investigated associations between temperament and creativity among cases with bipolar disorder, unipolar depression, creative (healthy) controls and healthy non-creative controls (Srivastava et al., 2010; Strong et al., 2007). Both of these studies showed that bipolar disorder patients and creative controls had higher levels of ‘neuroticism’, ‘cyclothymia’, ‘openness’ and ‘intuition’ scores (relative to non-creative healthy participants); in addition, both studies found that ‘neuroticism’ and ‘cyclothymia’ scores (of all participants) were positively correlated with Barron-Welsh Art Scale (BWAS)-*Dislike* (and *Total*) (Barron, 1963) scores, while openness scores and intuition (at least in the Srivastava et al., study) were positively correlated with BWAS-*Like* (and *Total*) scores.³ These studies suggest that features of temperament (measured by the high BWAS “*dislike*”) might contribute to creative cognition through negative discrimination, in which both the ability to access intense and often negative and varied shifts in emotion (neuroticism and cyclothymia) propels innovation through dissatisfaction with the status quo. In addition, high BWAS “*like*” scores might reflect openness to embrace the complexity of change.

³ The BWAS index is calculated on ratings of approval and disapproval of images in which high “like” (approval) ratings for complex figures and “dislike” ratings for simple drawings are interpreted as the ability to embrace complexity and perceptual openness.

Moreover, the association of intuition with creative potential has been suggested to reflect a bias toward positive internal discrimination of sensory information, or the unconscious ability to “know” what is relevant from the array of unfiltered sensory information (Metcalf, 2000).

Other studies in student populations have examined the relationship between psychosis-proneness and measures of affective temperament (Akiskal et al., 2005) and creative cognition assessed with divergent thinking measures (Wallach & Kogan, 1965). For example, using the Oxford-Liverpool Inventory of Feelings and Experiences (O-Life; (Mason & Claridge, 2006) to assess the associations of temperament and divergent thinking with four factors of schizotypy (i.e., ‘unusual experiences’, ‘impulsive non-conformity’ ‘cognitive disorganisation’ and ‘introvertive anhedonia’), (Claridge & Blakey, 2009) showed that affective temperament features were more effective in predicting creative potential (i.e., greater divergent thinking scores) than schizotypal features, with ‘impulsive non-conformity’ the only schizotypal feature to be significantly associated with divergent thinking. These findings support the notion that positive affect (shared by the highly creative and those with Bipolar Disorder, but not Schizophrenia patients) might be associated with efficient use of increased cognitive material associated with ‘defective’ filtering mechanisms.

In a more recent study of professional comedians (Ando, Claridge, & Clark, 2014), compared to both professional actors (non-comedians) and a healthy control group, both professional (creative) groups scored higher on all four

factors of schizotypy relative to the healthy control group; interestingly, the comedians also scored significantly higher on the introverted anhedonia dimension (i.e., reflecting depressive-like lack of pleasure in social activities), alongside the more extroverted and manic-like traits found in both comedian and actor populations (impulsive nonconformity). The authors of this study noted that these differences might relate to distinct approaches or motivations toward performance (i.e., engagement vs. disengagement with audiences) in these two creative samples.

Collectively, these studies converge to suggest that temperamental features of openness, impulsivity, emotional lability and intuition likely play a role in modulating the effective use of creative cognitive potential; these aspects of temperament are more associated with bipolar populations (Barnett et al., 2011; Nowakowska et al., 2005; Rybakowski & Klonowska, 2011) and may therefore contribute to this population's ability to translate creative potential to creative product. Clearly the recent study by Ando et al (Ando et al., 2014) raises questions for further research: do specific creative domains align more strongly with different temperament factors and in what way might these modulate distinct aspects of the creative process?

Reward Sensitivity

The pursuit of creative endeavours – and especially the ability to manage frustration and rejection along with momentary high of creative success (Klotz, Wheeler, Halvesleben, Brock, & Buckley, 2011) – by implication assumes individuals exhibit well developed intrinsic motivation and/or the ability to

tolerate delayed rewards. It is therefore plausible that regulation of reward systems would be a necessary characteristic of successful creative individuals. Notably, both schizophrenia and bipolar disorder patients have been shown to value smaller, immediate rewards, compared to healthy controls (Ahn et al., 2011; Simon et al., 2010). However increased motivation and sensitivity to the anticipation of reward has been implicated in bipolar disorder, but not schizophrenia (Greg. Murray & Johnson, 2010; Nusslock et al., 2012; Trost et al., 2014). It may be that goal-directed behaviour represents factors that distinguish the highly creative as those who are able to regulate reward systems to pursue and sustain motivation. These proposals deserve further investigation in the context of findings suggesting that those with bipolar disorder have high reward sensitivity but poor outcome motivation (Alloy et al., 2012), while schizophrenia populations exhibit even greater deficits in reward processing that may be associated with apathy and poor motivation (Nielsen et al., 2012). Further consideration of cognitive factors associated with intrinsic motivation and creative potential is therefore warranted (Richards, 2001).

The role of IQ

Consistent with the neuroimaging literature reviewed above, the results from a meta analysis of variables associated with creativity further support the role of increased executive control in creative thought (Ma, 2009). This meta-analysis included 111 studies in which creativity was defined according to creative product (described as ideas, solutions, performances or products), the

creative person (personality characteristics; cognitive ability;) and/or the creative process (creative problem solving defined as experience; ideation; thinking; evaluation) (Ma, 2009). The largest effects sizes were reported for variables associated executive functions, namely the problem solving ability to *find* (Cohen's $d = 0.93$) and *retrieve* knowledge (Cohen's $d = 0.86$). Given that standard estimates of 'intelligence' (i.e., the Intelligence Quotient, or 'IQ') depend on the capacity to manipulate and effectively (or adaptively) utilise information it has been contended that *high IQ, enhanced working memory capacity and cognitive flexibility* differentiate highly creative individuals from psychotic individuals (Carson, 2011). This follows empirical study of "eminent creative achievers" (Carson et al., 2003) comprising Harvard undergraduate psychology students reporting high scores on a single domain of creative achievement, 30% of the variance in creative achievement scores between was accounted for by reduced LI and high IQ (with IQ measured using WASI –R verbal and block design subtests). However, this strong association between IQ and creativity has not been supported in other non-student based studies, indicating possible bias in the sampling characteristics of this study. In addition, the recent epidemiological study reporting greater incidence of creative professions in the relatives of individuals with schizophrenia and bipolar disorder (and in bipolar disorder probands), specifically investigated whether IQ mediated the association between creativity and psychopathology; although the IQ data were available for men only, no significant effect of IQ could account for this link between creativity and psychopathology (Kyaga et al., 2011).

While poor IQ is strongly associated with schizophrenia, evidence in studies with bipolar disorder patients is less equivocal (Hill et al., 2008). Poor IQ may thus account for the inability of schizophrenia patients to translate their greater divergent thinking, reduced latent inhibition and pre-attentive filtering, into creative output, and this is consistent with epidemiological evidence.

Conversely patients with bipolar disorder do not have such severe decrements in IQ as seen in schizophrenia (Hill et al., 2008).

It is therefore understandable that there is conflicting data on the role of IQ as a primary mediating factor between creativity and psychopathology, as proposed by Carson (Carson, 2011). Interestingly, a recent study by (Furnham & Bachtar, 2008) examined both personality and intelligence as predictors of creativity in a non-clinical group; they reported that IQ (Wonderlic, 1992) failed to explain any of the variance in scores of creative potential as measured by Divergent Thinking (DT) task (Guilford, 1967). The collective literature thus points to the need to more carefully delineate the role of specific mediating factors, including temperament and reward processing systems that may explain previous associations between creativity and IQ.

2.5 Clinical implications for the creative-psychosis spectrum population

Given the considerable support for an association between creativity and psychopathology, it is somewhat surprising that little attention has been given to the clinical applications of this shared vulnerability, beyond the use of

creative therapies to enhance treatment in those with bipolar disorder and schizophrenia (Carson, 2011; Xia & Grant, 2009). For example, leading proponents of targeted intervention for creative individuals with bipolar disorder (Carson, 2011; Jamison, 2011) proffer changes to treatment regimes that minimise the negative impact of medication on creative 'mood', and point to the development of specific non-pharmacological interventions for these populations, (Greg. Murray & Johnson, 2010) such as psycho-education and cognitive behavioural treatments (Greg. Murray & Johnson, 2010).

An alternative view is that, if creative people depend on these vulnerability factors to enhance their work, then psychosis-prone individuals might also find a successful vocational niche in learning to utilise such 'vulnerability' factors to advantage. Indeed, the cognitive features considered deficits in psychosis have been promoted and cultivated in creative populations (Dane, Baer, Pratt, & Oldham, 2011; Gilson & Madjar, 2011). Should we thus be asking whether it is possible to enhance creative potential in vulnerable youth or those with emerging first episode psychosis? For example, there may be scope to develop individual and preventative, early intervention programs, which enhance cognitive flexibility (the rapid shift from divergent to convergent thinking) and awareness, self-management and re-processing of overwhelming sensory information in highly creative psychosis vulnerable youth. Furthermore, as the spectrum model for shared vulnerability unfolds, clinical intervention programmes may also be amenable for a creative bipolar but not schizophrenia patient population; further research is required to delineate the precise targets for remediation, versus enhancement, in these disorders.

The model illustrated in Figure 1 summarises a spectrum model of shared vulnerability for creativity and psychosis-proneness, on the basis of the evidence reviewed above. Overwhelmingly, the evidence to date demonstrates similarities in cognition and temperament among creative and psychotic individuals evident in enhanced divergent thinking, reduced preattentive filtering, attenuated latent inhibition, and increased levels of openness to experience and neuroticism. At the same time, epidemiological evidence suggests that extreme expressions of schizophrenic psychosis are not conducive to creative achievement (Kyaga et al., 2011). Thus, differences among creative and non-creative individuals on the psychosis spectrum will likely reflect reduced cognitive flexibility and motivational aspects of cognition (i.e., concerned with reward processing), alongside less extraversion, agreeableness and conscientiousness in psychosis-prone individuals, compared to highly creative individuals. In terms of biological significance, shared vulnerability to psychosis and creative thinking suggests that these aspects of cognition and temperament might be recognised as an ‘adaptive’ intermediate phenotype for psychosis, among the many maladaptive candidates in the current literature (e.g., Hill et al., 2008).

New therapeutic strategies to increase resilience in the face of risk for psychosis might involve maximising the adaptive capacity of cognitive anomalies associated with risk and creativity alike, rather than remediating all cognitive ‘deficits’ associated with psychosis predisposition. This requires

firstly the elucidation of *adaptive* aspects of temperament and cognition that are utilised by highly functional individuals to engage in creative endeavours. If indeed it is possible to extricate the cognitive basis of creative *potential* from creative *achievement*, targeted remediation of appropriate cognitive processes that render increased creative ability (in the context of sparing remediation of some apparent attentional “deficits” that serve in fact to enhance creative processes), may be an appropriately benign first line treatment for young individuals with signs of emerging psychotic disorder. Learned utility of cognitive ‘deficits’ and positive application of features of creative temperament may assist in averting negative vocational trajectories associated with first episode psychosis and chronic sub-threshold psychotic conditions.

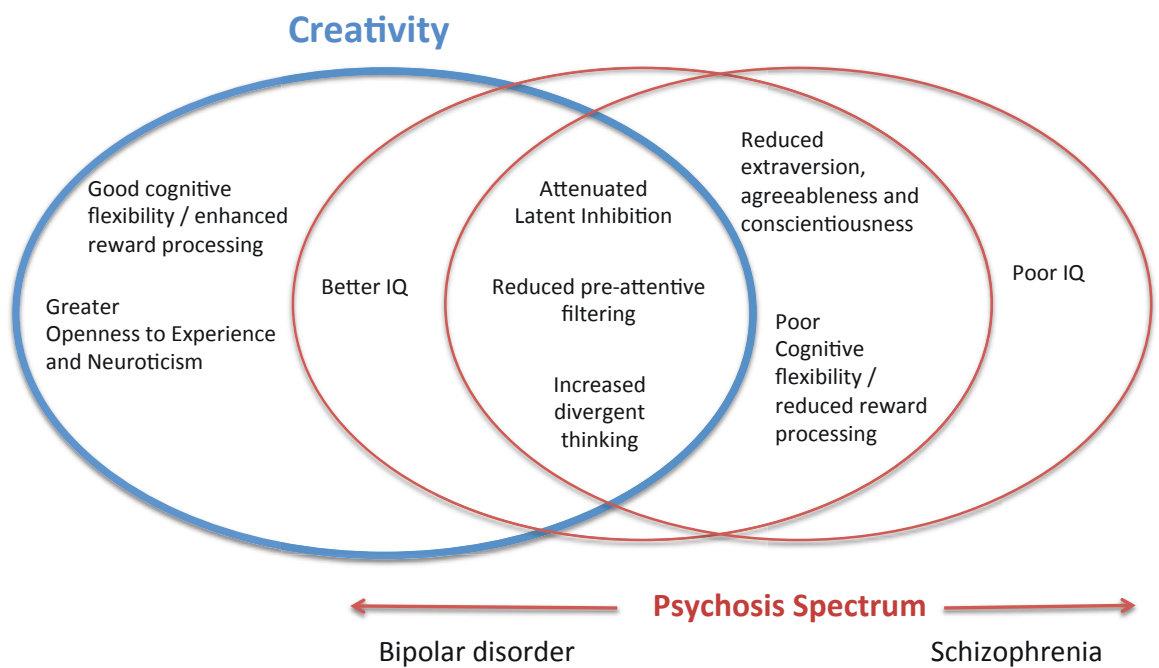


Figure 1: Spectrum model of shared vulnerability for creativity and psychosis

2.6 Addendum: Additional relevant, recent research published subsequent to “*Creative cognition and psychosis vulnerability: what’s the difference?*” (Crabtree & Green, 2016)

As stated earlier, the purpose of this research is to more carefully delineate the personality and cognitive similarities and differences between the professionally creative and those with bipolar disorder and schizophrenia. While the paper presented in this chapter: “*Creative cognition and psychosis vulnerability: What’s the difference?*” presents a detailed review of the literature up to the point of publication (Crabtree & Green, 2016), additional studies not included for reasons of publication limitations or that were published subsequently have provided more clarity on the delineation between creativity and psychopathology. Discussed below are applicable studies that informed revision of the original research aims, as presented in the *spectrum model of shared vulnerability*. In examining these additional studies, emphasis was given to research, which included well validated clinical and creativity measures.

2.7 Schizophrenia patients have limited creativity: this creativity is associated with enhanced creative imagery

In a recent study of a group of forty-two schizophrenia participants, (Wang et al., 2017) the researchers recorded no enhanced creative (divergent) thinking except on a figural task that was assessing for originality. This population had a mean age of 30.23 years. In this sample age was restricted to 18-40 year olds so as to correspond with the age of the non-clinical population and also used a well-validated measure of creativity. Visual creativity appears to be particularly associated with those with schizophrenia and is supported by studies from earlier researchers (Nettle, 2006; Schildkraut et al., 1994). However these findings suggest that those with schizophrenia do not have an aptitude for all forms of creativity.

These findings may also underlie the results from the large Swedish case-control study that found those with schizophrenia reported achievement with only visual artistic creativity (Kyaga et al., 2011). The unique place of visual artistic creativity with this population, informed the inclusion of spatial working memory and vividness of mental imagery measures that were examined in study two and discussed in chapter five.

2.8 Positive schizotypy but not negative schizotypy associated with creativity

In this same study (Wang et al., 2017), thirty-five high schizotypal and thirty-nine low schizotypal groups (selected using the SPQ) were assessed on divergent and convergent thinking tasks. The high schizotypal group outperformed both the

schizophrenia and low schizotypal group on both verbal and figural divergent thinking tasks. Similar results have been found in an earlier study that compared features of schizotypy and affective temperament using established divergent thinking tasks (ATTA) (Claridge & Blakey, 2009).

2.9 Bipolar disorder and creativity

The association between bipolar disorder and creativity is more clearly established in the literature (Rybakowski & Klonowska, 2011; Soeiro-de-Souza et al.; Srivastava et al., 2010; Strong et al., 2007). All studies cited above used a population with an established diagnostic measure to delineate a bipolar sample and a well-validated creativity measure (BWAS or ATTA). The bipolar sample in these studies had significantly higher creativity compared to the unipolar sample and a non-creative population, however only one study compared bipolar states (Soeiro-de-Souza et al., 2011). In this study both the manic and mixed populations recorded significantly higher creativity compared to those in a depressed state. This will be discussed in more detail in chapter five.

2.9.1 Defining early psychosis populations

Alongside the above, established literature associated with chronic bipolar/schizophrenia populations is the study of first episode, vulnerable and at risk populations. This field of study employs various terms, which can lead to confusion in defining specific populations. Examples of the terms used include, 'psychosis

vulnerability', 'at risk mental state', 'ultra high risk', 'first episode', 'early psychosis' and 'transition to psychosis' (Goghari et al., 2014; Gostoli, Cerini, Piolanti, & Rafanelli, 2017; G. Murray & Jones, 2012). Focus on this important area of investigation has been in response to calls for research into early intervention in psychosis and mental health (McGorry, Killackey, & Yung, 2009a) and would seem to be of key interest in the creativity/bipolar and schizophrenia association. Specifically an examination of a younger, clinical population at the early stages of psychosis, rather than a chronic and older clinical population (who would be affected by a decline in cognitive functioning with age (Fucetola et al., 2000)) would provide a comparison of more subtle differences. This is particularly as the study of early illness enables researchers to identify various bio-psychosocial variables that may be associated with decline in cognitive functioning (Fucetola et al., 2000). These factors would be of particular relevance to research into the creativity/ psychopathology association. Therefore for the present thesis, it was decided to examine a sample at the early stages of psychosis, rather than a chronic clinical population. An examination of the best definition for this population is discussed below.

To avoid confusion with nomenclature and based on the review of the literature into conflicting definitions, it was decided to adopt the operational definition proposed by Brietborde and colleagues (2009) who advocate the use of the term 'early psychosis'. This is to delineate a sample who are early in the course of their psychotic illness or treatment rather than those who may be in the midst of a first episode and therefore potentially unstable and highly symptomatic. The authors (Breitborde et al., 2009) suggest, that duration of illness be used as a determining factor for defining early

psychosis with five-year post-onset of psychotic symptoms used as a guide.

Furthermore they suggest other operational criteria, should be adopted as determined by their research. Based on these guidelines the term ‘early psychosis’ will be used in this thesis to define the clinical sample represented and delineates those who are diagnosed with an experience of early psychosis. The specific criterion used to operationalize this population, are listed in chapter three.

2.9.2 ‘At –risk’ and vulnerable clinical populations

With respect to the ‘at risk’ and transition to psychosis populations, a number of meta-analyses have reviewed the literature on factors associated with risk for psychosis and transition to psychosis and these factors may be pertinent to the creativity/early psychosis association (Carrión et al., 2018; Fusar-Poli et al., 2016; Radua et al., 2018). These meta-analyses will be discussed in more detail in later chapters, however it should be noted that none of these studies examined creativity, nor addressed creativity as a risk factor.

Only one study to date has investigated bipolar vulnerability and creativity in a student population (Gostoli et al., 2017). Aspects of bipolar vulnerability, namely cyclothymic and hyperthymic traits were associated with creative personality traits using a measure of divergent feeling (TDF) (Williams, 1980)⁴. In particular hyperthymia or elevated positive mood and disinhibition were correlated with creative personality and positive wellbeing. While the authors point to the preliminary nature of this work,

⁴ The test of divergent feeling (TDF) is part of a creativity assessment packet comprising a test of divergent thinking, test of divergent feeling and the Williams Scale.

it proposes the view that psychosis vulnerability specific to creativity may have positive not negative implications for wellbeing. The measure of creativity used a test of divergent feeling (TDF) however this was one of a suite of three creativity assessment measures, which have not been commonly examined for validity and reliability (Cooper, 1991). The lack of a robust creativity measure may have conflated these promising results.

The abovementioned meta-analyses in 'at risk' and psychosis vulnerable populations identify factors, other than personality and cognition that have also been associated with these populations (Radua et al., 2018). These factors may have relevance to the creativity/early psychosis association. Three factors in particular are considered and they are discussed in detail below.

2.9.3 Anxiety

As indicated earlier in the chapter, the personality factor of high neurosis or the ability to experience intense emotions such as sadness and anxiety, has been associated with both psychopathology and highly creative individuals (Rybakowski et al., 2008).

Although the role of depression with both populations has been extensively examined (Andreasen, 1987; Schildkraut et al., 1994), anxiety has received relatively little attention in comparison. Of those studies that have investigated creativity and anxiety none have examined in detail a professional creative population (Byron & Khazanchi, 2011; Silva & Kimbrel, 2010). As indicated in the introduction, a recent extensive survey into the mental health of creative professionals in Australia found 44% of the

sample (n=1358) had moderate to severe levels of anxiety. This is ten times the national average as a comparative Australian sample had a reported 3.7% in the moderate to severe range. In the survey of creative professionals, rates of depression were 15.2% in the moderate to severe range; which was higher than the national average (3%) but not as elevated as anxiety (Van den Eynde et al., 2016). Both performance anxiety and trait anxiety have been of increasing concern within creative industries (Brugues, 2011), however the prevalence and incidence of anxiety among creative professionals has not resulted in associated research. This is surprising given the creativity/psychopathology association and the high rates (45%) of co-morbid anxiety within schizophrenia, schizoaffective and bipolar populations (Cosoff & Hafner, 1998). Moreover high neurosis, which is associated with both creative and clinical populations, (Nelson & Rawlings, 2010; Strong et al., 2007) has also been found to be associated with the development of anxiety (Rapee, Schniering, & Hudson, 2009).

It is for these reasons that an investigation of anxiety was included in chapter six.

2.9.4 Paranoia

Most psychotic disorders begin with a prodrome phase and there has been recent attention given to identifying the symptomatology associated with those at high risk for psychosis. The Comprehensive Assessment of At-risk Mental State (CAARMS) is one of the most widely used and well-validated instruments for monitoring sub-threshold psychosis (Yung et al., 2003). At risk mental state is defined as 1) attenuated psychotic symptoms, 2) brief and limited intermittent psychotic symptoms, 3) *genetic or other*

vulnerability risk factors such as schizotypal symptoms and 4) psychotic thought threshold (Yung et al., 2003). As indicated earlier in this thesis, there is evidence that the artistic creative population share vulnerability risk factors, specifically, common polygenic risk and schizotypal symptoms. As indicated earlier, schizotypy refers to personality constructs, such as magical thinking, suspiciousness and eccentric behaviour, (Claridge & Beech, 1995) that can indicate a person's proneness to psychosis/schizophrenia (Siddi et al., 2017). It is typically defined as three factors: positive, negative and disorganised (Debbane & Barrantes-Vidal, 2015) with creativity strongly associated with positive schizotypy (Claridge & Blakey, 2009). Paranoia is considered a dimension of positive schizotypy however it has rarely been examined in creative populations (Cicero & Kerns, 2010). It has been argued in a review of schizotypy and its clinical relevance that any research into schizotypy should include an additional well-validated measure of paranoia as this factor is not adequately identified in most schizotypy measures (Mason, 2015). It is for this reason that paranoia is examined. Paranoia can be conceptualised as a hierarchy ranging from fears of vulnerability and rejection, ideas of reference, to more severe perceptions of threat, conspiracies and physical harm (Freeman et al., 2018). It has been extensively researched in clinical and at-risk for psychosis populations (Debbané et al., 2014), however it has not been included in other research into creativity despite it being considered an aspect of positive schizotypy (Ando et al., 2014). In study one (chapter four), paranoia was examined across three populations: early psychosis, creative professional and non-creative controls. It was examined again in study three (chapter six) as part of a four-sample analysis due to the association between anxiety, adverse life events and the development of paranoia (Masillo et al., 2017).

2.9.5 Stressful life events

Identified as a possible a risk factor for psychosis (Radua et al., 2018) and alongside anxiety, the incidence of stressful life events has been examined in limited professional creative populations (Thomson & Jaque, 2012). In a group of professional and pre-professional dancers examined for anxiety, fantasy and trauma, a study found that 23.3% of the dancers experienced clinical levels of anxiety (as measured by the Beck Anxiety Inventory) and this group with elevated anxiety reported a greater number of traumatic events. A regression analysis was undertaken and the researchers found fantasy (vivid imagination) and past trauma accounted for 19.4% of the variance in anxiety. A related study with a larger population of dancers (n=234) found that the professional dancers who had a higher incidence of trauma (greater than four adverse events) reported an increased incidence of anxiety and shame (Thomson & Jaque, 2018).

There are two further studies into creative populations that similarly implicate a higher incidence of stressful life events. An examination of 13,195 records of the life expectancy of musicians, found life style factors alongside the incidence of violent deaths, accidents and homicides exceeded those in normal populations (Kenny & Asher, 2016). The researchers implicated the vagaries of their work environment alongside inherent personality vulnerabilities to explain the propensity for musicians to die from non-natural causes. Additionally a retrospective study of 1,489 rock and pop stars from 1956 to 2006 found increased mortality due primarily to substance

abuse and risk-taking behaviour (Bellis, Hughes, Sharples, Hennell, & Hardcastle, 2012). The author's associated this with reported adverse life experiences, which may have predisposed them to health damaging behaviours. These four studies suggest that the creative professionals, compared to non-creative populations may experience an increased incidence of adverse life events.

Within clinical populations there are indications of an association between childhood adversity and the emergence of psychosis. In a population of 138 patients with first episode psychosis (schizophrenia and affective psychosis), corresponding to a geographically matched control population of 138 people, there was a significantly higher incidence of childhood trauma amongst the early psychosis population ($\chi^2 = 21.15$, $df = 1$, $p < 0.001$) (Aas et al., 2011). Moreover in the clinical population those with childhood trauma reported a decline in cognitive function in verbal, language and attention with the bipolar subgroup reporting a significant decline in visuo-perceptual abilities. Visuospatial cognitive deficits specific to the early psychosis compared to creative populations will be discussed in chapter five.

This association between childhood trauma and early psychosis has also been supported in a recent longitudinal study, which examined factors associated with the development of psychotic thinking over a thirty-five year period. The researchers found that childhood abuse was significantly associated with psychotic experiences moreover anxiety was one of the highest comorbid factors during period (Bell et al., 2018). Similar associations among childhood adversity, psychotic and affective disorder were reported in a recent meta-analysis (van Nierop, 2015) and a higher incidence of

childhood trauma was found in an at-risk of psychosis group compared to controls (de Vos et al., 2019).

Recent studies have examined the association between adverse life events and the later development of anxiety and paranoia within an 'at risk' for psychosis population (Freeman & Fowler, 2009; Masillo et al., 2017). These three factors have not been investigated in an early psychosis and professional creative population, compared to non-creative controls. As indicated earlier study three (chapter six), will examine similarities and differences across the four samples on life events, anxiety and paranoia.

In summary

The spectrum model of shared vulnerability (Crabtree & Green, 2016) proposed a series of cognitive and personality factors that may differentiate a creative from a bipolar and schizophrenia population. Since the publication of that theoretical review, research attention has focused on early intervention in psychosis. In support of this growing research base, and in order to ensure the clinical sample were not affected by illness-related cognitive decline, an early psychosis sample were the focus of this thesis, rather than a chronic bipolar or schizophrenia population. Additional factors associated with risk for psychosis, namely anxiety, paranoia and stressful life events, were included as additional areas for examination.

Chapter Three

3.1 Methodology

The methodology describes the overarching strategy or framework for answering the research question (O'Leary, 2014).

As indicated in chapter one, the research question under examination is:

What differentiates creativity and psychosis vulnerability?

In a comparison between an early psychosis, professional creative and non-creative cohort, what aspects of personality, cognition, mood and adverse life events differentiate the early psychosis, professional creative and non-creative cohort.

The earlier chapters have outlined the methodological problems that have plagued this research question, which have often led to conflicting research results. Particularly as most relevant publications seek empirical research, it was therefore decided to adopt an empirical research design with an emphasis on reliable, deductive, valid and generalizable results. The research design was determined to be a quantitative survey of differences between populations; a clinical and two control populations. The two control populations were recruited from a professional creative and non-creative control group. While mixed method and qualitative research methods are becoming increasingly popular, it was decided to collect hard data as quantitative research is most commonly employed in population studies and with clinical populations (O'Leary, 2014).

Cross-sectional methodology

As the research question examines differences in the prevalence of factors across populations, an observational study design was selected. Observational study designs can be either cohort, cross-sectional or case control. A cross-sectional methodology was employed as this is considered to be the best research approach to determine prevalence and associations between factors that may be studied later in more detail (Mann, 2003). A cross-sectional methodology involves examining the characteristics of several populations at one point in time and participants in a cross-sectional methodology are selected based on pre-determined inclusion and exclusion criteria (Setia, 2016). It has many advantages; specifically it is quick and inexpensive to administer, as there is no follow up. This was a key factor in selecting this methodology as a one –off testing period would be advantageous in testing a clinical population. This is particularly as a clinical population are more vulnerable and difficult to research in multiple settings and at different points in time due the variability of their clinical presentation. A cross-sectional methodology also enables multiple factors to be examined within the population. As the research question was seeking to study cognition, personality, anxiety and adverse life events, a cross-sectional methodology was selected that allows for multiple factors to be examined at one point in time.

However, a cross-sectional methodology has associated disadvantages. Specifically this type of study cannot differentiate cause and effect from association. Therefore this type of design cannot answer the question if creativity “causes” psychosis vulnerability. It was therefore understood that in selecting a cross-sectional

methodology, further research of a longitudinal nature would also be needed (Setia, 2016).

The research question was examined in three studies. These three studies are outlined below.

Study one (chapter four) examined similarities and differences in personality and aspects of schizotypy among early psychosis, creative controls and non-creative controls.

Study two (chapter five) examined cognition, specifically IQ, executive function, pre-attentive filtering and spatial working memory. Study two also included an examination of vividness of mental imagery. These measures are studied across a four-group sample, specifically an early psychosis, at risk creative with sub-clinical levels of hypomania and psychotic thinking, creative control with no sub-clinical symptoms of hypomania and psychosis and non-creative control population.

Study three (chapter six) examined anxiety, stressful life events and paranoia across a four-group sample to determine similarities and differences between an early psychosis and creative sample with sub-clinical symptoms of hypomania and psychotic thinking. These two populations were examined along-side the remaining creative and non-creative controls.

3.2 Ethics

Recruitment and study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 11279)

and ratified by the University of Technology (HREC UTS ETH16-0532). All participants provided written consent prior to participation. Participants were aged 18-35 years old as we were interested in first episode psychosis and epidemiological studies suggest that the age of onset of psychosis ranges from 15 to 35 with the median age of initial presentation being in the mid-twenties (Kessler et al., 2007). All participants were given a monetary reimbursement of AUD 40 for travel costs.

Methods

Methods describe micro-level techniques that are used to collect and analyse data. Therefore this section will outline the methods used to address the research question.

3.3 Participants

Early psychosis participants (EP) N=21

Early psychosis participants were recruited from a previous study (Rowland et al., 2012), and had given consent to be approached for further studies. Twenty-five participants were approached for the study and twenty-one agreed to participate. Of the four who declined to participate, two reported active psychotic symptoms and two failed to respond to invitations to participate. All were recruited from either an inpatient or outpatient hospital clinic (St Vincent's Hospital and PEIPOD, early intervention unit) and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis (DIP), which was administered by an experienced clinician undergoing training in psychiatry. The OPCRIT algorithm (an electronic system used for psychiatric diagnosis) was used to confirm clinical diagnosis. This ensured

consistency across interviewer ratings on the Diagnostic Interview for Psychosis (Castle et al., 2006). All participants with an experience of early psychosis met criteria for psychotic disorder according to ICD -10 criteria and had recorded a first episode psychosis or hospitalisation. As discussed earlier, this group were identified as an early onset psychosis group (Breitborde et al., 2009) based on either being identified as in the early stages of psychosis or having had experienced initial hospitalisation. Active psychotic symptoms were an exclusion criteria for the study, hence a Positive and Negative Syndrome Scale for Schizophrenia (PANSS) (Kay, Fiszbein, & Opler, 1987) measure was given at the time of testing. No participants were excluded due to the presence of acute psychotic symptoms. They were all tested at St Vincent's Hospital, O'Brien's unit.

Creative control participants (CC) N=55

Creative control participants were recruited following a brief presentation by the lead researcher (JC), to several Creative Art Colleges around Sydney, Australia. The recruitment sites included tertiary creative training institutions such as music colleges (i.e. Australian Institute of Music where they were studying contemporary, classical music, composition, vocals,) visual arts colleges (e.g. National Arts School and College of Fine Arts), as well as advertising on relevant creative websites (e.g.

livingwithacreativemind.com). Individuals were presented with an outline of the research and gave written consent to take part in the study. A total of seventy-three indicated a willingness to be contacted for the study and fifty-five agreed to be tested. All creative controls were tested at the various creative arts colleges or St Vincent's Hospital, O'Brien's unit. Creative controls were screened for past or present psychotic symptoms using a MINI Plus (Mini international neuropsychiatric interview) (Lecrubier

et al.). None were found to have past or present syndromal psychiatric disorders (although twenty-five had sub-threshold symptoms as discussed below). Of those recruited twenty-seven were primarily engaged with music; fifteen were visual or graphic artists, twelve were actors or involved in the theatre and one was engaged in web development and design. Compared to clinical and control sample sizes, additional numbers of creative participants were recruited and tested as the author initially wanted to examine differences in cognition and personality across specific creative domains. However the larger creative control sample allowed for the later identification of an 'at risk' sub group of creative participants (discussed below) based on results from the MINI Plus structured neuropsychiatric interview.

After identifying the 'at risk' creative control sample, thirty participants remained and these formed the creative control group.

'At Risk' Creative Control (ARCC) N=25

The decision to identify this creative sub group was made in response to the overarching research question: is creativity associated with psychosis vulnerability? Specifically the aim of the research is to identify similarities and differences between the early psychosis and professional creative control. In administering the neuropsychiatric structured interview (MINI), it was observed that twenty-five of the creative participants reported past symptoms of hypomania or psychosis symptoms that failed to reach criteria for diagnosis. It was proposed that this creative sub group of 'at risk' participants may provide insight into particular and unique discriminating factors associated with this cohort.

Included below is a brief excerpt from the MINI Plus neuropsychiatric structured interview (Lecrubier et al., 1997) specifying the type of questions used to determine

criteria for hypo (mania episode) and psychotic disorder. This indicates the 'at risk' creative controls reported past symptoms (at least two were endorsed) that failed to reach criteria for diagnosis.

In the times when you felt high, full of energy or irritable did you

- a) Feel that you could do things that others couldn't do or you were an especially important person**
- b) Need less sleep**
- c) Talk too much without stopping**
- d) Have racing thoughts**
- e) Became easily distracted so that any little interruption could distract you**
- f) Become so active or physically restless that others were worried about you**
- g) Want to engage in pleasurable activities that you ignored the risks**

Or

Have you ever believed that you were being sent special messages through the TV, radio or newspaper or that a person you did not know was particularly interested in you?

Have your relatives or friends ever considered any of your beliefs strange or unusual?

Due to the high number of creative participants who reported these symptoms at sub-clinical levels, it was decided in two of the three studies (chapter five and six), to undertake further analysis and consider this a possible 'at risk' creative group.

Assessment of 'at-risk mental states' is commonly undertaken in help seeking patients who attend outpatient or inpatient services where symptoms can be assessed over time (Brewer et al., 2006). As outlined earlier the CAARMS (Comprehensive Assessment of At-risk Mental State) is one of the most widely used and well-validated instruments for monitoring sub-threshold psychosis (Yung et al., 2005). It is defined as 1) attenuated psychotic symptoms, 2) brief and limited intermittent psychotic

symptoms, 3) genetic or other vulnerability risk factors such as schizotypal symptoms and 4) psychotic thought threshold (Yung et al., 2005). The CARRMS is used to evaluate the prodrome phase and assess psychopathology associated with imminent development to first episode psychosis and to determine criteria for ultra high risk for psychosis (UHR). In contrast this 'at risk' creative group was self-reporting and recruited as a control group within several creative arts institutions and therefore could not be considered to satisfy the criteria for "at-risk mental states" (Yung et al., 2005). Therefore the term 'at risk' as applied to the creative control cohort was deemed to delineate a creative control sub group who was hypothesised to be at greater risk for psychopathology, rather than a prodromal cohort who had been assessed over time as having an 'at risk mental state' for psychosis.

Non-creative control participants (NCC) N=34

Healthy, non-creative controls were recruited from the UNSW university website and university message boards. The information asked for psychologically healthy volunteers to participate in research into creative cognition, and thirty-three individuals initially responded. Nine participants were excluded because they met one of the following three exclusion criteria: i) personal or family history of mental illness (1); ii) an inability to communicate proficiently in spoken and written English (7) and iii) receipt of more than rudimentary training in any field of creative arts (1). Using the MINI Plus (Lecrubier et al., 1997) the normal non-creative controls were also screened by researchers trained in psychiatry for any current mental illness and one participant was excluded as she reported current symptoms of an eating disorder (anorexia nervosa). These participants were reimbursed for their time. Due to faulty equipment

from a computer-based task, test results were corrupted for seven of the non-creative control participants. As a consequence an additional ten participants was recruited and tested to supplement the numbers. These participants were recruited and tested according to the inclusion and exclusion criteria outlined above. A total of thirty-four non-creative controls therefore participated in the research.

Statistical analysis

As the research question examines differences between populations, an ANOVA was the primary statistical analysis that was used in the studies.

Study one: Examined differences in personality and schizotypy between the early psychosis, creative control and non-creative control populations using ANOVA statistical analysis.

Study two: Examined differences in IQ, Executive function IED, Spatial working memory, Negative Priming and vividness of mental imagery between the early psychosis, at risk creative, creative control and non-creative control populations using ANOVA statistical analysis. A multiple regression analysis examined what variables predicted creative cognition and creative achievement. A discriminant functional analysis analysed what variables predicted group membership.

Study three: Examined differences in measures of anxiety and paranoia using ANOVA statistical analysis. Incidence of adverse life events between populations was reported as percentages and the association between anxiety and creative cognition and achievement was analysed using a Pearson's product moment correlation.

3.4 Measures

A multi-method assessment process was used to examine the variables under investigation. These methods include seven pen and paper self-report questionnaires; two standardised tests; four computer-based neuropsychiatric assessments and two, diagnostic neuropsychiatric structured interviews. Although these measures have been reported as part of submitted and published manuscripts, word limit restrictions imposed by journals often preclude a detailed examination of validity and reliability. Therefore a comprehensive discussion of relevant measures is included below. Not all measures included in the test battery were reported in the three studies. The measures that were omitted were mysticism scale; STAI – state, trait anxiety scale and CANTAB Cambridge gambling task, a neurocognitive measure of reward processing. A summary of the measures used in the three studies is below (Table 1).

Table 1*Summary table of measures used across the three studies*

	Screening measures							Study specific measures								
	D.Q	DIP	PANSS	MINI	CAQ	ATTA	WASI	NEO FFI- R	O- Life	PSQ	S W M	I E D	STROOP	VVIQ	DASS	SLE
Study 1	✓	✓		✓	✓	✓	✓	✓	✓	✓						
Study 2	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓		
Study 3	✓	✓	✓	✓	✓	✓	✓			✓					✓	✓

Neuropsychiatric structured interviews

- **Diagnostic Interview for Psychiatry: DIP (Castle et al., 2006)**

The Diagnostic Interview for Psychosis (DIP) was developed as a tool for those with clinical training and comprises four main domains: (a) demographic data; (b) social functioning and disability; (c) a diagnostic module comprising symptoms, signs and past history ratings; and (d) patterns of service utilization and patient-perceived need for services. It is normally administered over two assessment sessions. The OPCRIT algorithm (McGuffin & Farmer, 1991) was used to confirm clinical diagnosis. This ensured consistency across interviewer for ratings on the Diagnostic Interview for Psychosis (Castle et al., 2006). Reliability for the DIP was determined on twenty cases assessed by twenty-four clinicians. Seven cases were interviewed 2–11 weeks apart to determine test–retest reliability, with pairwise agreement of 0.8–1.0 for most items. Diagnostic validity was determined by comparing ICD-10 SCAN diagnoses with DIP generated diagnoses. The level of agreement between ICD-10 SCAN-generated diagnoses and ICD-10 DIP-generated diagnoses was good, with nine out of the ten DIP diagnoses matching the SCAN diagnosis at the 3-digit level. All early psychosis participants met criteria according to ICD -10 and recorded a first episode psychosis or hospitalisation.

- **International Neuropsychiatric Interview: MINI Plus (Lecrubier et al., 1997; Sheehan et al., 1998)**

The MINI Plus was designed as a modularised, structured interview for major Axis 1 psychiatric disorders in DSM V and ICD 10. In comparison studies with the SCID-P for DSM-11-R and CIDI for ICD 10, the MINI has high reliability (test, re-test for psychotic

disorder kappa 0.90) and validity (psychotic, mood disorder: kappa 0.63-0.82). The MINI Plus has good sensitivity for all diagnosis (range 0.72-0.97) and specificity for psychotic and mood disorder (range 0.77-0.94) (Lecrubier et al., 1997).

Creativity Measures:

- **Abbreviated Torrance Test for Adults: ATTA (Torrance, 1990)**

To determine creative ability, all participants were administered a test of divergent thinking (Abbreviated Torrance Test for Adults: ATTA) which is a well-validated measure of creative potential (Goff & Torrance, 2002). This test comprises three tasks; the first calls for a verbal response to a hypothetical problem and the following two tasks require figural responses. Participants were asked to respond to the task using problem solving and imagination. Their responses were scored according to four norm referenced indicators (fluency (KR21= .45; SEM: 1.48), originality (KR21=.38;SEM:1.69), flexibility (KR21=.38;SEM:.1.47) and elaboration (KR21=.84;SEM:.78)) and fifteen criterion referenced indicators (e.g. humour, use of imagery etc.). Following this computation, an indicator of verbal and figural creativity as well as an overall creative indicator (CI: KR21=.69; SEM: 4.76) is calculated. The CI can be mapped to a seven point scaled score to identify the participant as demonstrating a minimal to substantial creativity level. Two scorers (JC and SG) coded each ATTA according to the ATTA guidelines for scoring and there was good inter-rater agreement 96%, and consensus was reached for the 4% where there were different scores. The ATTA records good inter-rater reliabilities range from .95 to.99 (Goff & Torrance, 2002). A more detailed discussion of the ATTA is included later in the chapter together with examples of creativity from the participants.

- **Creative achievement questionnaire (CAQ) (Carson, Peterson, & Higgins, 2005)**

To evaluate creative output, the Creative Achievement Questionnaire (CAQ) (Carson et al., 2005) was administered to all participants. As emerging professional creative artists were the focus of the creative participant group, an amended form of the CAQ was administered to identify arts focused domains only and include relevant early accomplishment and achievement associated with contemporary outputs in online and digital creativity. These changes were based on documented changes to creative industries and how creative achievement is now measured (i.e. song downloads rather than number of record sales as a measure of music achievement) (Hughes, Evans, Morrow, & Keith, 2016). This forms an extension of the creative domains used by Carson and Peterson in the CAQ. In the formulation of the CAQ, Carson and Peterson (2005) developed these domains, based on a review of areas of accomplishments formulated in the 1970's (Colangelo et al 1992; Hocesvar, 1979; MacKinnon, 1962; Taylor and Ellison, 1967; Torrance 1972). In an interview format using the CAQ, participants were asked to indicate their creative accomplishments in ten separate domains: (visual arts; music including both instrument and voice; dance; theatre, film and including acting and creative direction; architecture including graphic design; creative writing; humour; inventions including software design). The Creative Achievement Questionnaire allows for sub classification of achievement into expressive, scientific and performance creative achievement (principal component analysis with varimax rotation accounted for 43.8% of the variance). Expressive creative achievement refers to domains such as writing, song-writing and visual and

graphic arts whereas performance creative achievement pertains to dance, music and drama performance (as indicated earlier scientific creativity was not included) The CAQ has good test-re-rest reliability ($r=.81$, $p<.0001$) and internal consistency ($\alpha = .96$) (Carson et al., 2005).

3.5 Study 1 (Chapter four) *Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants*

A detailed discussion of the validity, reliability and factor structure of the measures used in this study is included below, as word limits for the journals in question preclude a more thorough discussion.

Personality Measure

- **NEO- FFI-R five factor personality inventory (Costa & McCrae, 1992)**

The NEO –FFI-R is a widely used, sixty item self-report personality measure (Costa & McCrae, 1985; Mc Crae & Costa, 2004) that measures a person's Big five personality factors. It rates five aspects of personality, namely Neuroticism (alpha coefficient: $\alpha = .82$), extroversion ($\alpha = .80$), Openness ($\alpha = .76$), Agreeableness ($\alpha = .75$) and Conscientiousness ($\alpha = .81$). It has good validity and reliability with two-week retest reliability is uniformly high, ranging from 0.86 to 0.90 for the five scales, and internal consistency ranges from 0.68 to 0.86 (Costa & McCrae, 1992). The revised version was developed in order to improve the psychometric properties of the instrument and provide validity across a broad sample, including a younger sample. The revised

version NEO-FFI_R was selected for this study, as it was valid for a younger sample and as indicated, the sample age in the research was 18-35 years. For the NEO-FFI-R the absolute discriminant correlations ranged from 0.02 to 0.43 with a median of 0.15. Recent psychometric evaluation of the NEO-FFI-R confirmed the five factor structure with high congruence across genders (Perera, McIlveen, Burton, & Corser, 2015).

Schizotypy Measure

- **Oxford-Liverpool Inventory of Feelings and Experiences (O-Life)**
(Mason & Claridge, 2006)

The Oxford-Liverpool Inventory of Feelings and Experiences (Mason & Claridge, 2006) is a well used measure of schizotypy (Ando et al., 2014; Burch, Pavelis, Hemsley, & Corr, 2006; Yaghoubi H & A., 2012). It comprises 104 items across four scales with the first two subscales associated with positive schizotypy; Unusual Experiences (Un Ex (30) $\alpha=.89$), which describes a propensity toward engaging in magical, mystical experiences and includes perceptual aberrations and magical thinking; Impulsive Non-Conformity (ImpNon (23) alpha coefficient: $\alpha=.77$) describes eccentric forms of behaviour including impulsivity and a lack of self control; Introverted Anhedonia (InAn (27) $\alpha .82$) is associated with the avoidance of intimacy and discomfort in social and physical environments and is associated with negative schizotypy; and Cognitive Disorganisation (CogDis (24) $\alpha=.87$) which contains items describing thought disorder and poor decision making together with aspects of social anxiety (Mason, 2015). The O-Life has been shown to have good test-retest reliability (3–6 months. 0.86 UnEx, 0.93 CogDis, 0.84 IntAn, 0.77 ImpNon), with factor analysis confirming the four scale structure (Mason, 2015). The authors also note that it is particularly sympathetic to

the unitary theory of psychosis proneness (Mason & Claridge, 2006) and appropriate for an at risk for psychosis population (Mason, 2015).

Paranoia Measure

- **Paranoid and suspiciousness questionnaire (PSQ) (Rawlings & Freeman, 1996)**

The Paranoia/Suspiciousness Questionnaire was designed to measure paranoia and suspiciousness in largely non-clinical populations. The forty-seven items in the questionnaire were developed from five existing criterion scales specifically assessing cognitions involving paranoia, hostility and suspiciousness. These scales were the paranoia scale from the MMPI; PEN psychoticism scale; STA paranoid ideation scale and 16PF suspiciousness scale and the Buss hostility scale. Of the 84 items examined only those items with a factor score of .32 and above were included. Five subscales were produced based on factor loadings, which were examined for internal consistency: interpersonal suspiciousness/hostility (IS: α .77); negative affect/withdrawal (NM: α .66); anger/impulsiveness (AI: α .71); mistrust/wariness (MW: α .65) and perceived hardship (PH: α .74) (Rawlings & Freeman, 1997). The PSQ had good internal reliability and test – retest reliability (α = .89)(Rawlings & Freeman, 1996).

3.6 Study 2 (Chapter five): *Spatial working memory rather than IQ or executive function discriminates early psychosis and ‘at risk’ creative individuals.*

- **Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler & Zhou, 2011)**

In order to screen for IQ, the two-subscale version of the WASI was administered to all participants (Wechsler & Zhou, 2011). The WASI has been found to be a valid measure of intelligence for both adult (eigenvalue factor 1: 2.87 factor 2: .58) and clinical samples (eigenvalue factor 1: 2.90, factor 2: .55) (Ryan et al., 2003). The measure was administered and scored according to standard protocols and the t scores combined to give an overall IQ score (mean = 107.7, standard deviation = 13.4). The WASI was administered to both clinical and control participants.

- **CANTAB Spatial Working Memory (Sahakian & Owen, 1992)**

Spatial working memory was assessed using the Cambridge Neuropsychological Test Automated Battery (CANTAB) (Sahakian & Owen, 1992). The CANTAB is a reliable and valid neuro-cognitive computerised measure. A review of validity and reliability using CANTAB in a clinical population indicated that the computerised tests corroborated results from neuropsychological studies using traditional tests (Levaux et al., 2007). Moreover the reviewers concluded that it was a useful tool to detect subjects at risk of developing psychosis (Levaux et al., 2007) prior to the apparition of the disorder as it discriminated aspects of spatial working memory. In the spatial working memory task used in study two, a number of coloured boxes were displayed on the screen with several of the boxes containing hidden tokens. The participant was required to search through the boxes to find these hidden tokens. In each trial the participant, had to remember where the tokens had been located and search in alternate boxes. Strategies used by the participant to remember the location of the tokens were also recorded and each trial increased in difficulty. *Between search errors* where a participant returns to a box in which a token had already been found and *strategy*

score based on a participant following a predetermined search sequence were the primary indicators used for analysis. A high strategy score indicates the participant is not using planning or preparation in the search sequence indicating that the participant is employing an inefficient strategy. The spatial working memory task was included in the test battery to determine whether it may discriminate early psychosis from control samples.

- **CANTAB Intra-extra Dimensional Shift (IED)** (Sahakian & Owen, 1992)

The IED is an attentional set-shifting neuropsychological assessment from the CANTAB battery (Sahakian & Owen, 1992). The IED has been designed based on a component analysis of the Wisconsin Card Sorting Test (WCST). It comprises two types of set-shifts: (i) “intra-dimensional shifts (IDS), which involve the transfer of a rule within the same stimulus dimension (e.g. choosing circles instead of squares); and (ii) extra-dimensional shifts (EDS), which require a transfer of attention across different stimulus dimensions (e.g. choosing on the basis of colour rather than on the previous category of shape). There are nine stages and the participant advances through the stages by learning the ‘rule’ at each stage. The number of stages completed was the primary indices used to measure executive function (Fagerlund, Pagsberg, & Hemmingsen, 2006; Luciana & Nelson, 1998). Previous studies have found that those with schizophrenia in particular, compared to controls record significant deficits in the extra-dimensional shift stage, which suggests deficits in executive function (Levaux et al., 2007).

- **Negative Priming Task** (Beech, Agar, & Baylis, 1989)

In order to measure reduced pre-attentive filtering (also known as cognitive inhibition), as discussed in 'Creative cognition and psychosis vulnerability: what's the difference' a negative priming task was included in the test battery. The negative priming task used is a computer generated modified version of the Stroop task, based on the procedure outlined by Beech, Powell, et al. (1989) and repeated in other studies (Green & Williams, 1999; Kaplan & Lubow, 2011). A stimulus for the negative priming task was generated on the one computer (MacBook pro) and using a device to record the target (colour). Responses measured the accuracy in identifying the colour and reaction times. Twelve lists of nine items were generated for each of the following conditions (36 in total). The order of presentation is as follows:

1. Priming distractor (PD): a stroop colour name (distractor) predicted the hue of the following stroop word (target).
2. Unrelated distractor (UD): the colour word and ink colour of the successive stroop words were unrelated.
3. Neutral distractor (ND): rows of X's in successively varied colours were used instead of stroop words.

Target stimuli in the PD and UD conditions were the colour hues red, blue, green and yellow; distractors were the colour words 'red' 'blue' 'green' and 'yellow' written in uppercase teletext characters 5 mm high. In the ND the rows of X's from 3-6 characters in length corresponding to the lengths of the distractor words. The fixation cross that preceded each train was 0.5 cm². Reaction times on the priming distractor (PD); neutral distractor (ND) and unrelated distractor (UD) were calculated and a negative priming effect calculated by subtracting PD-UD. The interference or stroop effect is calculated by subtracting UD-ND. Although the negative priming task has been

associated with reduced pre-attentive filtering in those with schizotypy (Beech, Baylis, et al., 1989) and those with schizophrenia (Beech, Powell, et al., 1989), an effect was not found in a first episode population (Chen, Wong, Chen, & Au, 2001).

- **Vividness of mental imagery Questionnaire (VVIQ) (Marks, 1973)**

As will be outlined in chapter five, vividness of mental imagery has been proposed as a trait marker for schizophrenia (Sack, van de Ven, Etschenberg, Schtz, & Linden, 2005). The VVIQ is a pen and paper questionnaire, where participants were asked to imagine sixteen items and provide ratings of the vividness of their images using a five-point rating scale. In this scale 5 indicated the least vivid image (no image at all) and 1 the most vivid (perfectly clear and vivid as normal vision). The VVIQ has a test-retest reliability coefficient on 0.74 and a split-half reliability coefficient of 0.85 (Marks, 1973). The VVIQ was used to determine good (indicated as a mean rating of 2.68) and bad (mean rating of 3.26) visualisers and these participants were examined on three separate visual tasks. The VVIQ was found to accurately predict good and bad visualisers based on their independent recall of visual information.

3.7 Study 3 (chapter seven): *Anxiety, paranoia and trauma in early psychosis and creative populations*

- **Depression, Anxiety and Stress Scale (DASS) (Lovibond & Lovibond, 1995)**

The Depression, Anxiety and Stress scale is a forty-two item instrument, consisting of three subscales measuring symptoms of depression, anxiety and stress (Lovibond &

Lovibond, 1995). In this scale depression is characterised as the absence of positive affect; anxiety is characterised as hyperarousal and fear while stress is identified as persistent irritability and frustration. There is however supporting evidence to suggest that DASS-stress is a measure of negative affect and symptoms, which correspond to generalised anxiety disorder (Brown, Chorpita, Korotitsch, & Barlow, 1997; Henry & Crawford, 2005). It was for this reason that both DASS-anxiety and DASS- stress subscales were specifically analysed in this study. Participants are asked to rate using a 0-3 scale (0 didn't apply to me, 3 applied to me very much) how much the symptoms applied to them over the past seven days. Higher scores indicate increased levels of emotional distress. The DASS has high internal consistency and convergent and discriminant validity (depression=.88 anxiety= .82 stress= .90 and total scale=.93) and it has been assessed as a reliable measure for community and clinical settings (Henry & Crawford, 2005).

- **Stressful Life Events Screening Questionnaire (SLE) (Goodman, Corcoran, Turner, Yuan, & Green, 1998)**

A modified version of the Stressful Life Events Screening Questionnaire (Goodman et al., 1998) was used. This is a twelve-item (rather than fourteen item) questionnaire that assesses exposure to stressful or traumatic life events. The items included 1) serious accidents, 2) natural disasters, 3 non-sexual assault by family member or someone you know 4) non-sexual assault by stranger 5) sexual assault by family member or someone known 6) sexual assault by stranger 7) military combat or war zone 8) sexual contact, younger than 18 with someone 5 + years older 9) imprisonment 10) torture 11) life threatening illness 12) catch all question- other

traumatic event e.g. traumatic relationship breakdown. The scale was modified to minimise the negative impact of the administering the scale within a research setting therefore participants were only asked to indicate whether they had experienced a specific stressful life event. They were then asked to indicate their age at the time of the event and to indicate how distressing they found this event on five-point scale (0-not stressful to 4-extremely stressful). Although the distress question was asked in the test battery, this was not included in the final analysis as reported incidence (including multiple incidence) and age were of primary interest. The original questionnaire has a good test, re-test reliability (overall correlation of .89) with the median kappa for reporting on specific events across administrations being .73 (Goodman et al., 1998). In the final analysis (chapter six), three items were not included, namely military combat, torture and imprisonment due to insufficient response. Of the remaining subscales, total incidence of stressful life events and type of stressful life event were reported.

3.8 Examples of creative potential: Abbreviated Torrance Test for Adults (Goff & Torrance, 2002)

As outlined earlier in this chapter, all participants were administered the Abbreviated Torrance Test for Adults (ATTA) (Goff & Torrance, 2002). This test comprises three tasks; the first calls for a verbal response to a hypothetical problem and the following two tasks require figural responses. In three minutes the participant is asked to draw a story from incomplete figures or triangle figures. Participants are asked to respond to the challenge using imagination and problem solving ability. The raw scores for the four individual measures of fluency, originality, elaboration and flexibility were

converted to normalised scaled scores. These scaled scores when combined with the criterion reference indicators (such as openness: resistance to premature closure, richness and colourfulness of imagery, abstractness of titles, humour) to give a creativity indicator. The creativity indicator (CI) can then be mapped to a composite measure that assesses creativity level from minimal to substantial. One of the criticisms levels at creativity research is determining how to measure creativity. The ATTA was chosen from other measures of creativity as it had a detailed and validated scoring, which eliminates subjectivity when determining levels of creativity. As indicated earlier the ATTA records good inter-rater reliabilities ranging from .95 to .99. These give a verbal and a figural creativity measure and lead to a total Creativity Indicator (CI) with a range of 1 to 85+ with a mean of 68-73. Internal reliability as assessed by the KR21 was reported to be .84 (Goff & Torrance, 2002).

In order to illustrate the difference in creativity between the different groups in this thesis, the following are actual examples from the ATTA. The figures (Figure 2) below provides an example of two different responses from each of the four groups (non-creative, creative, 'at risk' creative and early psychosis).

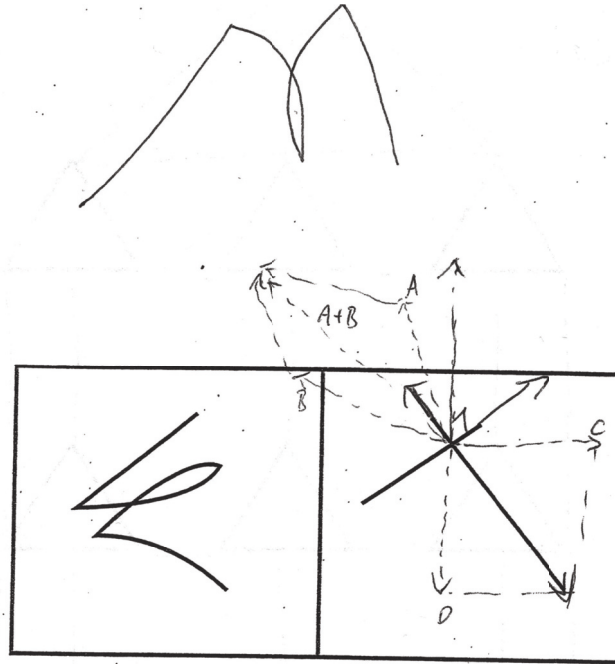
Figure 2: Examples of participant responses from ATTA Figural test 2/3

Non-creative control: 077CCPDT CI: 47 (minimal creativity)

Gender: Male

Age: 23 years

Occupation: Fifth year medical student at a prestigious university



When he completed the test he said,

"This is the hardest thing I've had to do" and

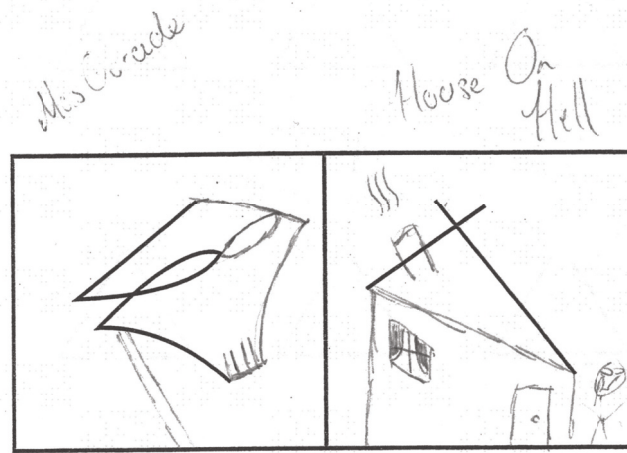
"Why is creativity important anyway".

Creative control 037CCPMA CI 75 (above average creativity)

Gender: Male

Age: 18years

Occupation: Student: Australian Institute of Music

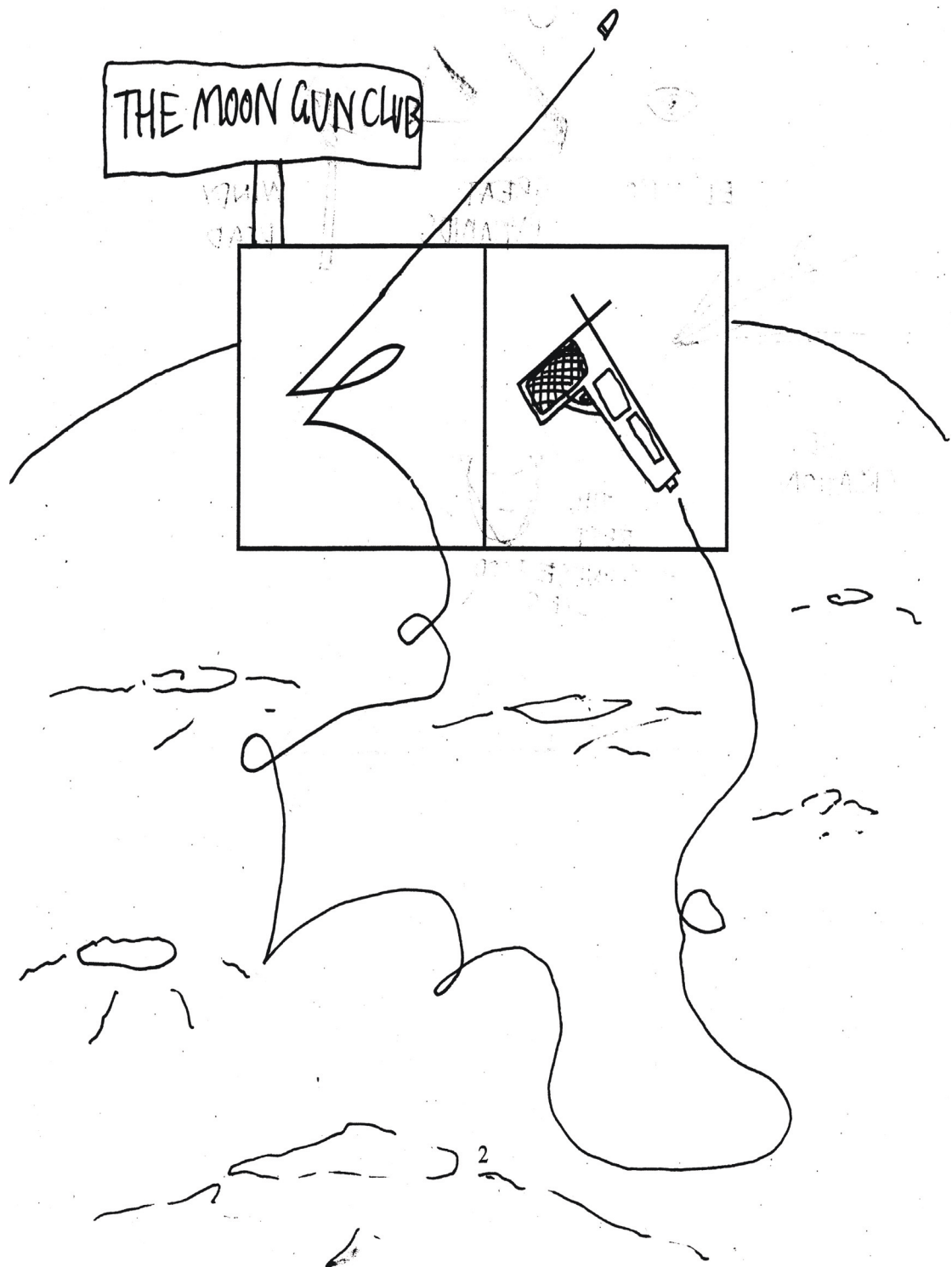


'at risk' Creative control 102CCPSW CI 91 (Substantial creativity)

Gender: Male

Age: 28 years

Occupation: Masters student at National Art School

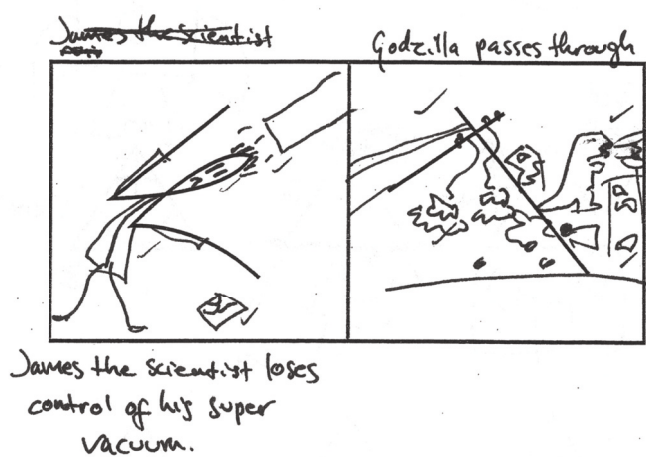


Early Psychosis: 097CCPJS CI:92 (substantial creativity)

Gender: Female

Age: 23 years

Occupation: Fire-eater in a small circus performance group



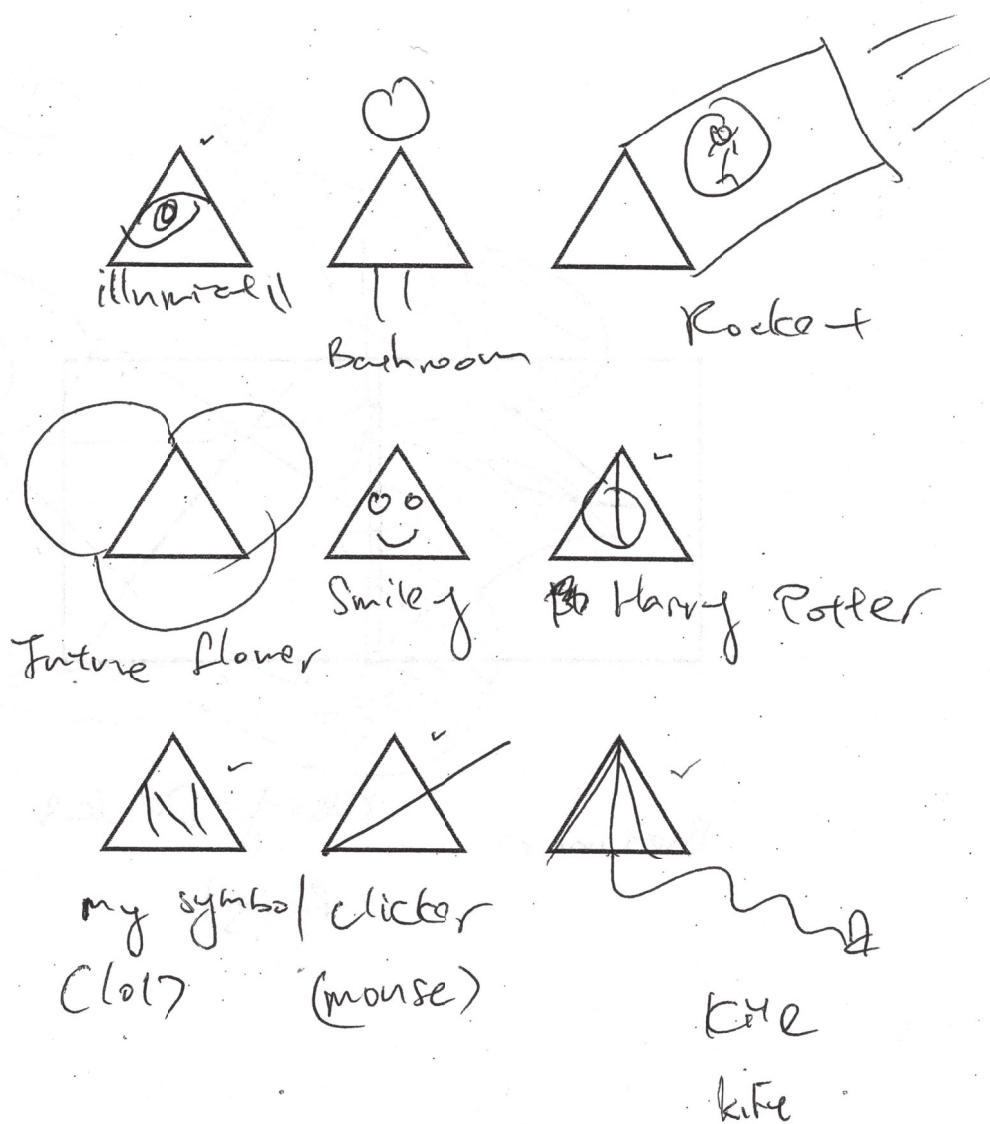
The ATTA had a final figural text. The participant was asked, in 3 minutes to make objects or pictures from the triangles below.

Early psychosis – 049CCPNN CI: 82: (High creativity)

Gender: Female

Aged : 20 years

Occupation: Film director

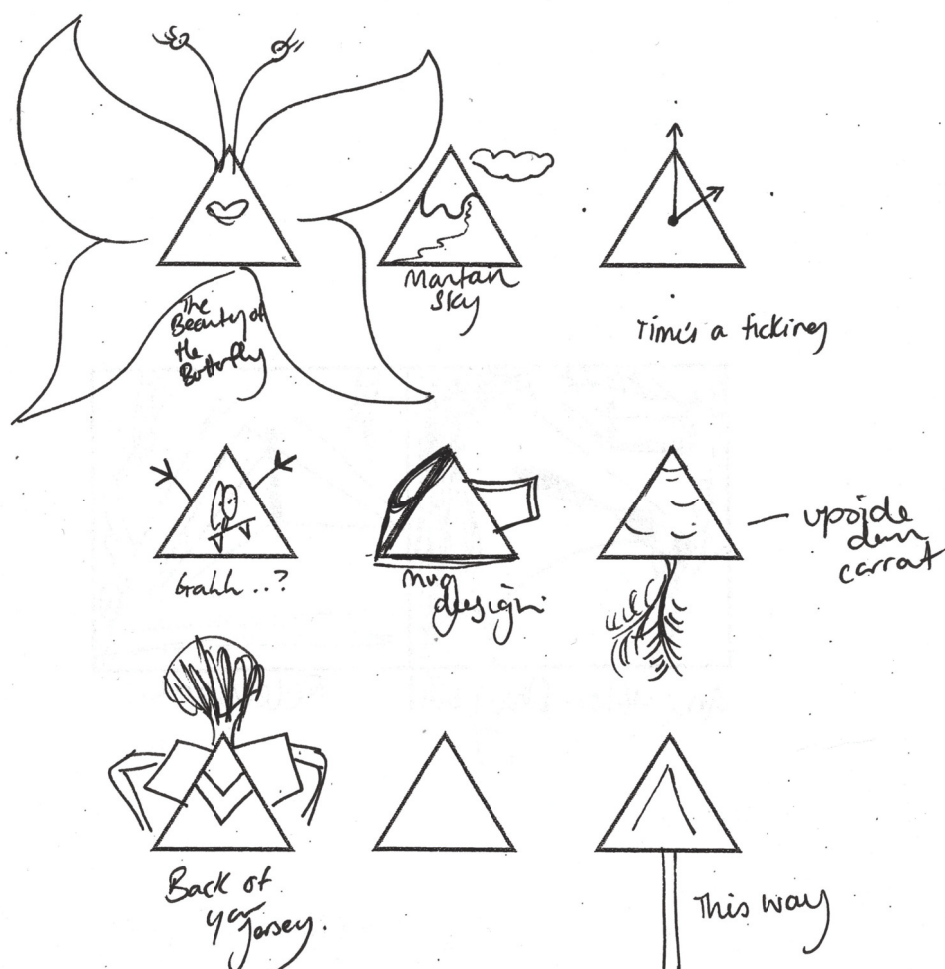


'at risk' creative-093CCPHH :94: (substantial creativity)

Gender: Female

Age: 23 years

Occupation: student: performance and drama

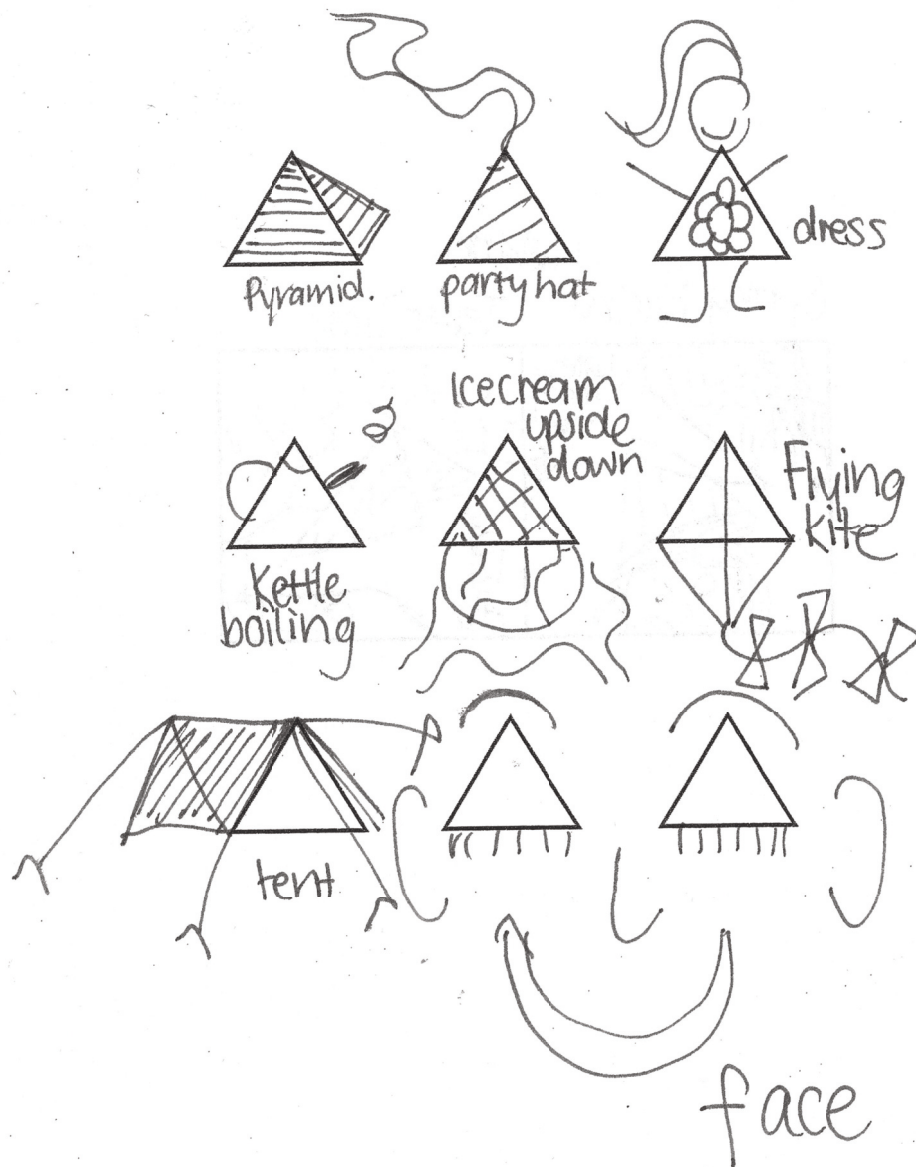


Creative 045CCPCY : CI: 90 (substantial creativity)

Gender: Female

Age: 24 years

Occupation: Student NAS

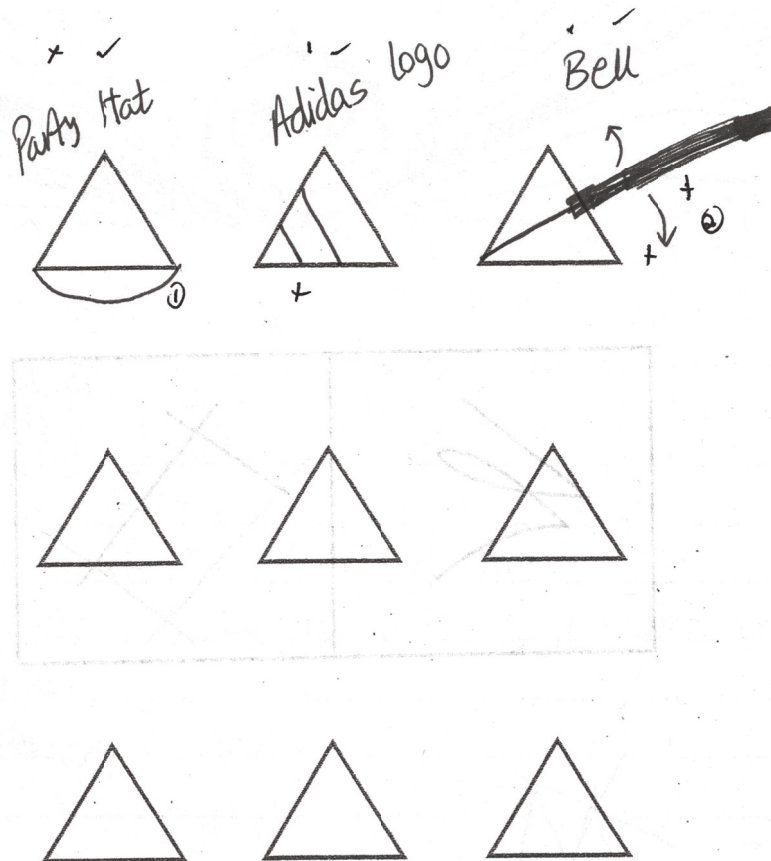


Non-creative 113CCPUM:CI: 56: (low creativity)

Gender: Female

Age: 23 years

Occupation: MA student management



These examples from the ATTA depict examples of

fluency – the ability to think quickly

originality – the ability to think original thoughts (compared to a list of standard ideas)

elaboration – the ability to develop ideas

flexibility – the ability to think about objects in multiple ways

The difference between the creative and early psychosis results compared to the non-creative population is evident from the above representative examples. Examples of criterion referenced indicators such as humour; resistance to premature closure; ideas are open; use of imagery are also present in the above examples.

In summary

As the research question sought to examine similarities and differences between an early psychosis, creative and non-creative sample, a cross sectional methodology was used. The first study examined personality similarities and differences; the second study investigated cognitive differences and the third study determined aspects of anxiety, paranoia and stressful life events that may differentiate the populations.

The first study to be discussed is examining personality.

Chapter Four

Prelude to chapter four

The ability to create has been associated with specific personality features common to both creative and clinical populations, specifically those with bipolar and schizophrenia (Nettle, 2006; Nowakowska et al., 2005). Various theorists have attempted to describe the processes involved in creativity. Although there are differences in language (Basadur & Basadur, 2011; Crabtree & Crabtree, 2011; Ma, 2009; Mednick, 1962), most describe a four or five stage process:

1. Preparation: curiosity or problem finding;
2. Incubation: perception or problem retrieving
3. Illumination: discovery or generating potential solutions
4. Generating criteria for evaluating solutions
5. Verification: production or selecting and implementing solutions

It may be hypothesised that many of the personality and schizotypal features associated with creative individuals can be connected to the drive to create (Nelson & Rawlings, 2010). For example these personality and schizotypal features include the ability to seek novelty (openness); feel self and others pain (neurosis) along side being non-conformist (impulsive non-conformity) and open to unusual and often mystical experiences (unusual experiences). With respect to the creative process, preparation/curiosity may be linked to openness where the individual is creating memories from which to draw in the moment of creative perception (Bink & Marsh, 2000). Unusual experiences and high neurosis may be linked to the ability to discover

or incubate the creative idea (Michalica & Hunt, 2013; Nelson & Rawlings, 2010) and Impulsive non-conformity may be linked to the problem finding or curiosity. On the one hand these personality and schizotypal qualities are linked to the creative process, while on the other hand they are also associated with psychopathology.

Chapter four discusses similarities and differences in personality across creative, non-creative and early psychosis populations.

Title: Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants

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Journal: Psychosis

Author Contribution: Julie Crabtree (90%); Toby RO Newton-John (10%)

This manuscript is exactly as it appears in the following published article:

Crabtree, J., & Newton-John, T. R. (2019). Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants. *Psychosis*, 11(2), 138-150.

4.0 Abstract

Epidemiological evidence supports common genetic determinants between psychosis spectrum populations and creative individuals. Aspects of personality may contribute to protecting the creative artist from psychosis vulnerability. This study examines the similarities and differences in personality within a sample of Early Psychosis (EP), Creative Control (CC) and Non-Creative Control (NCC) participants. Findings indicated that the CC group shared closer personality commonalities with the EP group than with NCC participants, on traits such as Neuroticism, Openness, and Impulsive Non-conformity as well as on variables such as Unusual Experiences, Cognitive Disorganization and Paranoia/Suspiciousness. However, the CC group may better manage their emotional sensitivity and interpersonal suspiciousness than the EP participants. In separate analyses, CC and EP participants recorded higher creative cognition than NCC participants. Unsurprisingly the CC group reported significantly higher creative achievement than the EP and NCC samples. Of note, the findings indicate that, EP participants recorded significantly higher creative achievement than NCC, suggesting that EP patients demonstrate some capacity for creative cognition and creative achievement. These preliminary findings may encourage further research and promote avenues of treatment for 'at risk' creative individuals and early psychosis individuals.

4.1 Introduction

Similarities between highly creative individuals and those with bipolar disorder and schizophrenia have been well documented (Andreasen, 1987; Brod, 1997; Jamison, 1995; Ma, 2009; Rybakowski et al., 2008), however there is ongoing debate over what aspects of these schizophrenia and bipolar disorder populations contribute to this association. Three large Swedish epidemiological studies provide support for the assertion that there are common genetic determinants between bipolar disorder and schizophrenia (Kyaga et al., 2011; Lichtenstein et al., 2009; MacCabe et al., 2018), and that creativity and creative professions are overly represented amongst those with bipolar disorder and among the family members of those with schizophrenia and bipolar disorder (Kyaga et al., 2011). Furthermore, a recent study also found the common polygenetic risk scores associated with bipolar disorder and schizophrenia also predicted creativity (Power et al., 2015) providing additional genetic evidence supporting the association between creativity and mental illness.

In considering these associations, a unitary psychosis theory has been proposed (Carson, 2011; Claridge & Blakey, 2009; Sass, 2001) which argues that the apparently distinct clinical classifications with bipolar disorder and schizophrenia in fact have common underlying processes that differentially contribute to creativity. Specifically, Carson proposed a model of shared vulnerability between those with high creativity and individuals with psychopathology (Carson, 2011) based on existing research into

molecular biology. The author suggested that hyper-connectivity, or the unusual neural linking of uncommon brain areas (often associated with psychosis), a preference for novelty, and attenuated latent inhibitions, are shared vulnerability factors operating below the level of consciousness between those with high creativity and those with psychopathology. High IQ, working memory skills and cognitive flexibility are thought to help protect the high creativity population from developing psychosis by providing a meta-cognitive control over bizarre, unusual thoughts. In contrast, she suggests risk factors such as low IQ, perseveration, and poor working memory may render the creative individual vulnerable to developing psychopathology. Carson acknowledges that this is an incomplete list and suggests additional studies would extend this model. Further clarification is particularly apt as the factors proposed are generic and too broad to have specific clinical application. Since this model was proposed, vulnerability factors for those 'at risk' for psychosis has been an area under increasing investigation (Fusar-Poli, Nelson, Valmaggia, Yung, & McGuire, 2014) with risk factors such as childhood trauma, early adolescent low functioning and socio-demographic factors along with cognitive deficits such as verbal learning impairments (Carrión et al., 2018) also associated with transition to psychosis. However, these additional vulnerability factors have not, as yet, been considered in relation to a specific creative population.

Carson's shared vulnerability model proposed novelty seeking as the only personality trait common to the creative individual and those with psychopathology. This study will examine if aspects of personality beyond the factors outlined by Carson, contribute to "protecting" the creative population from psychosis. Specifically, do aspects of personality and schizotypy differentiate the highly creative from those with

expressed psychosis? Schizotypy is considered to be an aggregate of personality traits that lie along a continuum from normality to schizophrenia (Cochrane et al., 2012; Siddi et al., 2017). Genetic, cognitive and brain fMRI studies provide supportive evidence for an overlap between schizophrenia and schizotypy (Wang et al., 2017). Aspects of positive schizotypy such as Impulsive Non-Conformity and Unusual Experiences, along with personality features such as Openness and Neuroticism have consistently been associated with both the highly creative, bipolar and schizotypal populations (Batey & Furnham, 2008; Srivastava et al., 2010).

The authors, (Nelson & Rawlings, 2010) investigated psychopathology and personality indicators of creative experience in a study of 100 creative artists. Aspects of positive schizotypy (Unusual Experiences) were found to be the strongest predictor of creative experience, along with the 'Big Five' personality dimensions of Openness to Experience and Neuroticism, when compared to normative data. This is consistent with a number of other studies associating in particular Openness to Experience with creative cognition (Jung, Grazioplene, Caprihan, Chavez, & Haier, 2010; Jung, Mead, Carrasco, & Flores, 2013). As it has been postulated, Openness provides creative individuals with a deeper memory bank of experiences, thoughts and problem solving strategies for creative thinking (Ma, 2009).

Whilst the research discussed above has primarily investigated personality in non-clinical populations, a small number of studies have analysed personality and cognitive features in clinical and creative samples. In a comparison of personality similarities and differences between participants with a diagnosis of Bipolar 1 Disorder (BD), unipolar depression diagnosis (MDD), creative arts students (CC) and healthy controls (HC), Nowakowska and colleagues (Nowakowska et al., 2005) reported the most prominent

personality similarities were between BD and CC populations. In particular the authors found novelty seeking, self-transcendence (the experience of oneself as an integral part of the universe (Cloninger, 1994)) and the affective temperament factor, cyclothymia, were similar across BP and CC populations. This finding of common personality traits between Bipolar (BD) and Creative (CC) populations has been supported in two similar studies (Srivastava et al., 2010; Strong et al., 2007). Both these studies record similarly high scores on Neuroticism and Openness in BD and CC populations, which Strong suggests implicates an affective (e.g. Neuroticism) and cognitive/flexibility (e.g. Openness) component to creativity. Strong et al. (2007) hypothesised that these tendencies may assist creative expression through the ability to tolerate intense and often negative and varied shifts in emotion (Neuroticism), associated with driving innovation through dissatisfaction with the status quo (Strong et al., 2007). In contrast, she suggests Openness (which she associates with cognitive flexibility) may contribute to creative achievement and interpersonal relationships. Taken together, these studies suggest that particular personality traits and certain positive schizotypal traits may differentially contribute to creative cognition. Mason's review of the assessment of schizotypy (Mason, 2015), noted that research into schizotypal personality characteristics should include a measure of paranoia/suspiciousness. Paranoid ideation has also been associated with those 'at risk' for psychosis (Masillo et al., 2017; Valmaggia et al., 2015) however most research has examined the relationship between positive schizotypy and creativity e.g. (Nettle, 2006) rather than paranoia.

Similarly, while many studies have researched creative inclination and creative potential with both bipolar and schizophrenia populations (Wang et al., 2017), few

studies have investigated creative production or the ability to follow through with creative inclination to actually produce and deliver creative outputs (Andreasen, 1987). Further investigation is warranted into which aspects of personality and schizotypy (including paranoia/suspiciousness) are associated with creative production (or the lack of it) in populations with these clinical disorders, in the presence of creative cognition (Kyaga et al., 2011).

Therefore, the aim of the present study is to further investigate relationships between personality and creativity across clinical, creative and non-creative control samples.

Based on previous research, we hypothesise:

- (1)** Non-significant differences in specific personality traits will be observed between highly creative and clinical populations, such that individuals with early psychosis (EP) will report similar levels of Neuroticism and Openness, Impulsive Nonconformity and Unusual Experiences to individuals defined as highly creative; however both groups will show significantly elevated levels of these traits compared to non-creative control individuals.
- (2)** Personality traits such as paranoia and suspiciousness will be more evident in early psychosis (EP) participants when compared to CC and NCC individuals.
- (3)** The CC and early psychosis (EP) participants will demonstrate significantly higher creative thinking scores compared to NCC participants, but CC participants will record significantly higher levels of creative achievement when compared to both NCC and EP individuals.

4.2 Methods

Recruitment and study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 11279) and ratified by the University of Technology (HREC UTS ETH16-0532). All participants provided written consent prior to participation. Participants were aged 18-35 as we were interested in first episode psychosis and epidemiological studies suggest the age of onset of psychosis ranges from 15 – 35 with the median age of initial presentation in the mid twenties (Kessler et al., 2007). All participants were given a \$AUD40 monetary reimbursement for travel costs.

Participants

Early psychosis participants (EP) N=21

Early psychosis participants were recruited from a previous study (Rowland et al., 2012), and had given consent to be approached for further studies. Twenty-five participants were approached for the study and twenty-one agreed to participate. Of the four who declined to participate, two reported active psychotic symptoms and two failed to respond to invitations to participate. All were recruited from either an inpatient or outpatient hospital clinic and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis (DIP), administered by an experienced clinician. All early psychosis participants met criteria for psychotic disorder according to ICD -10 criteria and had recorded a first episode psychosis or hospitalisation. Active psychotic symptoms were an exclusion criteria for the study, hence a PANSS (Positive and Negative Syndrome Scale for Schizophrenia (Kay et al.,

1987) measure was given at the time of testing. No participants were excluded due to the presence of acute psychotic symptoms.

Creative control participants (CC) N=55

Creative control participants were recruited following a brief presentation by the lead researcher (JC), to several Creative Art Colleges around Sydney, Australia. The recruitment sites included tertiary creative training institutions such as music colleges (contemporary, classical music, composition, vocals), visual arts colleges, as well as advertising on relevant creative websites (e.g. *livingwithacreativemind.com*).

Individuals were presented with an outline of the research and gave written consent to take part in the study. Creative controls were screened for past or present psychotic symptoms using a MINI (brief structured psychiatric questionnaire) (Lecrubier et al., 1997). None were found to have past or present syndromal psychiatric disorders. Of those recruited 27 were primarily engaged with music; 15 were visual or graphic artists, 12 were actors or involved in the theatre and 1 was engaged in web development and design.

Non-creative control participants (NCC) N=24

Healthy, non-creative controls were recruited via a university website. The online information asked for psychologically healthy volunteers to participate in research into creative cognition, and thirty-three individuals initially responded. Nine participants were excluded because they met either of the following three exclusion criteria: i) no personal or family history of mental illness; ii) an inability to communicate proficiently in spoken and written English and iii) receipt of more than rudimentary training in any field of creative arts. Using the MINI (Lecrubier et al.), the normal non-creative

controls were also screened for any current mental illness and one participant was excluded (eating disorder). These participants were reimbursed for their time.

Measures

All participants completed a series of tests including self-report questionnaires, mood assessment and intellectual ability testing.

Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler & Zhou, 2011)

In order to screen for IQ, the two-scale version of the WASI was administered to all participants. The WASI has been found to be a brief but valid measure of intelligence in both healthy adult and clinical populations (Ryan et al., 2003). The two-scale version comprises a forty-two item test of vocabulary and a thirty-five item matrix reasoning test. The measure was administered and scored according to standard protocols.

Abbreviated Torrance Test for Adults (Goff & Torrance, 2002).

All participants were administered the Abbreviated Torrance Test for Adults (ATTA)(Goff & Torrance, 2002) as a measure of creative potential. This test comprises three tasks where participants are asked to respond to each challenge using imagination and problem-solving ability. The measure was selected as longitudinal studies support the consistent relationship between test behaviour and creative achievement and the Torrance test is the most widely used and well researched creativity measure (Torrance, 2000). Two scorers (JC and SG) evaluated each ATTA and where scores differed, the average was used.

Creative Achievement Questionnaire (Carson, 2005).

To evaluate creative output, the Creative Achievement Questionnaire (CAQ) (Carson et al., 2005); was administered to all participants. In the CAQ participants were asked to

indicate their creative accomplishments in ten separate domains: (visual arts; music including both instrument and voice; dance; theatre, film and including acting and creative direction; architecture including graphic design; creative writing; humour; inventions including computer and web design). Weighted scores indicating the achievements within each domain were calculated. The CAQ has good test-re-test reliability ($r=.81$, $p<.0001$) and internal consistency ($\alpha = .96$).

Neuroticism Extraversion and Openness Scale Five Factor Inventory (NEO-FFI-R)
(McCrae & Costa, 2004).

Participants were administered a self-report personality measure NEO-FFI-R (Costa & McCrae, 1985; McCrae & Costa, 2004) which rates five aspects of personality, namely Neuroticism, Extroversion, Openness, Agreeableness and Conscientiousness. The NEO-FFI-R is a 60-item, widely used measure of personality.

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE) (Mason & Claridge, 2006)

The Oxford-Liverpool Inventory of Feelings and Experiences (Mason & Claridge, 2006) is a well used measure of schizotypal personality in schizophrenic patients and healthy controls ($\alpha=.87$) (Ando et al., 2014; Burch, Pavelis, et al., 2006; Cochrane, Petch, & Pickering, 2010; Yaghoubi H & A., 2012). It comprises 104 items across four scales; Unusual Experiences (Un Ex), which describes perceptual aberrations and magical thinking and is linked to positive aspects of schizotypy; Impulsive Non-Conformity (ImpNon) describes eccentric forms of behaviour including impulsivity and a lack of self-control; Introverted Anhedonia (InAn) associated with avoidance of intimacy and discomfort in social and physical environments and is associated with negative

schizotypy; and Cognitive Disorganisation (CogDis) which contains items describing thought disorder and poor decision making along with aspects of social anxiety.

Paranoid Suspiciousness Questionnaire (PSQ) (Rawlings & Freeman, 1996)

The `Paranoia/Suspiciousness Questionnaire was designed to support the O-LIFE as a measure of schizotypy in largely non-clinical populations. It is a 47-item questionnaire specifically assessing cognitions involving paranoia and suspiciousness. It also includes seven subscales: interpersonal suspiciousness/hostility (IS); negative affect/withdrawal (NA); anger/impulsiveness (AI); mistrust/wariness (MW) and perceived hardship (PH) (Rawlings & Freeman, 1997).

Procedures

All participants were tested individually, at a single session, in a dedicated confidential space either within a hospital environment (EP) or on student campus at a creative arts (CC) or a university setting (NCC). Participants presented themselves at the testing room and completed a written consent form prior to testing. The testing period ranged from 2-3 hours. Standardised test administration protocols were followed for all tests including the two-scale version WASI IQ (Wechsler & Zhou, 2011). Multiple test administrators were used and all were professionally trained in standardised intelligence testing.

Data analysis

Data were initially screened for missing values, and less than 5% of the dataset found to be missing which is within recommended limits for non-correction (Tabachnick, Fidell, & Osterlind, 2001). A series of data normality of distribution checks were then run (presence of outliers, skewness/kurtosis), as well as Levene's test for homogeneity

of variance, and all variables found to meet criteria for parametric statistical analyses. A post-hoc power calculation was carried out using G*Power (Erdfelder, Faul, & Buchner, 1996), which confirmed that assuming a small to medium effect size (0.4), and using an alpha rate of 0.05, the study was powered at 0.9 to detect a significant difference between groups with the present sample. A Bonferroni correction was applied to all comparative analyses, given the multiple tests conducted in this study. All statistical analyses were conducted using SPSS version 23.

4.3 Results

Descriptive statistics

A total of 100 subjects participated in the study (EP: 21; CC: 55; NCC: 24). Mantel-Haenszel chi-square tests of significance were used to test for differences in the bivariate associations between demographic variables (age, sex and IQ), and are presented in Table 2. There were no significant differences in age, gender or IQ between the three groups of participants. The sample was predominantly female (61.4%), the mean age of the participants was 23.71 (SD= 4.19; Median = 23), and 53.5% of all participants were in the younger age group (<23 years).

Table 2.

Sample description

	EP	CC	NCC	Statistical Value for main effect
<i>N</i>	21	55	24	
Age	25.4 ± 4.2	23.4 ± 4.3	22.8 ± 3.6	($F_{2,101}=2.433$, $p=.093$)
Female (%)	57.1	63.6	62.5	($\chi^2 = 0.201$, $p=.904$)
IQ	107.9 ± 15.2	109.4 ± 10.3	104.9 ± 13.4	($F_{2,97}=1.101$, $p=.337$)

EP will report similar levels of Neuroticism and Openness, Impulsive Nonconformity and Unusual Experiences to individuals defined as highly creative

Group differences on NEO-FFI-R

Group means and standard deviations for NEO results are summarized in Table 3. To examine group differences, we conducted a series of ANOVAs with group (NCC; CC; EP) as the independent variable and the NEO-FFI-R subscales (Extraversion; Neuroticism; Openness; Agreeableness and Conscientiousness) as the dependent variables. The CC and EP groups both reported significantly higher scores on the Neuroticism and Openness subscales compared to NCC ($p < .001$). The EP population also reported significantly higher scores on the Neuroticism subscale compared to the CC (and NCC groups). The non-creative control group was significantly more Conscientious than the early psychosis group ($p < .05$).

Group Differences on the O-LIFE

Whereas the NEO-FFI-R is a measure of “normal” personality features, the O-LIFE measures schizotypal personality traits. Results of the one-way ANOVA comparing the three groups on the O-LIFE subscales are presented in Table 4. These show the EP and CC participants scored significantly higher on Unusual Experiences (UE), Impulsive Non-Conformity (Imp N), and Cognitive Disorganisation (Cog D) compared to the NCC participants (all $p < .001$), but were not significantly different from each other. In relation to Introverted Anhedonia (IA), although the ANOVA just met statistical significance, none of the post-hoc tests were significantly different from each other. This casts doubt on the reliability of the omnibus test; hence we have not included this variable among the group of significantly different group comparisons.

Considering NEO and O'LIFE together, Openness, Impulsive Non-Conformity, Unusual Experiences and Cognitive Disorganisation are similarly associated with EP and CC populations. Results on the Neuroticism personality factor in the NEO_FFI_R present a slightly different picture. Similar to the above factors, both clinical and creative participants recorded significantly higher scores on Neuroticism when compared to the NCC group, however the EP sample recorded significantly higher results again when compared to the CC group.

Table 3

Means and Standard Deviations for all Groups on the NEO-FFI-R variable

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	55	24	
Neuroticism	30.4 ± 8.6	24.6 ± 8.3	17.0 ± 6.9	$F_{2,99}=15.90, p<.001^a$
Extraversion	29.3 ± 7.9	30.3 ± 6.4	29.2 ± 4.8	$F_{2,99}=.346, p=.709$
Openness	33.9 ± 7.2	33.4 ± 6.8	24.2 ± 5.8	$F_{2,99}=17.90, p<.001^b$
Agreeableness	28.1 ± 5.3	31.7 ± 7.1	31.0 ± 5.9	$F_{2,99}=2.45, p=.091$
Conscientiousness	26.8 ± 7.5	29.7 ± 6.9	32.4 ± 7.3	$F_{2,99}=3.45, p<.05^c$

a = EP > CC > NCC**

b = EP, CC > NCC**

c = NCC > EP*

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

Table 4

Means and Standard Deviations for all Groups on the O-LIFE variable

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	55	23	
Unusual Experiences	12.4 ± 7.6	13.3 ± 6.4	3.4 ± 4.0	$F_{2,98}=20.89, p<.001^a$
Cognitive Disorganisation	14.8 ± 5.1	12.3 ± 5.0	5.7 ± 5.1	$F_{2,98}=19.96, p<.001^a$
Introverted Anhedonia	8.2 ± 5.3	5.6 ± 3.9	7.6 ± 5.0	$F_{2,96}= 3.30, p=.042$
Impulsive Nonconformity	9.6 ± 4.9	9.4 ± 4.0	5.1 ± 3.3	$F_{2,98}=10.05, p<.001^a$

a = EP, CC > NCC**

** $p<.01$

Negative personality features such as paranoia and suspiciousness will be more evident in EP participants, when compared to CC, NCC participants.

Group Differences on the P/SQ

The P/SQ measures negative personality feature such as general suspiciousness and hostility in interpersonal communication, alongside mistrustful and wary tendencies and resentment toward perceived hardship. To test the hypothesis that there would be a difference in positive and negative schizotypal features between EP, CC and NCC groups, a one-way ANOVA was conducted on P/SQ scores (see Table 5). The overall paranoia/suspiciousness mean score was significantly higher in the EP and CC groups compared to the NCC ($p < .001$), however a significant difference ($p < .001$) was also recorded between the EP and CC groups, supporting our hypothesis that negative schizotypal personality characteristics, measured by the PSQ, will be more prevalent in the EP population. Within the subscale comparisons, a comparative pattern of results was found for the Interpersonal Suspiciousness domain, with the NCC group reporting significantly lower scores than the other two groups ($p < .001$). The EP participants reported significantly greater negative personality features on Negative Mood and Anger Impulsiveness compared to the NCC participants ($p < .001$), however they were not significantly elevated compared to the CC group. Finally, scores on the Hardship/Resentment subscale were significantly higher among the EP group compared to both the CC and NCC groups.

Table 5

Means and Standard Deviations for all Groups on the PSQ variable

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	56	23	
Total paranoia/suspicious	24.9 ± 9.2	19.1 ± 7.9	14.2 ± 7.2	$F_{2,99}=9.83, p<.001^a$
Interpersonal suspicious	6.6 ± 3.4	5.5 ± 2.7	3.1 ± 2.6	$F_{2,99}=9.18, p<.001^{b,c}$
Negative mood	4.5 ± 1.7	3.7 ± 1.6	2.8 ± 1.2	$F_{2,99}=6.33, p<.05^d$
Anger impulsiveness	4.3 ± 3.2	3.3 ± 1.7	2.3 ± 1.2	$F_{2,99}=5.36, p<.05^d$
Mistrust Wariness	3.6 ± 2.0	2.8 ± 1.9	2.6 ± 1.9	$F_{2,99}=1.76, p=.176$
Hardship	3.5 ± 2.2 ^e	2.1 ± 2.1	1.7 ± 1.5	$F_{2,99}=5.36, p<.05^e$

a = EP > CC > NCC*

b = EP > NCC**

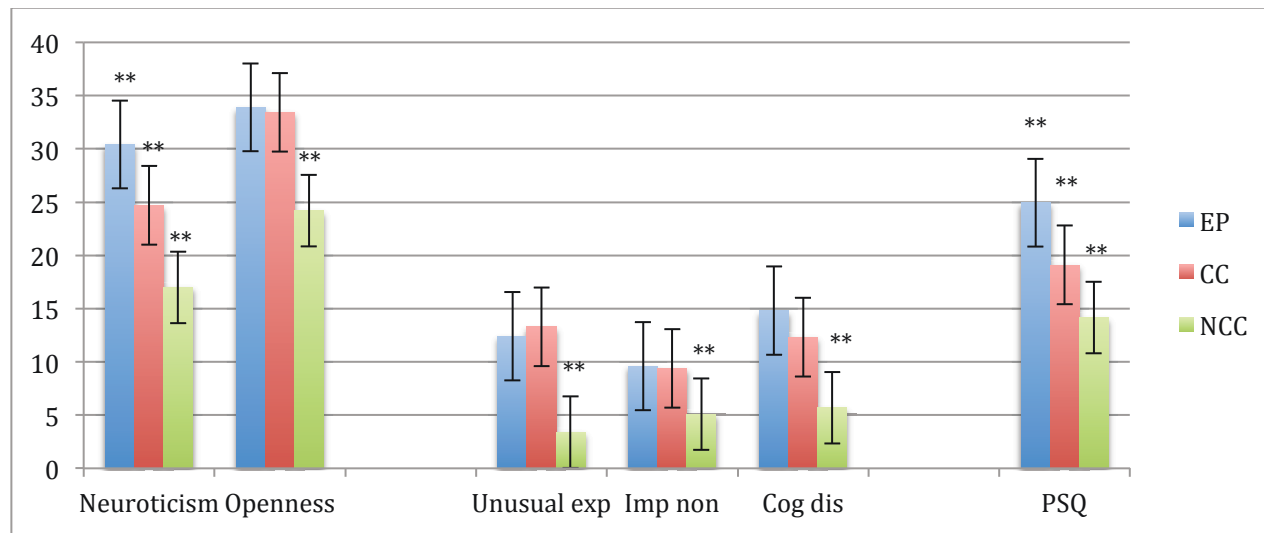
c = CC > NCC*

d = EP > NCC*

e = EP > CC, NCC*

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

To summarize, this cluster of shared personality features indicates adaptive character traits typically associated with positive schizotypal features were found in both EP and CC populations. However, the EP population is distinguished from the CC both by an increase in Neuroticism and Interpersonal Suspiciousness symptoms, and the presence of additional negative schizotypal features. The presence and intensity of these negative traits may either impede creativity or prevent this creative potential converting to creative achievement in the EP population. Figure 3 illustrates a graph of means for NEO-FFI-R, O-Life and PSQ.



** $p < .01$

Figure 3: Graph of means for NEO-FFI-R (Neuroticism, Openness), O-LIFE (Unusual Experiences, Impulsive Non-Conformity, Cognitive Disorganization) and Paranoid Suspiciousness Questionnaire (Total score).

The CC and EP participants will record significantly higher creative thinking, but CC participants will record significantly higher levels of creative achievement

Group Differences of the Abbreviated Torrance Test for Adults (ATTA) (Goff, 2002) and Creative Achievement Questionnaire (CAQ) (Carson, 2005).

A series of one-way ANOVAs were conducted to determine if there were any group differences in creative potential as measured by the divergent thinking (ATTA measure) and in creative achievement as measured by the CAQ (see Table 6). Not surprisingly the CC individuals scored significantly higher on the divergent thinking and CAQ measures, compared to the NCC group. While there was no significant difference between the CC and EP population on the divergent thinking task, there was a significant difference between CC and EP on the CAQ. Of particular note however is the finding that the EP population scored significantly higher than the NCC on the CAQ. These results suggest that while the EP population has similar creative potential (divergent thinking) to the creative population, they are less able to translate this into creative achievement. However, some creative achievement was still evident.

Table 6

Means and Standard Deviation for all Groups on Creative Achievement (CAQ) and Creative Thinking (ATTA)

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	54	23	
Creative Achievement	25.1 ± 25.6	48.2 ± 29.4	3.4 ± 4.7	$F_{(2,97)} = 27.11, p < .001^{a,b}$
Creative Thinking	76.5 ± 12.5	79.7 ± 8.8	67.5 ± 9.2	$F_{(2,97)} = 12.68, p < .001^{b,c}$

a = CC > EP, NCC**

b = EP > NCC*

c = CC > NCC**

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

4.4 Discussion

This research aimed to delineate the similarities and differences in personality between highly creative and early psychosis populations, using a non-creative but similarly intellectually capable control group. Before discussing the results it is important to note that as our research was cross sectional rather than longitudinal and so our comments are preliminary in nature. These results support previous assertions that the personality and schizotypal traits of highly creative individuals are more closely aligned with clinical patients than the normal population (Claridge & Blakey, 2009; Strong et al., 2007). Furthermore, these results lend additional support to the widely held view that both affect (Neuroticism) and aspects of cognitive flexibility (Openness) contribute to creativity (Richards, 2001; Rybakowski et al., 2008; Srivastava et al., 2010; Strong et al., 2007). Both creative and clinical populations share personality traits that are exploratory, seek new experiences, are non-conformist, and prone to challenge social norms. Furthermore, both demonstrate a propensity for disorganised thinking, emotional sensitivity and general interpersonal suspiciousness. There are of course a range of biological, social and motivational inhibitors to the psychosis population not achieving the creative output that their creativity scores in this study would suggest they have the capacity for creativity (Richards, 2001). However, one additional difference between the two populations suggested by these data may lie in the ability to regulate heightened emotions for the purposes of maintaining social connectedness. On the one hand, emotional intensity is required for creative expression (Feist, 2006) while on the other hand self-management of

emotions are needed in collaborative social interactions necessary for creative achievement. Csikszentmihalyi (1999) hypothesised that an individual's ability to achieve creatively involves not simply the ability to produce outstanding creative products, but implicates personality traits that enable access to a network of contacts and highly developed interpersonal skills that make it possible for the creative product to have influence. The high functioning creative individual may have the ability to sufficiently regulate their sensitivity in the social relationships necessary for creative influence. The model below (Figure 4) summarises these results.

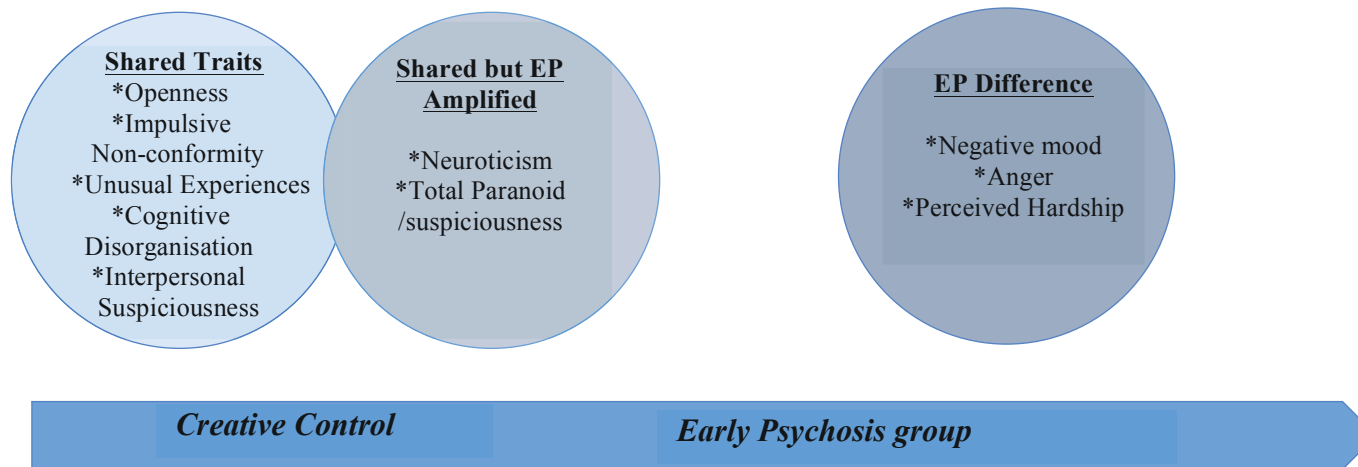


Figure 4.: A model of shared and distinct personality and schizotypal traits mapped to CC and EP populations

Nevertheless, some creative achievement is possible for psychosis patients, as evidenced by the early psychosis group's significantly higher scores on creative achievement compared to non-creative controls. This suggests that those with early psychosis have a capacity for creative achievement. It may be in part that psychosis patients' elevated emotional sensitivity, suspiciousness and defensiveness impedes their ability to effectively communicate and collaborate with others within their creative network. Elevated emotional sensitivity is of particular relevance in creative achievement as rejection (of creative work) is an associated aspect of a creative vocation (Van den Eynde et al., 2015a). Mature creative artists learn to manage this rejection (Czikszentmihalyi, 1999), however, this may be difficult for the equally talented but emotionally vulnerable early psychosis individual. Difficulties with managing this type of rejection inherent in creative industries is likely to have a reciprocal relationship with the characteristics of hypersensitivity, suspiciousness and defensiveness found in this study.

This may prove to be a new avenue for intervention for early psychosis patients; in that early psychosis patients with proven creative ability may benefit from interventions aimed at enhancing communication skills and building resilience in the face of rejection. This in turn may increase their ability to maintain creative networks and improve vocational outcome. Therefore through research, which focuses on creative outcomes for early psychosis populations, rather than cognitive deficits, it may lead to an associated reduction in stigma for this population (Serafini et al., 2011).

Limitations

Our findings are limited by the relatively small sample size and by the cross-sectional nature of the research. Moreover the challenge of defining a creative and early psychosis sample has been articulated by other researchers (Breitborde et al., 2009; Kaufman & Beghetto, 2009; MacCabe et al., 2018). While we have sought to address these issues, the ongoing discourse in determining operational definitions for these populations remains a concern for researchers in the field. The lack of clarification in defining these populations contributes to difficulty in comparing studies and therefore is a limiting factor for the current research. Further research to elucidate these differences will be important future area of investigation.

Conclusion and implications

Our findings support the need for further targeted longitudinal research into young, 'at risk', creative populations and early psychosis patients (McGorry, Killackey, et al., 2009a). In particular our results underscore the need to research and develop programmes to foster and strengthen resilient, personality features in young, vulnerable, creative populations. These programmes would promote emotional self-management, along with interpersonal skills to challenge negative, suspicious patterns of thinking and behaviour.

Finally, the current results provide additional support for the development of preventative treatment protocols for creative populations, consistent with other recent studies that have identified the unique psychological vulnerability of creative populations (Gostoli et al., 2017; Van den Eynde et al., 2015a). The recent McCabe epidemiological study (MacCabe et al., 2018) provides additional compelling support

for this assertion as they conclude that, artistic creativity is a risk factor for mental illness, which is analogous to other well documented risk factors for psychosis.

Conflict of interest

The authors have no conflict of interest to declare.

Acknowledgements

The authors would like to acknowledge Shannon Gostelow and Nicole O'Reilly who were research assistants for the project and Rob Brockman for his contribution to the research. The authors would also like to acknowledge the National Health and Medical Research Council (NHMRC) Project grant (APP630471), and the Australian Research Council (ARC) Future Fellowship (FT0991511) both grants held by Melissa J Green (UNSW). Melissa J Green was responsible for this project as executed at UNSW and is affiliated with UNSW, Neuroscience Research Australia (NeuRA), the Black Dog Institute, and the Macquarie Centre for Excellence in Cognition and its Disorders.

Chapter Five

Prelude to chapter five

The findings from chapter four regarding personality aspects support the premise that there are significant similarities in personality as measured by the NEO-FFI-R between creative individuals and individuals with early psychosis. These similarities include shared, elevated neurosis and openness. Furthermore similarities in aspects of schizotypy i.e. impulsive non-conformity, unusual experiences, total paranoia/suspiciousness, are also shared between creative and early psychosis populations. These similarities were not surprising given what is shown in the literature, however many researchers in the field propose cognitive factors as the key to understanding what differentiates a creative individual from those with early psychosis. The spectrum model of shared vulnerability (Crabtree & Green, 2016) proposed that IQ and executive function would differentiate the creative and early psychosis populations. The following chapter is an examination of cognitive factors, which may discriminate creative and early psychosis groups.

Title: Spatial working memory, not IQ or executive function, discriminates early psychosis and 'at risk' creative individuals

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Journal: Early Intervention in Psychiatry

Status: Accepted for publication

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5.0 Abstract

Aim: While associations between creativity and psychopathology have been well researched, the specific cognitive processes that distinguish highly creative from those with psychopathology warrant further investigation. This study will examine whether IQ, executive function, cognitive inhibition or spatial working memory differentiate individuals with early psychosis, clinically vulnerable creative individuals, creative controls and non-creative controls.

Methods: The study sample consisted of 110 participants: early psychosis (n = 21); clinically vulnerable creative controls (n = 25); creative controls (n = 30) and non-creative control (n = 34). The Diagnostic Interview for Psychosis assessed early psychosis participants and the Mini Neuropsychiatric Interview was used to screen for psychopathology in the remaining groups. Several cognitive tests were administered: IQ, neurocognitive measures of executive function and spatial working memory. Creativity was assessed using the Torrance Test of Creativity and Creative Achievement Questionnaire. A measure of vividness of mental imagery was also given.

Results: Across all cognitive tests, spatial working memory differentiated the early psychosis group from both creative and non-creative control groups. Spatial working memory predicted group membership but vivid imagery was a better predictor of creative achievement. The early psychosis, clinically vulnerable creative and creative groups all recorded significantly higher results on creative achievement and creative cognition compared to non-creative controls.

Conclusions: Our results provide further support for spatial working memory as an early neuro-cognitive marker for early psychosis. Spatial working memory, rather than IQ or executive function, may also be an early protective factor for clinically vulnerable young creative individuals.

5.1 Introduction

The association between creativity and psychopathology has been the subject of speculation and conjecture since antiquity when Aristotle first commented on melancholy among those who were prominent in society at the time (Becker, 2014). More recent studies provide evidence of a strong link between creativity and mood disorder and thought disorder similar to psychotic thinking (Rybakowski et al., 2008). This association has been corroborated in recent genetic and epidemiological studies, which suggest shared genetic roots between creative professionals and those with a diagnosed psychosis (Kyaga et al., 2011; Parnas et al., 2019). Notably, epidemiological evidence suggests that this association is particularly found between artistic creativity and psychosis. A recent large population based case-controlled study (MacCabe et al., 2018) found that students who studied artistic subjects (such as art and performance) at university had significantly increased odds of developing schizophrenia and bipolar disorder. Moreover the author's conclude that the association between creativity and psychopathology represents risk factors similar to other identified risk factors for psychotic illness. Similarly, a genetic study from Iceland (Power et al., 2015) reported that both bipolar and schizophrenia polygenic risk scores were associated with professional creative artists, and that this association was not found in five other professions. Although research in this area has focused on the similarities between creativity and psychopathology (Claridge & Blakey, 2009), the question of what enables a young artistic, creative student to follow a career of creative expression rather than a trajectory of pathology invites a closer examination of possible cognitive distinguishing factors that may protect

young creative artists from psychopathology (Carson, 2011). Although previous research has examined some aspects of cognition, visuo-cognitive factors have not been studied. This investigation into what cognitive (including visuo-cognitive) similarities and differences exist between the highly creative individual and those with early psychosis is of increased importance as it may lead to innovative treatments and early remediation of those presenting as at risk for psychosis and young clinically vulnerable creative individuals.

Cognitive and schizotypal similarities between artistic creative and psychosis populations

A number of studies have found personality and cognitive similarities between the creative and those with psychopathology, with similarities in schizotypy in particular extensively examined. Schizotypy refers to aspects of personality and perceptual beliefs that indicate a person's proneness to schizophrenia and psychosis (Siddi et al., 2017). It is usually defined as three factors: positive, negative and disorganised (Debbané et al., 2015) with creativity strongly associated with positive schizotypy, namely impulsive non-conformity and unusual experiences (Ando et al., 2014; Nelson & Rawlings, 2010; Nettle, 2006). With respect to cognition, similarities in divergent thinking (Claridge & Blakey, 2009; Srivastava et al., 2010) and cognitive inhibition (Beech et al., 1989; Carson et al., 2003) have been reported in both highly creative and psychosis populations (Richards, 2001; Sass & Schuldberg, 2001). Divergent thinking is rapid, fluid thinking in which the person is able to make unique associations (Guilford, 1967; Torrance, 1993) and underlies both schizotypal and

manic thought (Claridge & Blakey, 2009; Srivastava et al., 2010). Decreased cognitive inhibition, or the reduced ability to filter out irrelevant information and bring more stimuli into conscious awareness, is thought to be a process underlying divergent thinking (Eysenck, 1994) and has been linked with both schizotypy and creativity (Brod, 1997; Ottemiller et al., 2014).

*Proposed cognitive differences between artistic creative and psychosis populations:
IQ, executive function*

General intellectual functioning (IQ) has been mooted as a possible cognitive protective factor for highly creative individuals (Carson, 2011; Rybakowski et al., 2008) where it is thought that those with high IQ are better able to process and manipulate additional stimuli arising from reduced cognitive inhibition. However, few studies support this assertion (Kyaga et al., 2011; Miller & Tal, 2007; Soeiro-de-Souza et al.). If not high IQ, then executive function may differentiate the two populations. Executive functions are those subserved by the frontal lobes of the brain and refer to cognitive skills such as planning, organising, and shifting mental set (often termed cognitive flexibility) (Baddeley, 1996). However, while executive function deficits are found in both bipolar and schizophrenia populations (Bora et al., 2009), age (Fucetola et al., 2000), onset and duration of illness are key factors in assessing executive function. Rather than declining executive function, a meta-analysis of cognitive deficits in ultra-high risk and early psychosis populations found stable and improved executive function across both “at risk” and early psychosis populations (Bora & Murray, 2013). This research suggests that executive function deficits are not as

evident in “at risk” or early stage psychosis, which is the population of most concern in discriminating possible risk factors in creative arts students.

Executive function in the context of creativity and psychosis has been investigated in one previous study. Soeiro-de-Souza and colleagues (2011) tested a group of 18-35 year old, un-medicated participants experiencing manic, depressed and mixed (mania and depression) episodes. In this study, creativity was higher in manic and mixed states, compared to those experiencing a depressive episode and importantly, higher creativity was associated with greater executive function in manic state only. IQ did not influence creativity across all three, mood states. Based on this study, where the manic group had elevated creativity and executive function, early indicators are that executive function may not differentiate the creative from those with psychopathology. However, a comparison of executive function in early psychosis and creative populations would provide more clarity of the role of executive function as a protective factor for the creative population. Notwithstanding there are additional visuo-cognitive factors that warrant attention.

Visuo-cognitive factors: Does spatial working memory differentiate between artistic creativity and psychosis?

One important area of cognitive functioning that has received relatively less research attention in understanding the creativity/psychopathology nexus is visuospatial working memory. Visuospatial working memory refers to the ability to keep spatial information active for a period of time, involving spatial orientation and the

recording of information about one's environment. Although not investigating creativity specifically, a group of researchers (Goghari et al., 2014), examined the role of spatial working deficits and IQ in those at ultra-high risk (UHR) for psychosis and first episode psychosis patients (FEP), compared to controls (HC). All three groups were compared on WASI Verbal and Performance IQ (Canivez et al., 2009), and spatial working memory. The spatial working memory (SWM) task was taken from Cambridge Neuropsychological Test Automated Battery (CANTAB) (Sahakian & Owen, 1992) and requires retention and manipulation of visuospatial material. The SWM task is able to differentiate two of the components of working memory, namely the short-term maintenance of material (in the visuospatial sketchpad) and the use of task strategy. This study found that, controlling for IQ the short-term maintenance of material in the visuospatial sketchpad differentiated the UHR from the HC groups. Furthermore, it was impaired SWM, rather than IQ, that significantly predicted global functioning in both the UHR and FEP groups. The assertion that deficits in spatial working memory may be an early risk factor for psychosis and a more reliable neurocognitive marker for psychosis, compared to other cognitive factors, (Carrión et al., 2018), has been supported in other studies (Badcock et al., 2005; Brewer et al., 2006; Pirkola et al., 2005). In addition to this, a number of recent reviews have proposed that aberrations in visual functioning, such as deficits in spatial working memory are associated with early psychosis (Landgraf & Osterheider, 2013; Uhlhaas & Mishara, 2007), which may in turn drive delusion formation (Grillo, 2018). Further research into these visuo-cognitive impairments is needed. Whilst the role of spatial working memory as a possible vulnerability marker for psychosis is an emerging area of research, its relationship to creativity has not been examined.

Similarities in vividness of mental imagery in artistic creative and psychosis populations

Associated with spatial memory and common to both creative and psychosis populations is enhanced vividness of mental imagery. Vivid mental imagery is defined as the degree of perceptual detail experienced in visualising scenes and objects (Oertel et al., 2009). It has been associated with hallucinations in schizophrenia and has been proposed as a trait marker for schizophrenia (Sack et al., 2005). Moreover it is one of the indicators of creativity (Michalica & Hunt, 2013; Thomson & Jaque, 2018; Wang et al., 2017). It may be that there is also a relationship between those with strong mental imagery and spatial working memory such that those with heightened mental imagery may utilise it to aid performance in visuospatial working memory tasks (Keogh & Pearson, 2011). Aspects of this association have been examined in recent studies using small clinical populations and healthy controls (Benson & Park, 2013; Matthews et al., 2014). Benson and Park (2013) investigated visuospatial ability and mental imagery in a population of eighteen patients with schizophrenia (Scz) matched to eighteen controls. The clinical population demonstrated enhanced mental imagery but impaired spatial working memory, indicating that the clinical population were unable to recruit their superior mental imagery in spatial working memory tasks. No studies have explored this question in a creative and early psychosis population and this will be investigated in this study.

Aims

The aims of this study are to investigate whether spatial working memory rather than IQ and measures of executive function differentiate creative and non-creative controls, from early psychosis populations. We hypothesise that IQ, cognitive inhibition and executive function will not differentiate early psychosis and control groups however early psychosis participants will record greater SWM deficits than both control groups. Furthermore the early psychosis cohort will retain similarly enhanced vividness of mental imagery and creative cognition but not creative achievement compared to creative controls.

5.2. Methods

Recruitment and study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 11279) and ratified by University of Technology (HREC UTS 16-0532). All participants provided written consent prior to participation. As the study sought to focus on first episode psychosis, only participants aged between 18-35 were recruited. All participants were given an AUD\$40 monetary reimbursement for travel costs.

Participants

Early psychosis participants (EP) N=21

Early psychosis participants were recruited from a previous study (Rowland et al., 2012), and had given consent to be approached for further studies. All were recruited

from either an inpatient or outpatient hospital clinic and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis (DIP)(Castle DJ et al., 2006), administered by an experienced clinician. All early psychosis participants met criteria for psychotic disorder according to ICD -10 criteria and had recorded a first episode psychosis or hospitalisation. All were under regular psychiatric supervision. Active psychotic symptoms were an exclusion criterion for the study (see table 1 for PANSS scores), however no participants were excluded due to the presence of acute psychotic symptoms.

Creative control participants (CC) N=30

Creative control participants were recruited from several Creative Art Colleges around Sydney, Australia. The recruitment sites included tertiary creative training institutions; music colleges (contemporary, classical music, composition, vocals), visual arts colleges, as well as advertising on relevant creative websites (such as *livingwithacreativemind.com*). Creative controls were screened for past or present psychotic symptoms using a MINI Plus 5.0 (structured psychiatric questionnaire) (Lecrubier et al., 1997). None were excluded for past or present syndromal psychiatric disorders.

Clinically vulnerable creative control (CVCC)⁵ N=25

In administering the MINI Plus 5.0 structured psychiatric interview, it was observed that twenty-five of the creative participants reported past symptoms of hypomania

⁵ The editors of the journal *Early Intervention in psychiatry* requested a change in nomenclature and therefore at risk creative control (ARCC) has been termed clinically vulnerable creative control (CVCC) in chapter 5.

or psychosis symptoms that failed to reach criteria for diagnosis. Due to the high number of creative participants who reported these symptoms, it was decided to undertake further analysis and consider this a possible clinically vulnerable creative group. Assessment of clinically vulnerable and at risk mental states for psychosis is commonly undertaken in help seeking patients who attend outpatient or inpatient services where symptoms can be assessed over time (Brewer et al., 2006). In contrast this clinically vulnerable creative group was not treatment seeking and recruited as a control group from several creative arts institutions and therefore could not be considered to satisfy the normal criteria for “at risk” mental states (Yung et al., 2005).

However as schizotypal personality is one of the CAARMS (Comprehensive assessment of “at risk” mental states) vulnerability factors for determining “at risk” for psychosis (Debbané et al., 2015; Yung et al., 2005), we examined schizotypy scores taken from the O-Life and Paranoia Suspiciousness scale. Only the clinically vulnerable creative group (CVCC) had a schizotypal profile that was more aligned to the early psychosis group (EP), when compared to the creative and non-creative groups (see appendix 1). Both CVCC and EP recorded significantly higher scores on positive negative and disorganised schizotypy compared to creative and non-creative participants. These findings lend support for the conjecture that this clinically vulnerable creative group may be more closely related to the early psychosis population. It was therefore decided to investigate this group as a separate more vulnerable creative subgroup. Moreover it was hypothesised that this group may be more cognitively aligned to the early psychosis population.

Non-creative control participants (NCC) N= 34

Healthy, non-creative controls were recruited via a university website. The online information asked for psychologically healthy volunteers to participate in research into creative cognition, and thirty-three individuals initially responded. Nine participants were excluded because they met either of the following three exclusion criteria: i) no personal or family history of mental illness; ii) an inability to communicate proficiently in spoken and written English and iii) receipt of more than rudimentary training (defined as three years of less) in any field of creative arts. Using the MINI Plus 5.0 (Lecrubier et al., 1997) the normal non-creative controls were also screened for any current mental illness and one participant was excluded (presence of an eating disorder). These participants were reimbursed \$AUD 40 or their time.

Measures

All participants completed a series of tests including cognitive measures, self-report questionnaires, mood assessment and intellectual ability testing.

Intelligence Quotient -Wechsler Abbreviated Scale of Intelligence (WASI) (Wechsler & Zhou, 2011)

In order to test for IQ, the two-scale version of the WASI was administered to all participants.

Executive function (cognitive flexibility)- Intra-extra Dimensional Shift (IED) (Sahakian & Owen, 1992)

The IED is an attentional set-shifting neuropsychological assessment from the CANTAB battery. There are nine stages and the participant advances through the stages by learning the “rule” at each stage. The number of stages completed was the primary index used to measure executive function (Fagerlund et al., 2006; Luciana & Nelson, 1998).

Cognitive Inhibition -Negative Priming Task

The negative priming task is a computer generated modified version of the Stroop task based on a procedure outlined by Beech (*Beech et al., 1989*). Reaction times on a priming distractor (PD); neutral distractor (ND) and unrelated distractor (UD) are calculated and a negative priming effect calculated by subtracting PD-UD. The interference or Stroop effect is calculated by subtracting UD-ND.

Spatial Working Memory: SWM (Sahakian & Owen, 1992)

Spatial working memory was assessed using the Cambridge Neuropsychological Test Automated Battery. In this task a number of coloured boxes were displayed on the screen with several of the boxes containing hidden tokens. The participant was required to search through the boxes to find these hidden tokens. In each trial the participant, had to remember where the tokens had been located and search in alternate boxes. Strategies used by the participant to remember the location of the tokens were also recorded and each trial increased in difficulty. *Between search errors* occur when a participant returns to a box in which a token had already been

found and *strategy score* based on the participant following a predetermined search sequence were the primary indicators used for analysis. A high strategy score indicated an inefficient strategy. All participants completed the battery however a small number of CC and NCC did not have their results recorded on IED/ SWM task due to faulty equipment.

Divergent (creative) thinking task: Abbreviated Torrance Test of Adults (ATTA) (Goff & Torrance, 2002)).

All participants were administered the Abbreviated Torrance Test for Adults (ATTA; (Goff & Torrance, 2002). This test comprises three tasks; the first calls for a verbal response to a hypothetical problem and the following two tasks require figural responses. Participants are asked to respond to the challenge using imagination and problem solving ability. Their responses are scored according to four normative referenced and fifteen criterion referenced indicators to obtain an overall creative indicator.

Creative achievement: Creative Achievement Questionnaire (Carson, 2005).

To evaluate creative output, the Creative Achievement Questionnaire (CAQ; Carson, 2005 #4} was administered to all participants. As young, developing professional creative artists were the focus of the creative participant group, an amended form of the CAQ questionnaire was administered to include relevant early achievement and achievement associated with contemporary outputs in online and digital creativity.

Vivid mental imagery: VVIQ (Marks, 1973)

In this pen and paper questionnaire, participants were asked to imagine sixteen items and provide ratings of the vividness of their images using a five-point rating scale where 5 indicated the least vivid image (no image at all) and 1 the most vivid (perfectly clear and vivid as normal vision).

Statistical Methods

Statistical analyses were conducted using SPSS 25. Descriptive analysis including mean and SD were performed on all continuous variables and chi-square on categorical variables. ANOVA with Bonferroni correction was used to determine between group differences on all cognitive and creative variables. Effects of spatial working memory, vividness of mental imagery, IQ and IED were independently explored by a hierarchical regression. Creative achievement, as measured by the creative achievement questionnaire, was the outcome variable. Demographic covariables and then clinical predictors were entered into the model. For each step of the model, R square and R square change were reported. To further investigate the importance of spatial working memory relative to executive function/IQ and as a discriminatory variable, we conducted a stepwise discriminant functional analysis. Missing data was handled through listwise deletion.

5.3 Results

Participants

A total of one hundred and ten subjects participated in the study (PSD = 21; CVCC = 25; CC = 30; NCC = 34). No participants reported any visual impairment or colour

blindness. The socio-demographic and clinical characteristics of the sample are shown in Table 1. More than half the participants were female (67%) and the mean age was 23.9 (SD = 4.1). A total of 63.6 % were students and had completed an average of 15.3 (SD = 2.09) years of education. With respect to occupation, due to the small sample size the cells were recoded (part-time/unemployed vs other; EP,CCxNCC) (Fishers exact $p < .001$) and a significant difference was recorded. This was considered to be possibly indicative of the clinical and creative individual's unpredictable employment (Van den Eynde et al., 2016), however it was not deemed critical to further analysis.

Table 7.
Sample description

	EP	ARCC	CC	NCC	Statistical Value for main effect
N	21	25	30	34	
Age	25.4 ± 4.2	23.8 ± 4.8	23.1 ± 3.9	23.7 ± 3.7	$F_{2,111} = 1.40, p = .246$
Female (%)	57.1	56.0	68.8	58.8	$\chi^2 (3; N = 112) = 1.06, p = .738$
Years of education	14.95 ± 2.78	15.53 ± 1.77	14.56 ± 2.39	15.91 ± 1.86	$F_{2,109} = 1.07, p = .394$
Employment status	N (%)	N (%)	N (%)	N (%)	
Student	7 (33.3)	14 (56.0)	21 (70.0)	28 (82.4)	
Employee	6 (28.6)	2 (8.0)	2 (6.7)	6 (17.6)	
Part time employment	6 (28.6)	7 (28.0)	6 (20.0)	0 (0)	
Unemployed	2 (9.5)	2 (8.0)	1 (3.3)	0 (0)	
PANSS –positive	9.38 ± 2.97				
PANSS – negative	11.24 ± 4.81				
PANSS – general	21.00 ± 4.16				
Age at onset	16.58 ± 2.91				
Age at first diagnosis	19.10 ± 3.53				

Comparison between groups on cognitive and creative tests

In Table 2, the ANOVA revealed a between group differences on creative thinking (ATTA), creative achievement (CAQ), vividness of mental imagery (VVIQ) and spatial working memory, *between errors* and *strategy* scores (Table 2). There were no significant differences between groups on IED, IQ and Negative Priming (NP) tasks. IQ, executive function, set shifting and cognitive inhibition did not discriminate EP and control groups. SWM *between errors* discriminated EP from all control groups however *strategy* was the only significant indicator of difference between EP and CVCC groups. These results indicate that compared to the early psychosis group, the clinically vulnerable creative group had significantly higher creative achievement and employed better spatial working memory *strategy*.

Predicting creative achievement and group membership

Results from the stepwise regression analysis indicated that while the cognitive factors of IQ, and executive function (IED) made some contribution to creative achievement, it was vividness of mental imagery ($\beta = .39, p < .01$) that was the stronger predictor, contributing 16% of the variance.

Stepwise discriminant functional analysis was used to determine what variables; WASI IQ, executive function (IED total errors adjusted) and spatial working

memory *between errors* and *strategy* best discriminated the four groups. Only the *between errors* spatial working memory variable significantly discriminated groups (Wilks' $\lambda = 0.85$, $\chi^2(1 \text{ N} = 109) = 13.72$, $p = 0.003$; canonical discriminant coefficients: between search errors = 0.06, constant = -1.2; functions at group centroids: EP = 0.74, CVCC = -.34, CC = -.21, NCC = -0.10). These results indicate that while spatial working memory is not a strong predictor of creative achievement, poor SWM does predict membership in the early psychosis group.

Table 8

Means and Standard Deviations for all Groups on IQ, SWM, IED, Negative Priming, Creative Thinking (ATTA), Creative Achievement (CAQ) and Vivid Imagery (VVIQ)

	EP	CVCC	CC	NCC	Statistical values for main effects
N	21	25	30	33	
WASI IQ	107.9 ± 15.2	108.3 ± 10.2	110.2 ± 10.2	103.5 ± 13.1	$F_{3,109} = 1.8, p = .15$ ns
IED total errors adjusted	22.67 ± 20.94	15.79 ± 11.81	26.83 ± 22.13	27.50 ± 22.59	$F_{3,101} = 1.83, p = .147$ ns
Negative Priming	.0188 ± .069	-.0081 ± .107	-.0170 ± .061	-.0081 ± .089	$F_{3,90} = .764, p = .517$ ns
Interference	.0387 ± .090	.0297 ± .075	.041 ± .060	.0578 ± .087	$F_{3,88} = 1.26, p = .292$ ns
SWM Between errors	29.6 ± 21.6	14.0 ± 12.3	14.8 ± 11.9	15.5 ± 12.9	$F_{3,93} = 5.42, p < .01$ ^a
SWM Strategy	32.9 ± 4.6	28.8 ± 4.5	29.7 ± 4.7	30.3 ± 5.3	$F_{3,93} = 2.92, p < .05$ ^b
ATTA	76.5 ± 12.5	81.92 ± 7.0	77.4 ± 9.9	65.0 ± 11.5	$F_{3,108} = 14.5, p < .001$ ^c
CAQ	25.1 ± 25.6	55.8 ± 32.1	40.9 ± 26.6	2.6 ± 4.1	$F_{3,108} = 26.9, p < .001$ ^c
VVIQ	62.8 ± 12.0	63.7 ± 9.4	63.3 ± 9.3	52.6 ± 11.8	$F_{3,106} = 7.6, p < .001$ ^c

a = EP > CC, CVCC, NCC*

b = EP > CVCC*

c = EP, CC, CVCC > NCC**

All analysis made with Bonferroni correction

Table 9

Stepwise Regression with Creative Achievement as the Dependant Variable and IQ, Executive Function, Spatial Working Memory and Vivid Mental Imagery as predictors.

	B	SE B	β	P
Step 1				
Constant	18.51	19.67		.31
Age	.17	.80	.02	.87
Gender	10.72	6.43	.18	.09
Step 2				
Constant	-39.80	31.58		.21
Age	.21	.78	.03	.80
Gender	10.87	6.26	.18	.08
WASI IQ	.59	.25	.25	.02
IED	-.22	.15	-.16	.14
Step 3				
Constant	-95.49	35.90		<.01
Age	.06	.72	.01	.93
Gender	9.89	5.82	.16	.09
WASI IQ	.57	.23	.24	.02
IED	-.25	.14	-.18	.07
SWM between errors	-.07	.19	-.04	.73
SWM strategies	.13	.66	.02	.85
Vivid mental imagery	.99	.25	.39	<.01

Note: $R^2 = .03$ for step 1 ($p = .25$) $\Delta R^2 = .08$ for step 2 ($p = .02$) $\Delta R^2 = .16$ for step 3 ($p < .01$)

5.4 Discussion

This research aimed to investigate specific cognitive differences between early psychosis, clinically vulnerable creative, creative and non-creative populations. The early psychosis, creative control and clinically vulnerable creative groups, compared to non-creative controls, recorded significantly higher scores on creative potential (ATTA), creative achievement (CAQ) and vividness of mental imagery (VVIQ). The clinically vulnerable creative group performed better on creative cognition and achievement than the other groups.

There were no significant differences on IQ, negative priming or executive function (IED) across all four groups. This suggests that these global measures of cognitive function do not discriminate between those in the early stages of psychotic illness, those who may be more clinically vulnerable and those with no psychotic illness. However it should be noted that as the psychosis population ages a significant decline in executive function (abstraction), IQ and visual skills is reported (Fucetola et al., 2000) and this is impacted by age at onset of the illness (Bora et al., 2009). Similarly, there are differences in negative priming presentation between acute and those in remission with inhibition being reduced in florid psychosis but restored in those under remission (Minas & Park, 2007). Within a younger psychosis population, at the early stage of illness presentation and in remission, our results indicate that spatial working memory was significantly impaired. This finding is in line with results from a similar study (Goghari et al., 2014) discussed earlier, which found

that *between errors* and *strategy* on the CANTAB spatial working memory task differentiated UHR and FEP from HC. Similarly, the early psychosis group differed from all three control groups on the *between errors* score which measures short-term maintenance of visuospatial memory; indicating some initial decline in visuospatial working memory. However, it was only the clinically vulnerable creative group that recorded a significantly higher *strategy* score when compared to the early psychosis group, indicating superior executive function on visuospatial planning.

It has previously been suggested (Pirkola et al., 2005) that spatial working memory may be a better neuro-cognitive marker for psychosis than verbal processing skills. In our population, early psychosis participants recorded deficits in short term spatial working memory. However, unlike the UHR group investigated in the Goghari study, the creative clinically vulnerable group, alongside the creative and non- creative group recorded similar results on *between errors* indicating stable short- term spatial memory. Also, unlike the UHR group in the aforementioned study, the clinically vulnerable creative group had more efficient *strategy* than the early psychosis group. The creative and non-creative did not record any significant difference on *strategy*. This is a measure of executive working memory that reflects planning and integration of spatial information. Is it the superior ability to remember, plan and integrate spatial information that assists the clinically vulnerable group to manage their heightened creative imagination and vivid mental imagery to achieve creatively in the presence of positive and negative schizotypal symptoms and with sub

clinical symptoms? The early psychosis group in comparison has similar positive and negative schizotypal symptoms, creative imagination and vivid imagery but has deficits in spatial memory and planning and so was unable to achieve to the same extent creatively.

These results are considered in juxtaposition to the epidemiological study by McCabe et al (2018), which concluded that artistic creativity was as significant risk factor for psychotic disorders as other comparable risk factors. Our results support the view that creative artists and early psychosis participants share personality and cognitive risk factors. Our results point to spatial working memory as a possible cognitive “protective factor” for the clinically vulnerable artistic student. While these results are tentative, the role of spatial working memory as a possible cognitive factor that may prevent transition to psychosis in vulnerable creative populations warrants further investigation. One mechanism by which spatial working memory may act as a protective factor for creative artists may be that as spatial working memory deteriorates in early psychosis, vividness of imagery and creative imagination becomes more dominant (Matthews et al., 2014) and so may lead to delusions. Carr (2010) proposed the notion that delusion formation shares similarities to the creative process. He suggests that delusions start with an aberrant proto-psychotic anomalous experience in which the individual searches for meaning to explain the experience. This search for meaning occurs under reduced pre-frontal functioning (such as when SWM is impaired) where the delusion becomes the dominant belief. Carr likens this initial proto-psychotic anomalous experience

to the altered state and loosening of associations that occurs in the initial stages of creativity (Csikszentmihalyi, 1996; Eysenck, 1994) and supports other evidence that proposes a relationship between creativity and risk for psychosis (Abraham, 2014). Following the initial loosening of associations, he suggests that the second part of the creative process involves a problem solving exercise to assign significance to this flight of ideas. It may be for the creative individual, with intact spatial working memory, creative product occurs. For the early psychosis individual with impaired spatial working memory (i.e., impaired visual memory and problem solving ability), this may lead to inappropriate salience assignment and delusions (Grillo, 2018).

Clearly more research into the role of spatial working memory with early psychosis populations is needed. This study provides current evidence in support of the aforementioned epidemiological findings (MacCabe et al., 2018) indicating creativity as a vulnerability factor for psychosis. Our analysis identified an clinically vulnerable group of creative artists in training who show similar schizotypal vulnerabilities to early psychosis patients, without evidence of visuospatial cognitive decline. These findings lend support to further longitudinal research into identifying and monitoring vulnerable creative individuals in areas of schizotypy and spatial working memory.

Limitations

These results should be interpreted in view of the limitations of the research.

One of the limiting factors for this study is the small sample size and cross-

sectional methodology; therefore without follow up data we cannot draw any conclusions or implications on transition to psychosis. The clinically vulnerable creative control group developed out of observing a pattern of symptomatology in a sub-set of creative controls. Future research should seek to identify and provide longitudinal data on at risk creative populations. Although the pilot study by Burkhardt et al did not advocate screening for BP in creative populations, our research suggests that further longitudinal studies are needed with this population to identify and determine risk over time. Due to the small creative sample size we were not able to distinguish between different domains of creativity for analysis. For example, are visual artists, rather than musicians more clinically vulnerable and do visual artists have superior spatial working memory and strategy compared to other creative artists? These are questions that warrant further investigation.

Future Directions

This research supports the call for further research into visuo-cognitive impairments in individuals at risk and individuals transitioning to psychosis. It also provides support for innovative treatment protocols (Valmaggia, 2017) for early psychosis patients that use visual mediums such as computer-based and virtual reality programs that may develop and strengthen visuospatial working memory.

Acknowledgements

The authors would like to acknowledge Shannon Gostelow and Nicole O'Reilly who were research assistants for the project.

The authors would also like to acknowledge the National Health and Medical Research Council (NHMRC) Project grant (APP630471), and the Australian Research Council (ARC) Future Fellowship (FT0991511) both grants held by Melissa J Green (UNSW). Melissa J Green was responsible for this project as executed at UNSW and is affiliated with UNSW, Neuroscience Research Australia (NeuRA), the Black Dog Institute, and the Macquarie Centre for Excellence in Cognition and its Disorders.

Conflict of Interest

None

Appendix 1

TABLE 4

Schizotypy measured from Oxford Liverpool inventory of feelings and experiences (O-Life) and paranoid suspiciousness scale					
	EP	CVCC	CC	NCC	Statistical Value for main effect
<i>N</i>	21	25	32	34	
Positive (ImpNon)	9.57 ± 4.87^b	11.42 ± 3.5^b	7.84 ± 3.71^b	5.09 ± 3.4^b	(F _{3.98} =11.04, p<.001
Positive (UnExp)	12.38 ± 7.59^a	15.5 ± 5.68^a	11.50 ± 6.38^a	3.41 ± 4.03^a	(F _{3.98} =16.28, p<.001
Disorganised (CogDis)	14.81 ± 5.14^a	13.54 ± 5.3^a	11.06 ± 4.78^a	5.91 ± 5.18^a	(F _{3.98} =13.07, p<.001
Negative (Paranoid)	6.62 ± 3.4^b	6.36 ± 2.44^b	4.75 ± 2.65^b	3.18 ± 2.68^b	((FF _{3.99} =7.36, p<.001 (F _{3.99} =7.36, p<.001

Prelude to chapter six

Spatial working memory was the only significant cognitive difference between the early psychosis and creative, non-creative cohorts. The at risk group recorded superior spatial working memory – strategy, which may indicate that this aspect of pre-frontal spatial ability assists in managing vivid mental imagery and creative imagination. This is an area for further research.

Revised spectrum model of shared vulnerability

Following the analysis of personality and cognition, the author revised the spectrum model of shared vulnerability to indicate results from the afore-mentioned two research papers (Figure 5). The model was also amended to indicate a possible professional creative to early psychosis transition, identifying both vulnerability and protective factors. This is in line with the results of the previous epidemiological study (MacCabe et al., 2018), which identified artistic/professional creative individuals as being under greater risk. The model was also amended to reflect the investigation of an early psychosis population. As mentioned earlier, the inclusion of the early psychosis population was to align with an emerging research focus on identifying clinical early psychosis populations, rather than those who had an established diagnosis. It was considered that understanding the emerging differences in the early psychosis population, compared to professional creative cohorts would identify possible future avenues for research.

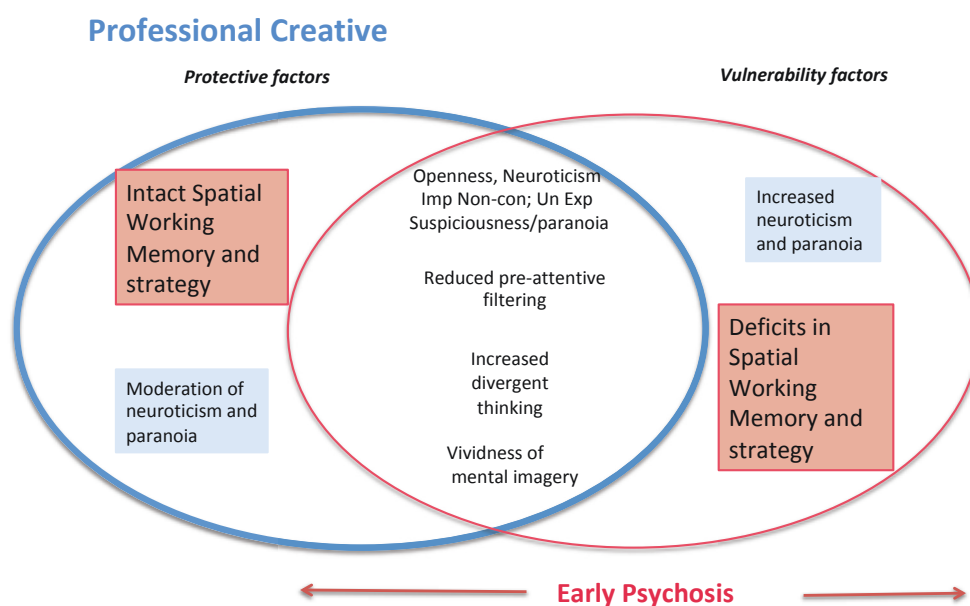


Figure 5 *Revised model of shared vulnerability between early psychosis and professional creative populations*

The analysis to date had identified a population of creative individuals who were more similar to the early psychosis population than the non-creative population. This similarity was most evident between the 'at risk' and early psychosis sample. As heightened paranoia was identified as a discriminating factor between the two populations, and as indicated in chapter two-addendum, it was decided to include an investigation of paranoia from the four-group sample (EP, ARCC, CC, NCC) alongside anxiety and stressful life events. A narrative review, which proposed a possible link between anxiety and the development of schizophrenia (Grillo, 2018), advanced the

theory that as the decline in visual spatial ability emerges, this may lead to increased anxiety and paranoia and an environment being perceived as more threatening. The author proposes the theory that delusion formation occurs in an attempt to make sense of this increased perceived threat. While some aspects of the review were speculative, the author cited research, which found that anxiety precedes paranoia and psychosis (Hartley, Barrowclough, & Haddock, 2013).

As indicated in chapter three, depression within a creative and psychosis population has been extensively investigated, (Andreasen, 1987; Baas, De Dreu, & Nijstad, 2008; Jamison, 1995) however, fewer studies had examined anxiety. Conversely, a recent survey into mental health amongst creative professionals in Australia (Van den Eynde et al., 2016) found 44% (ten times above the national average) reported anxiety. An examination of the risk factors associated with anxiety (Rapee et al., 2009) finds that these same factors are also common in creative populations. Specifically these factors include, neuroticism, vividness of mental imagery or fantasy and heightened response to threat, which may be associated with the paranoia/suspiciousness. These will be discussed in detail below.

Negative affectivity (neuroticism) and anxiety

As outlined in chapter four, a commonly used taxonomy of personality is the 'Big Five' model, which defines five key personality factors: neuroticism, extraversion,

openness, agreeableness and conscientiousness. Kotov et al (2010) performed a meta-analysis of 175 studies and while all diagnostic groups studied (anxiety, depression and substance abuse) were high on neuroticism, anxiety had one of the strongest associations with high levels of neuroticism ($d = 1.96$) (Kotov, Gamez, Schmidt, & Watson, 2010). Neuroticism, a related but distinct construct to negative affect (Miller, Vachon, & Lynam, 2009) is also identified as a personality risk factor for anxiety in young people (Rapee et al., 2009; Rothbart, 2007). As discussed in chapter three, high neuroticism is a well-established personality trait associated with the creative population and bipolar disorder/schizophrenia (Nowakowska et al., 2005; Srivastava et al., 2010).

Anxiety, creativity and mental imagery

Fantasy proneness, negative affect and pathology have also been closely linked (Thomson & Jaque, 2012). The ability to fantasise and vividly imagine has been associated in anxious (Lopez-Perez, Deepröse, & Hanoch, 2018), creative (Thomson & Jaque, 2012), bipolar disorder (Holmes, Geddes, Colom, & Goodwin, 2008) and schizophrenia populations (Sack et al., 2005). Vivid imagination on the one hand is essential for creative thought and product and is highly prized within creative industries, yet it is associated with anxiety-proneness and delusion formation (Carr, 2010). In bipolar populations, Holmes and colleagues (Holmes et al., 2008) proposed that mental imagery may amplify both the perception of threat in anxiety and may

amplify the positive interpretation of triggers leading to mania. While these authors acknowledged that creativity and heightened mental imagery might be positively associated, they acknowledged that the mechanisms for this were unclear. As outlined in chapter five, our findings describe a creative, 'at risk' creative and early psychosis population who have an elevated vividness of mental imagery (VVIQ) and who are creatively imaginative (ATTA). Furthermore it was a vividness of mental imagery that best predicted creative achievement.

Threat Bias

Fantasy proneness (vivid imagination) and bias toward threat, which may be associated with underlying trauma appear related (Thomson & Jaque, 2012). A model which has been proposed by Holmes and colleagues (2008), asserts that *anxiety triggers* increase *threat interpretation*, which in turn is amplified by heightened *vivid mental imagery*. The authors indicate that this may be particularly applicable within a bipolar disorder population (Holmes et al., 2008) where they suggest that mental imagery may amplify the hypomania state of bipolar disorder. Similarly an examination of fantasy proneness and trauma in dancers (Thomson & Jaque, 2012) found that those who had experienced trauma (which the authors associated with an increased sensitivity to threat (Holmes, 2003)), experienced heightened fantasy proneness. The authors related fantasy proneness and trauma with an associated heightened anxiety.

Cognitive models for anxiety propose that an attention bias toward threat causes and maintains anxiety (Barlow 2002). It may be speculated that a heightened response to imagined threat, which is central to anxiety, is also present in psychosis and bipolar disorder populations. While co-morbid anxiety disorder with psychosis and mood disorders is well established (Cosoff & Hafner, 1998), there has been some conjecture (Carr, 2010; Grillo, 2018), that it may precede and drive paranoia and psychotic thought (Freeman et al., 2018). These proposals require further research as the studies cited above implicate a possible relationship between having a vivid imagination, which drives threat interpretation, and may in turn amplify anxiety. The research cited above into fantasy proneness, driving threat bias, which may amplify the manic response (Holmes et al., 2008) and lead to anxiety (Thomson & Jaque, 2012) provides early support for this thesis. The following study presented in chapter six, sought to examine whether anxiety may be amplified in both the early psychosis and creative professional populations as both reported elevated vividness of mental imagery (chapter five).

Additionally the elevated levels of paranoia, presented in chapter four suggest that threat bias may be an area for further investigation with a creative population. A small study of students assessed for high and low creativity, found that those with high creativity recorded significantly higher, state and trait anxiety and higher and more fluid defences (Carlsson, 2002). This provides some support for the notion that

elevated anxiety and heightened threat bias is present in not only early psychosis populations and may also be particularly heightened in a creative population. An examination of paranoia in the four-group sample (EP, ARCC, CC, NCC) was included in study three to determine whether a more thorough investigation of the subscales of the PSQ could elicit differences between the early psychosis, 'at risk' creative and creative populations. In particular the question under investigation is whether there may be a difference between the early psychosis and at risk group on measures of threat and hostility (An et al., 2010). The PSQ subscales of interpersonal suspiciousness (IS), mistrust wariness (MS) and perceived hardship (PH) will be examined to address this question.

Adverse life events have also been found to underlie anxiety and paranoia (van Nierop, 2015). In recent years there has been increased focus on the association between trauma, anxiety and the development of paranoia and psychosis (Aas et al., 2011; Freeman & Fowler, 2009). Research into the association between trauma and the development of psychosis has centred on childhood trauma (Bell et al., 2018; de Vos et al., 2019; Quidé et al., 2018), whereas the trauma associated with creative professions has been largely (but not solely) been associated with adult trauma (Kenny & Asher, 2016; Thomson & Jaque, 2015) although a recent study has investigated childhood adversity in a group of performers (Thomson & Jaque, 2018). The stressful life events questionnaire used in this research was selected as it determines both childhood and adult trauma. Study three (chapter six) examines

whether there is a difference between adverse life events in the EP, ARCC and CC groups.

Chapter six

Title: **Anxiety, paranoia and trauma in professional creative and early psychosis populations**

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Journal **Psychiatry**

Status: **Submitted under review**

Contribution: **Julie Crabtree (80%); Jennie L Hudson (16%); Toby R Newton-John (4%)**

6.0 Abstract

Background

For many years the association between creativity and psychopathology has intrigued researchers and recent research has affirmed clear genetic and epidemiological links. In fact some researchers argue that pursuing the study of artistic subjects, which implies inherent creativity, predates the onset of psychosis. They point to the need to investigate what aspects of the creative individual protect or provide risk for transition to psychosis. Within a clinical and creative population three factors, which have been associated with transition to psychosis, will be investigated in this study namely anxiety, tendency toward paranoia and stressful life events.

Methods

The diverse sample of 110 participants (18-35 years) was examined, including individuals with early psychosis (EP), creative professionals with subclinical 'at risk' psychotic symptoms (ARCC), creative professionals with no psychotic symptoms (CC) and a non-creative (NCC) population. Based on recent research into this association, measures of anxiety (STAI), (DASS), paranoia (PSQ), and stressful life events (SLE) were administered to the participants to determine whether creativity is positively or negatively correlated with creativity and what factors may differentiate the early psychosis from creative and non-creative populations.

Results

In the diverse population and combined creative group, creative cognition and achievement was positively correlated with anxiety. On measures of STAI, DASS, PSQ

and SLE the EP and ARCC groups were more closely aligned than expected and had significantly higher scores than the CC and NCC groups. The EP group was differentiated from the ARCC group on perceived hardship (associated with paranoia) and childhood sexual and physical assault when compared to the ARCC, CC and NCC groups.

Limitations

The methodology that was cross sectional, not longitudinal, therefore causality could not be determined. Moreover a small sample size may have contributed to reduced statistical power. Furthermore the questionnaires used were well validated but were self-report, which may indicate some reporting bias.

Conclusions

These results provide further support for the association between characteristics of creative professionals and those with early psychosis. It provides corroborating evidence of the vulnerability of creative individuals who appear to be aligned with the early psychosis group on anxiety, aspects of paranoia and overall trauma. It provides future directions for developing tools to identify creative individuals who are 'at risk' for psychosis and provides innovative avenues for intervention in early psychosis and creative 'at risk' populations.

KEYWORDS: Anxiety, paranoia, stressful life events, creativity, psychosis

6.1 Introduction

Epidemiological and genetic studies provide strong support for an association between psychosis and creativity (MacCabe et al., 2018). Specifically, an extensive epidemiological study (Kyaga et al., 2011) found those with bipolar disorder (BP) and family members of those with schizophrenia (Scz), were over represented in creative professions. Further, an Icelandic study recorded a significant association between the polygenic risk scores for Scz or BP and creative professionals, that is, the higher the genetic risk for either Scz or Bipolar the greater the likelihood the individual will be in a creative profession (Power et al., 2015). Whilst the creativity/psychosis association has received much attention, little research has examined the role of other underlying co-morbidity or risk factors that may differentiate the psychosis/creativity population. Recent studies have identified three possible factors worthy of exploration, due to their associated links with later psychosis, specifically paranoia, anxiety symptoms, and stressful life events (de Vos et al., 2019; McAusland et al., 2017).

Although schizotypy has been identified as a vulnerability risk factor for psychosis in artistic creative populations, paranoia - a dimension of positive schizotypy, which includes impulsive non-conformity and unusual experiences (Nelson & Rawlings, 2010; Nettle, 2006) - has rarely been examined in creative populations (Cicero & Kerns, 2010). Paranoia can be conceptualised as a hierarchy ranging from fears of vulnerability and rejection, ideas of reference, to more severe perceptions of threat

and physical harm (Freeman et al., 2018). Although it has been extensively researched in clinical and at-risk for psychosis populations (Masillo et al., 2017), little research has examined paranoia within a creative population using well-validated measures of paranoia (Ando et al., 2014; Mason, 2015).

Often preceding paranoia and psychosis, partly due to their early onset are the anxiety disorders (Hartley et al., 2013; Yung et al., 2003). In a systematic review of studies investigating the relationship between current anxiety symptoms and psychosis, delusions and hallucination (Hartley et al., 2013), the authors noted that anxiety is specifically related to the severity of paranoia and delusions. Furthermore, anxiety was linked to an increase in auditory hallucinations (Delespaul, deVries, & van Os, 2002). One possible explanation for the association between anxiety and psychotic symptoms is that anxiety increases safety behaviour, which is driven and reinforced by persecutory, paranoid beliefs (Freeman et al., 2007). In non-clinical populations, anxiety was found to moderate the relationship between experimentally induced stress and paranoia; indicating that those with elevated anxiety and at times of elevated stress, were more likely to experience paranoia (Lincoln, Peter, Schäfer, & Moritz, 2009). In further support of the link between anxiety and psychoses, elevated rates of comorbid anxiety have been identified in Scz and BP populations. Merikangas (2007) reports that as many as 86.7% of bipolar patients (BP1) may have lifetime comorbid anxiety disorders (Merikangas et al., 2007). Cosoff and Hafner (1998) also

recorded a similarly high one-month prevalence of anxiety disorders (42-45%) across one hundred Scz, SczA and BP inpatients.

Although the link between anxiety, paranoia and psychosis is well supported, the association between anxiety and creativity is equivocal. In an extensive review of creativity and psychopathology, Baas and colleagues (2016) propose that although approach-based psychopathologies (e.g., positive schizotypy) are associated with creativity, avoidance-based psychopathologies including cognitive disorganisation, anhedonia and anxiety were associated with reduced creativity. While there was strong evidence in support of a positive correlation between approach psychopathology and enhanced creativity, the association between avoidance psychopathology and reduced creativity was based on limited evidence. One meta-analysis reported that anxiety was significantly and negatively correlated with creative thinking (anxiety: $r = -.17$), suggesting that the higher anxiety the less creativity an individual displays (Byron & Khazanchi, 2011). However, of the 59 studies examined in this review, only two studies included individuals in creative arts training, the remainder comprised participants derived from general school or university students. This potentially excludes or reduces the proportion of individuals at the high end of the creativity continuum. Furthermore, the meta-analysis was limited to an examination of creative thinking and did not assess creative achievement, that is, achievements associated with contemporary creative outputs.

Recently, extensive surveys into mental health in the Australian entertainment industry (n = 2407) identified elevated levels of anxiety and stress in entertainment professionals (Van den Eynde, Fisher, & Sonn, 2015b; Van den Eynde et al., 2016). Although limited in their application, due to the reliance on self-report, a concerning number of respondents (44%) reported moderate to severe anxiety, ten times above the national average. The elevated anxiety may be in part due to the unique demands within the industry such as financial pressure and erratic work environment (Van den Eynde et al., 2015b, 2016). Notwithstanding, there is a need for further research examining the link between anxiety, paranoia, creativity and psychoses within professional creative and early psychosis populations.

Emerging research (Thomson & Jaque, 2018) has also highlighted the associated role of adverse life events in the development of anxiety, paranoia and psychotic thought (Masillo et al., 2016). A meta-analysis investigating childhood trauma and lifetime diagnosis on anxiety, mood disorder and schizophrenia amongst a large representative sample (n = 6646) (van Nierop, 2015), provides evidence that childhood trauma increases the likelihood of an admixture of psychosis, anxiety and mania, with psychosis recording the strongest association with childhood trauma. Similarly, a longitudinal study with a cohort of 1265 participants found those exposed to severe childhood abuse had significantly higher psychotic thinking (abnormal thoughts and perceptions) at age 35 years than those not exposed to childhood abuse

(Bell et al., 2018). This group also had comorbid anxiety, one of the highest recorded comorbid disorders found in this group.

In one of a few studies to examine anxiety and trauma in a professional creative population, Thomson and Jaque (2018) assessed 234 performing artists (dancers, actors, directors, musicians). The group was divided into low, medium and high adverse life events (ALE). Compared to the medium and low ALE groups, the high ALE group was found to be more fantasy prone and more anxious. However, despite increased negative affect they reported more positive creative experiences. These positive creative experiences were described as an awareness of heightened emotional intensity, technical and expressive abilities as well as elevated levels of absorption (i.e., greater inspiration and discovery during the creative process). Therefore, despite experiencing more ADL and greater anxiety, this group had heightened fantasy proneness and had an intense and highly valued creative process. Although this cross-sectional study cannot determine causal directions, one possibility proposed by the authors is that those performers with greater ALE were better able to channel their heightened emotional distress into creative imagery and expression. Notably these research findings are at odds with the proposal by Baas et al (2016), which suggests that avoidance-based psychopathologies such as anxiety is negatively associated with creativity.

In summary, recent research has identified anxiety, paranoia and childhood trauma as antecedent factors in populations at-risk for psychosis. These factors have not been examined in a professional creative population although there is some evidence that creative individuals with a history of trauma and with heightened anxiety have higher levels of creative expression. Thus, the aim of this research is to;

1. Examine the relationship between anxiety and creativity in a diverse sample including individuals with early psychosis, creative professionals with subclinical psychotic symptoms (at-risk creative), creative professionals with no psychotic symptoms (creative controls) and a non-creative population. It is hypothesised that, across this diverse sample and also within the creative population, anxiety will be positively associated with creative thinking and creative achievement.
2. Examine adverse life events, paranoid thought, anxiety in individuals with early psychosis (EP), 'at risk' creative professionals (ARCC), creative controls (CC) compared to non-creative controls (NCC). It is expected that overall adverse life events, anxiety and paranoia will be similarly elevated across the ARCC and EP sample compared to the CC and NCC. However, the early psychosis group will record significantly higher incidence of childhood trauma, when compared to the two professional creative groups and the non-creative group.

6.2 Methods

Study procedures were approved by the Human Research Ethics Committees of the University of New South Wales and ratified by the University of Technology. All participants provided written consent prior to participation. The age of participants was restricted to 18-35 year olds as the focus was on early psychosis. All participants were given a \$40 monetary reimbursement for travel costs.

Participants

A total of one hundred and ten participants completed the study across the four groups (*EP: n = 21; ARCC: n = 25; CC: n = 30; NCC: n = 34*).

Early psychosis participants (EP; n = 21).

Early psychosis participants were recruited from an existing clinical study (Rowland et al., 2012), and had given consent to be approached for further studies. Twenty-five participants were approached for the study and twenty-one agreed to participate. Of the four who declined to participate, two indicated active psychotic symptoms and two failed to respond to invitations to participate. All were recruited from either an inpatient or outpatient hospital clinic and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis (DIP), administered by an experienced clinician. The OPCRIT algorithm (McGuffin & Farmer, 1991) was used to confirm clinical diagnosis. This ensured consistency across interviewer ratings on the

Diagnostic Interview for Psychosis (Castle et al., 2006). All early psychosis participants met criteria for psychosis disorder according to ICD -10 criteria and recorded a first episode psychosis or hospitalisation (Breitborde et al., 2009). Although active psychotic symptoms were an exclusion criteria for the study, using the Positive and Negative Syndrome Scale for Schizophrenia (Kay et al., 1987), no participants were excluded.

Creative control participants: (Total n = 55: ARCC: n = 25; CC: n = 30)

Fifty-five creative control participants were recruited from several Creative Art Colleges. Individuals were presented with an outline of the research and gave written consent to take part in the study. CC were screened for past or present psychotic symptoms using a neuropsychiatric structured interview (MINI) (Lecrubier et al., 1997). None were found to have satisfied the criteria for past or present psychiatric disorders. In administering the MINI it was observed that twenty-five of the creative participants reported past symptoms of hypomania or psychosis symptoms that failed to reach criteria for diagnosis. Due to the high number of creative participants who reported these symptoms and in response to the epidemiological study by MacCabe (2018), it was decided to consider this a possible 'at risk' creative group. There remained thirty participants who did not have evidence of sub-clinical psychotic symptom and these formed the creative control group.

Non-creative control participants (NCC) N=34

Healthy, non-creative controls were recruited via a university website. The online information asked for psychologically healthy volunteers to participate in research into creative cognition, and thirty-three individuals initially responded. Nine participants were excluded because they met either of the following three exclusion criteria: i) personal or family history of mental illness; ii) an inability to communicate proficiently in spoken and written English and iii) receipt of more than rudimentary training in any field of creative arts. Using the MINI (Lecrubier et al., 1997) the non-creative controls were also screened for any history of mental health and one participant was excluded for a current psychopathology. These participants were reimbursed for their time.

Measures

Depression, Anxiety and Stress Scale (DASS) (Lovibond and Lovibond 1995)

The DASS is a 42 item instrument, consisting of three subscales measuring symptoms of depression, anxiety and stress (Lovibond & Lovibond, 1995). In this scale depression is characterised as the absence of positive affect; anxiety is characterised as hyper arousal and fear while stress is identified as persistent irritability and frustration.

There is however supporting evidence to suggest that DASS-S is a measure of negative affect and symptoms which correspond to generalised anxiety disorder (Brown et al., 1997). It was for this reason that both DASS-A and DASS-S subscales were specifically analysed in this study. Participants are asked to rate using a 0-3 scale how much the symptoms applied to them over the past seven days. Higher scores indicate increased

levels of emotional distress. The DASS has high internal consistency and convergent and discriminant validity (Depression .88 Anxiety .82 Stress .90 and Total scale .93) and it has been assessed as a reliable measure for community and clinical settings (Henry & Crawford, 2005). In the current study, the Cronbach alpha coefficient was .83.

Stressful Life Events Screening Questionnaire (SLE) (Goodman et al 1998)

A modified version of the SLE Screening Questionnaire (Goodman et al., 1998) was used. This was a twelve-item questionnaire to assess exposure to stressful life events⁶. The scale was modified to minimise the negative impact of administering the scale within a research setting therefore participants were only asked to indicate if they had experienced a specific stressful life event (yes or no). They were then asked to indicate their age at the time of the event and to indicate how distressing they found this event on a five-point scale. Although the distress question was asked in the test battery, this was not included in the final analysis as reported incidence (including multiple incidence) and age were of primary interest. The original questionnaire has a good test, re-test reliability (overall correlation .89) with the median kappa for reporting on specific events across administrations was .73 (Goodman et al., 1998). In the final analysis three items were not included due to insufficient response. Of the remaining nine subscales, total incidence of stressful life events and type of stressful life event were reported.

⁶ The items included 1) serious accidents, 2) natural disasters, 3 non-sexual assault by family member 4) non-sexual assault by stranger 5) sexual assault by family member 6) sexual assault by stranger 7) military combat or war zone 8) sexual contact, younger than 18 with someone 5 + years older 9) Imprisonment 10) Torture 11) Life threatening illness 12) Other traumatic event (e.g., traumatic relationship breakdown).

Paranoia/Suspiciousness Questionnaire (PSQ)(Rawlings & Freeman, 1996)

The PSQ was designed to measure paranoia and suspiciousness in largely non-clinical populations. The 47 items were developed from five existing criterion scales specifically assessing cognitions involving paranoia, hostility and suspiciousness. The participants were asked to indicate yes or no corresponding to each of the 47 items e.g., “Do you feel that people who act friendly to you can be disloyal to you behind your back?” Five subscales were produced based on factor loadings which were examined for internal consistency: interpersonal suspiciousness (IS: $\alpha = .77$); negative affect (NM: $\alpha = .66$); anger/impulsiveness (AI: $\alpha = .71$); mistrust/wariness (MW: $\alpha .65$) and perceived hardship (PH: $\alpha = .74$) (Rawlings & Freeman, 1997). The PSQ had good internal reliability and test – retest reliability ($\alpha = .89$)(Rawlings & Freeman, 1996).

Abbreviated Torrance test for Adults (ATTA) (Goff & Torrance, 2002)

To determine creative cognition all participants were administered a test of divergent thinking (ATTA) which is a well-validated measure of creative potential (Goff & Torrance, 2002). This test comprises three tasks; the first calls for a verbal response to a hypothetical problem and the following two tasks require figural responses. Participants were asked to respond to the task using problem solving and imagination. Their responses were scored according to four norm referenced indicators: fluency (KR21 = .45; SEM : 1.48), originality (KR21 = .38; SEM: 1.69), flexibility (KR21 = .38; SEM :1.47) and elaboration (KR21 = .84; SEM: .78) and fifteen criterion referenced

indicators (e.g., humour). Following this computation, an indicator of verbal and figural creativity as well as an overall creative indicator (CI: KR21=.69; SEM: 4.76) is calculated. Two scorers (JC and SG) coded each response according to the scoring guidelines and there was good inter-rater agreement 96% with consensus reached for the remaining 4%. The ATTA records good inter-rater reliabilities ranging from .95 -.99 (Goff & Torrance, 2002).

Creative Achievement Questionnaire (CAQ) (Carson et al., 2005)

To evaluate creative output, the CAQ (Carson et al., 2005) was administered to all participants. Ten domains were identified from previous research (Colangelo, Kerr, Hallowell, Huesman, & Gaeth, 1992); these items included domains in expressive and performance creativity as well as scientific discovery. As emerging professional creative artists were the focus of the creative participant group, an amended form of the CAQ was administered to identify arts focused domains only and include relevant early achievement associated with contemporary outputs in online and digital creativity (Hughes et al., 2016). The CAQ allows for sub classification of achievement into expressive, scientific and performance creative achievement (principal component analysis with varimax rotation accounted for 43.8% of the variance). Expressive achievement refers to domains such as writing, and visual arts while performance achievement pertains to dance, music, drama performance (scientific creativity was not included) The CAQ has good test-retest reliability ($r = .81$, $p < .0001$) and internal consistency ($\alpha = .96$).

6.3 Results

Participants

There was no significant difference in age ($F(3,111)=1.40, p=.246$), gender ($\chi^2(3, N = 112) = 1.06, p = .738$) or IQ ($F(3,109) = 1.8, p = .15$) between the four groups.

Although there were no significant differences in years of education, there were differences recorded in occupation (see Table 10)⁷. This could also be an indication of the early psychosis and creative individual's uncertain and erratic employment (Van den Eynde et al., 2016). Although significant, it was not considered relevant to further analysis. Table 1 also reports PANSS scores for all early psychosis participants.

Procedures

All participants were tested individually, at a single session, in a dedicated confidential space either within a hospital environment (EP) or on a student campus or a creative arts setting (CC, ARCC) or a university setting (NCC). Participants presented themselves at the testing room and completed a written consent form prior to testing. The testing period ranged from 2-3 hours. Standardised test administration protocols were followed for all tests.

Data analysis

⁷ Due to the methods of recruitment, the non-creative control group mostly identified as students and none reported being in part-time employment or unemployed. As a result, the cell sizes for this group prevented analysis across the four groups and thus, this variable was recoded (Group 1: EP, CCx Group 2: NCC) part-time/unemployed (Gp1: 31.6%; Gp2: 0%) vs student/full-time employed (Gp1: 68.4%, Gp2: 100%); (Fishers exact $p<.001$). There was a significant difference in occupation status between the four groups, whereby the NCC (unlike the EP, ARCC, CC) group was less likely to be in part-time employment or unemployed.

Data were initially screened for missing values, and less than 5% of the data were missing which is within recommended limits for non-correction (Tabachnick et al., 2001). A series of data normality of distribution checks were then run (presence of outliers, skewness/kurtosis), as well as Levene's test for homogeneity of variance, and all variables found to meet criteria. A Bonferroni correction was applied to all comparative analyses, given the multiple tests conducted in this study. All statistical analyses were conducted using SPSS version 25.

Anxiety and creativity positively associated

Compared to the NCC and CC population, the ARCC and EP group reported significantly higher mean scores on DASS-A/S scores (See Table 11). Additionally, the CC population reported significantly higher DASS-S than the non-creative controls but did not differ from the NCC group on other measures of anxiety. The relationship between anxiety (DASS-A/S) and creative cognition (verbal and figural) and creative achievement (expressive and performance) was investigated using Pearson product-moment coefficient. As reported in Table 11 Pearson product moment correlations were calculated between the total group and the combined creative group. With respect to the whole sample, there was a positive correlation between DASS A/S and both the ATTA and the CAQ. For the combined professional creative population, a significant association was found between DASS-S and engaging in creative achievement. When those who indicated expressive creativity were examined

alongside those who indicated performance creativity, the performance creative participants had a significant positive association with DASS-A/S.

Between group differences on anxiety, paranoia and stressful life events.

A one way between groups analysis of variance was conducted to explore between group differences on anxiety (DASS-A/S) and Paranoid/suspiciousness (PSQ total and subscale). Although results from PSQ have been reported in a previous analysis (Crabtree & Newton-John, 2018) these data were not interrogated using a four group sample nor was an association with anxiety and SLE examined. Participants were analysed according to the four groups (see Table 12). With respect to DASS-A/S and paranoia, the EP and ARCC groups were closely aligned. The EP and ARCC did not significantly differ from each other and reported significantly higher mean scores on DASS-A compared to NCC and CC. The only factor where the CC (along with EP, ARCC) group scored significantly higher compared to NCC was on DASS-S. Correspondingly, the EP and ARCC group reported similar elevated paranoia/suspiciousness compared to the NCC on all subscales except on perceived hardship where the EP but not ARCC recorded significantly higher results compared to NCC.

Results recorded from the SLE scale were noteworthy. As expected, both EP and ARCC reported significantly higher overall incidence of SLE scores than the CC and NCC groups with the ARCC group reported the highest mean score for SLE. With respect to the SLE subscale, Table 12 records the mean and standard deviation for all reported

incidence of SLE. For the EP cohort, incidence of non-sexual assault/ sexual assault within the family were higher compared to both creative groups; Non-sexual assault-family: $\chi^2(3, N=111)=14.3, p<.01$; Sexual assault family $\chi^2(3, N=111)=13.1, p<.01$. The NCC group recorded no incidence of either. The ARCC recorded higher mean scores on accidents $\chi^2(3, N=97)=9.03, p=.03$ ns, sexual contact under 18 $\chi^2(3, N=97)=6.73, p=.08$ ns; Other (i.e., Parent divorce, difficult breakup) $\chi^2(3, N=97)=10.5, p=.11$ ns.

6.4 Discussion

Based on recent genetic and epidemiological research identifying associations between creative professional individuals and those with psychopathology, we sought to examine what factors may differentiate an early psychosis and professional creative population. Emerging research has found anxiety, paranoia and early life events contribute to transition to psychosis (McAusland et al., 2017; van Nierop, 2015) and these factors were examined in this study.

Anxiety

On measures of anxiety (DASS-A), and negative affect (DASS-S) the EP and ARCC group had significantly higher scores, compared to the NCC, with the ARCC group recording levels of anxiety similar to a clinical rather than a control group (Bieling, Cox, Enns, & Swinson, 1998). As indicated earlier, those with anxiety and at times of elevated stress are more likely to experience paranoia (Freeman et al., 2018). Our sample of creative

professionals recorded higher levels of anxiety. The work by Van den Eynde and colleagues (2015b) records the heightened levels of stress this population of professional creative individuals experience due to performance stress, uncertain work and financial stress. The elevated levels of paranoia reported in this current study may arise from anxiety under stress and may be indicative of unique vulnerabilities in this population. These results lend further support to the assertion that professional creative artists may be more vulnerable to anxiety and negative affect and this vulnerability requires specific and targeted intervention (Van den Eynde et al., 2016).

Creative cognition and anxiety

The interaction between creative cognition and anxiety presents an interesting picture, which diverges from other findings. Although it has been postulated that anxiety is negatively associated with creativity (Baas et al., 2016; Byron & Khazanchi, 2011), our findings lend support to other recent findings, which record a positive association between anxiety and creativity, particularly within a creative performance population (Thomson & Jaque, 2018). The meta-analysis by Byron and Khazanchi (2011) proposed that anxiety was negatively associated with creative cognition. Our findings did not support this. Our results indicate, that in the diverse population the DASS-A and DASS-S, was positively associated with creative cognition. This association was strongest between DASS-S and figural creativity.

Creative achievement and anxiety

The study mentioned above by Byron and Khazanchi (2011) measured creative cognition and did not examine creative achievement. In our study, we measured both creative cognition and creative achievement. Consistent with the findings on creative cognition, our results provide evidence for a positive correlation between creative achievement and anxiety. This association was found in the total population and combined creative cohort. Creative achievement was further subdivided into expressive and performance creative attainment to determine whether the association with anxiety was strongest with those engaged with expressive creativity (writers, artists) or performance creativity (actors, dancers). Our evidence indicates that performers had a stronger positive association with anxiety. This provides further endorsement for the assertion proposed by Thompson and colleagues (2018) that, in performers, heightened anxiety and negative affect enhances performance and may indicate creative resilience.

Anxiety, paranoia and stressful life events

As hypothesised, the EP and ARCC were more closely aligned on measures of anxiety, paranoia and SLE compared to the CC and NCC. However, as SLE and paranoia are examined in detail, differences between the two populations become evident. With respect to the PSQ, the EP group was only discriminated from the ARCC on measures of perceived hardship. A recent systematic review of self-report measures of paranoia (Statham, Emerson, & Rowse, 2019), identified a hierarchy of paranoid ideation from

non-pathological to clinical paranoia (Freeman et al., 2018). Non-pathological was defined as paranoia associated with ideas of reference and social evaluation i.e., “they are talking about me” to higher order paranoia where life is perceived as unjust and the individual is under severe threat. It may be argued that the significantly higher “perceived hardship” score for the early psychosis population, compared to all other groups, is indicative of the higher order paranoia which is associated with a clinical rather than a non-clinical population. The authors of the meta-analysis note that the PSQ, used in this study may not sufficiently discriminate paranoia in a clinical population (Statham et al., 2019). Further studies into paranoia within professional creative and early psychosis populations, using measures assessing clinical paranoia may more closely discriminate these two populations.

Notwithstanding, this ‘belief of perceived hardship’ may arise from childhood trauma (de Vos et al., 2019). Childhood trauma is associated with the development of psychotic experiences (Bell et al., 2018; de Vos et al., 2019) and anxiety (Faravelli et al., 2012). Although the ‘at risk’ group reported similar elevated levels of trauma, it was the clinical groups higher incidence of childhood physical and sexual assault that was significant compared to the other control groups. The early psychosis group represents a small sample, however the findings identifying higher levels of childhood trauma is consistent with other larger studies (Bell et al., 2018; de Vos et al., 2019) and does represent a point of differentiation from the ‘at risk’ population. Exposure to childhood trauma has been associated with anxiety and alterations to the HPA system

(Faravelli et al., 2012), which implicates the development of anxiety, heightened stress and threat response (de Vos et al., 2019). Furthermore, it may be that exposure to early trauma establishes the internalised belief about perceived hardship and extreme threat of safety (paranoia) that precipitates delusion formation (Freeman & Fowler, 2009) .

In contrast, the 'at risk' creative participants reported a higher overall incidence of SLE but fewer incidence of childhood sexual and physical assault, compared to the early psychosis group. With respect to SLE in a creative population, Thompson and colleagues (2018) propose that those performers with higher levels of adult trauma and with elevated anxiety, report a deeper state of absorption. Absorption is described as heightened exploration, an immersion in the creative process and an intensification of experience (Nelson & Rawlings, 2010). Thompson and Jacque (2018) described this as a loss of sense of self in the creative process, alongside greater emotional intensity. They propose that this group of anxious performers who report a higher incidence of SLE experience enhanced creativity and may be more resilient. Moreover the creativity associated with performance may facilitate processing of negative affect. As indicated earlier and within the limitations of a cross-sectional analysis, our findings provide qualified support for this hypothesis. The aforementioned results indicate that a clinically vulnerable creative population, examined on measures of anxiety, with elevated incidence of SLE - had enhanced creative achievement and creative cognition compared to NCC.

Clinical Implications

On measures of overall anxiety, paranoia and experience of SLE, the 'at risk' creative group resembled the early psychosis sample. This is consistent with the epidemiological studies, which identify creative arts students at greater risk for psychosis (MacCabe et al., 2018). These results further emphasise the need for careful screening and intervention for this population of young creative artists. Certainly psycho-education programmes, which provide specific cognitive behavioural skills, may be implemented in creative arts tertiary institutions to address issues of anxiety, negative affect and paranoia. This study also provides support for the notion that creative performance may assist the 'at risk' creative population to process negative affect, however more specific research that examines this relationship across time needs to be undertaken. With respect to an early psychosis population and as proposed by other researchers (Bell et al., 2018; van Nierop, 2015), early identification and specific intervention for those with childhood trauma is of increasing importance. This may be of particular relevance for those who present with creative aptitude.

The question of what enables a sensitive creative individual to follow a path of paranoia and delusions rather than professional creativity requires further longitudinal study. Certainly the role of childhood trauma is one that warrants additional analysis. One explanation may be that as childhood trauma establishes sensitivity to stress and anxiety via alterations in the HPA axis regulation, which can in

turn be exacerbated by ongoing stressors (Faravelli et al., 2012; Gunnar & Quevedo, 2007), delusion formation may be an adaptive imaginative response to heightened threat (Carr, 2010; Grillo, 2018).

Limitations

The research was limited by small sample size, which may lead to reduced statistical power and account for negative findings that limit our ability to understand the relationship between these factors. Furthermore the cross-sectional methodology provided evidence of the association between professional creativity and early psychosis but does not enable determination of causality, nor can it lead to findings that imply change over time. Further limitations of this study include the bias associated with self-report measures. There have been several commentaries that discuss the limitations of self-report measures for SLE (Dohrenwend, 2006) and paranoia (Statham et al., 2019) and, as these commentaries indicate, this may have led to possible response bias distortion in the results. The research was furthermore limited by using a paranoid scale that may not have sufficiently differentiated a clinical sample.

Conclusion

Although the study had clear limitations, the strengths of the study involved the investigation of a distinct early psychosis and professional creative sample. The study included a neuropsychiatric structured interview, which enabled the professional

creative sample to be further sub-divided into those with and without sub-clinical symptoms of hypomania and psychosis. The finding that this sample of ‘at risk’ creative individuals is closely aligned with the early psychosis group on anxiety, stress, paranoia and adverse life events is of significance for further research. It points to an urgent need for targeted intervention for creative arts students and for ongoing assessment and monitoring for this vulnerable population.

In summary

Factors associated with later psychosis, namely anxiety, paranoia and stressful life events were examined in early psychosis, at risk creative, creative and non-creative controls. Anxiety was positively associated with creative cognition and achievement across diverse populations and creative population. At risk creative and early psychosis groups were closely aligned on measures of anxiety, paranoia and stressful life events. The Early psychosis group only differed from at risk creative group on *perceived hardship* paranoia subscale and incidence of *early childhood trauma*.

Acknowledgements

The authors would like to acknowledge Shannon Gostelow and Nicole O’Reilly who were research assistants for the project. The authors would also like to acknowledge the National Health and Medical Research Council (NHMRC) Project grant (APP630471), and the Australian Research Council (ARC) Future Fellowship (FT0991511) both grants held by Melissa J Green (UNSW). Melissa J Green was

responsible for this project as executed at UNSW and is affiliated with UNSW, Neuroscience Research Australia (NeuRA), the Black Dog Institute, and the Macquarie Centre for Excellence in Cognition and its Disorders

Table 10.

Sample Description

	EP	ARCC	CC	NCC	Statistical Value for main effect
N	21	25	30	34	
Age (years)	25.4 ± 4.2	23.8 ± 4.8	23.1 ± 3.9	23.7 ± 3.7	F(3,111) = 1.40, p = .246
Female (%)	57.1	56.0	68.8	58.8	$\chi^2(3, N = 111) = 1.06, p = .738$
IQ	107.9 ± 15.2	110.2 ± 10.2	108.3 ± 10.2	103.5 ± 13.1	F(3,109) = 1.8, p = .15 ns
Years of education	14.95 ± 2.78	15.53 ± 1.77	14.56 ± 2.39	15.91 ± 1.86	F(3,109) = 1.07, p = .394
ATTA	76.5 ± 12.5	81.92 ± 7.0	77.4 ± 9.9	65.0 ± 11.5	F(3,108) = 14.5, p < .001 ^a
CAQ	25.1 ± 25.6	55.8 ± 32.1	40.9 ± 26.6	2.6 ± 4.1	F(3,108) = 26.9, p < .001 ^{a,b}
EMPLOYMENT STATUS	N (%)	N (%)	N (%)	N (%)	
Student	7 (33.3)	14 (56.0)	21 (70.0)	28 (82.4)	
Employee	6 (28.6)	2 (8.0)	2 (6.7)	6 (17.6)	
Part time employment	6 (28.6)	7 (28.0)	6 (20.0)	0 (0)	
Unemployed	2 (9.5)	2 (8.0)	1 (3.3)	0 (0)	
PANSS					
Positive	9.38 ± 2.97				
Negative	11.24 ± 4.81				
General	21.00 ± 4.16				
Total	42.10 ± 8.04				

ATTA = Abbreviated Torrance Test for Adults; CAQ = Creative Achievement Questionnaire; PANSS = Positive and negative syndrome scale

a = EP,ARCC,CC>NCC**

b = ARCC>EP*

Table 11.

Bivariate correlation DASS (anxiety/stress) with ATTA (verbal/figural creative cognition) and CAQ, (total/expressive/performance)

TOTAL n = 102	ATTA	ATTA verbal	ATTA figural	CAQ total	CAQ expressive	CAQ performance
DASS-anxiety	.205*	.046	.149	.310**	.249*	.225*
DASS-stress	.328**	.142	.268**	.408**	.254**	.362**
CREATIVE n = 55						
DASS-anxiety	-.066	-.173	.030	.269	.003	.287*
DASS-stress	.069	-.137	.118	.305*	-.040	.356**

DASS= Depression, Anxiety, Stress Scale; ATTA-Verbal = Abbreviated Torrance Test for Adults-verbal

ATTA= Abbreviated Torrance Test for Adults – Figural; CAQ= Creative Achievement Questionnaire; CAQ expressive = Creative Achievement Questionnaire – Expressive; CAQ performance = Creative Achievement Questionnaire – Performance

* p <.05

** p<.01

Table 12:

Means and Standard Deviations for all Groups on DASS, Stressful Life Events and PSQ

	EP (n=21)	ARCC (n=25)	CC (n=29)	NCC (n=29)	Statistical values for main effects
Anxiety	M ± SD	M ± SD	M ± SD	M ± SD	
DASS Anxiety	9.86 ± 8.47	8.20 ± 5.57	5.83 ± 5.66	3.34 ± 4.40	$F(3,103)= 5.63, p < .01^a$
DASS Stress	15.48 ± 11.21	13.84 ± 8.23	11.52 ± 7.34	5.59 ± 5.43	$F(3,103)= 7.60, p < .01^c$
Paranoia scale(PSQ)					
Interpersonal suspiciousness	6.62 ± 3.42	6.36 ± 2.45	4.87 ± .2.68	.3.00 ± 2.50	$F(3,98)= 8.31, p < .001^a$
Negative mood	4.48 ± 1.66	4.04 ± 1.56	3.53 ± .1.65	2.70 ± 1.10	$F(3,98)= 5.67, p < .001^a$
Anger impulsivity	4.29 ± 3.16	4.16 ± 1.75	2.67 ± 1.42	2.30 ± 1.15	$F(3,98)= 6.46, p < .001^d$
Mistrust wariness	3.62 ± 2.03	3.72 ± 1.88	2.13 ± 1.75	2.48 ± 1.85	$F(3,98)= 4.68, p < .01^e$
Perceived hardship	3.52 ± 2.23	2.52 ± 2.31	1.70 ± 1.80	1.57 ± 1.31	$F(3,98)= 4.91, p < .01^b$
Total paranoia/susp	24.95 ± 9.21	23.04 ± 6.62	16.03 ± 7.65	13.43 ± 6.41	$F(3,98)= 12.60, p < .001^d$
Stressful Life events Scale	N (%)	N (%)	N (%)	N (%)	
Accident	7 (31.8%)	9 (40.9%)	4 (18.2%)	2 (9.1%)	
Natural Disaster	5 (38.5%)	3 (23.1%)	3 (23.1%)	2 (15.4%)	
Non-sex assault family, other	9 (47.4%)	6 (31.6%)	4 (21.1%)	0	
Non-sexual assault stranger	9 (34.6%)	7 (26.9%)	7 (26.9%)	3 (11.5%)	
Sexual assault family, other	8 (50%)	5 (31.3%)	3 (18.8%)	0	
Sexual assault stranger	0	2 (66.7%)	1 (33.3%)	0	
Sexual contact <18 +5 older	3 (30.0%)	5 (50.0%)	2 (20.0%)	0	
Illness	4 (18.2%)	5 (22.7%)	9 (40.9%)	4 (18.2%)	
Other (i.e., parental divorce)	17 (25.0%)	19 (27.9%)	20 (29.4%)	12 (17.6%)	
SLE total	8.86 ± 3.72	9.20 ± 5.84	5.83 ± 4.33	2.87 ± 3.67	$F(3,97)= 10.02, p < .001^a$

DASS= Depression, anxiety and stress scale; SLE= Stressful Life Events scale; PSQ=Paranoid /suspiciousness questionnaire

a = EP, ARCC > NCC**

b = EP > CC, NCC**

c = EP, ARCC, CC > NCC**

d = EP, ARCC > CC, NCC**

e = EP, ARCC > CC**

**p > .01

Chapter Seven

7.0 Discussion – more similar than different

This research was first conceived in an attempt to better understand the similarities and differences between creative individuals and those with schizophrenia and bipolar disorder. Whilst there had been a significant number of studies in this field (Ma, 2009; Schuldberg, 2001) there was apparent confusion about what distinguished these populations (Lauronen et al., 2004). In part this confusion stemmed from challenges in identifying creative and clinical populations and this ambiguity led to conflicting conclusions in the literature. However, a number of seminal papers which examined the neuro-biological and experimental research between creativity and psychopathology, (Jamison, 2011; Richards, 2001; Rybakowski et al., 2008) concluded that there was a clear association, but this association required further, considered research.

The spectrum model of shared vulnerability outlined in chapter two (Crabtree & Green, 2016) delineated factors common to the highly creative and those with psychosis spectrum, at the same time postulating what aspects of cognition and personality may protect the highly creative and differentially contribute to vulnerability in bipolar and schizophrenia populations. Since this work was published there has been an increased focus and attention on the need for early intervention (McGorry, Killackey, & Yung, 2009b). Over recent years a number of meta-analyses and reports have considered early intervention in those presenting with prodromal

symptoms and ‘at risk’ for psychosis markers (McGorry, Killackey, et al., 2009b; Yung et al., 2003; Yung et al., 2005). Additionally, early intervention in psychosis has been an increasing area of focus in psychiatry and attention has been given to identifying mechanisms to screen for ‘at risk’ and vulnerable psychosis populations (Carrión et al., 2018; Fusar-Poli et al., 2016). Consequently this thesis examined an early psychosis (rather than a distinct bipolar and schizophrenia) population. The model of shared vulnerability has been amended to better address the early psychosis population alongside a professional creative population and to update research findings from earlier chapters (figure 6).

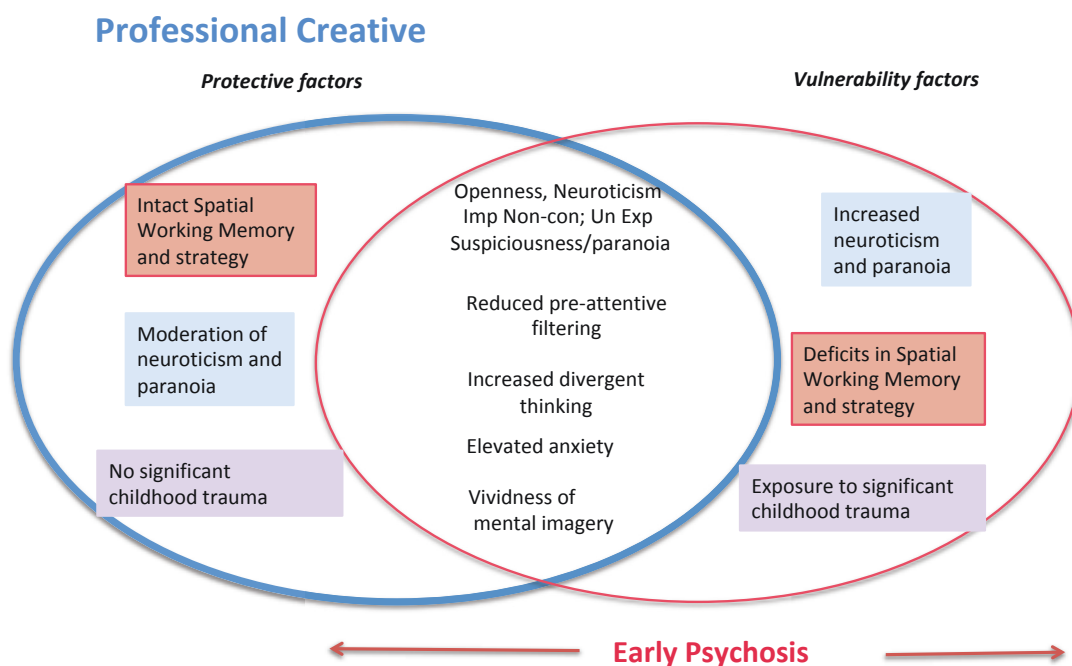


Figure 6: Shared vulnerability model: professional creative and early psychosis

7.1 Comparing the ‘at risk’ and early psychosis cohorts

Following significant epidemiological research identifying that artistic creative student populations had increased odds of developing psychopathology (MacCabe et al., 2018) it was decided to identify and examine an ‘at risk’ creative population drawn from the existing creative sample. A subgroup of creative controls, selected from the existing sample of creative controls were determined as being at risk due to sub-clinical levels of manic and psychotic symptoms (as measured by the MINI International Neuropsychiatric Interview (Lecrubier et al., 1997)). This group proved to be more aligned to the early psychosis population when compared to the general creative professional population on measures of personality and schizotypy including paranoia and anxiety. Although similarities between the ‘at risk’ and early psychosis populations are evident from the previous chapters, understanding what differentiates the two is particularly pertinent to the overall aims of this thesis. The following discussion will focus on the shared traits that differentiate the early psychosis and professional creative population from the non-creative sample and discuss the traits that distinguish the early psychosis from the professional creative population. A ***prodrome model of shared vulnerability***, which summarises these shared traits and differences, is discussed below (see Figure 7).

At risk creative

Intact SWM and superior strategy
Elevated creative thinking and achievement
Ideas of reference
Social Evaluative concerns
Exposure to stressful events

Early Psychosis

Deficits in SWM and strategy
Aptitude for creative thinking and limited achievement
High perceived hardship, persecutory paranoia, Exposure to childhood trauma

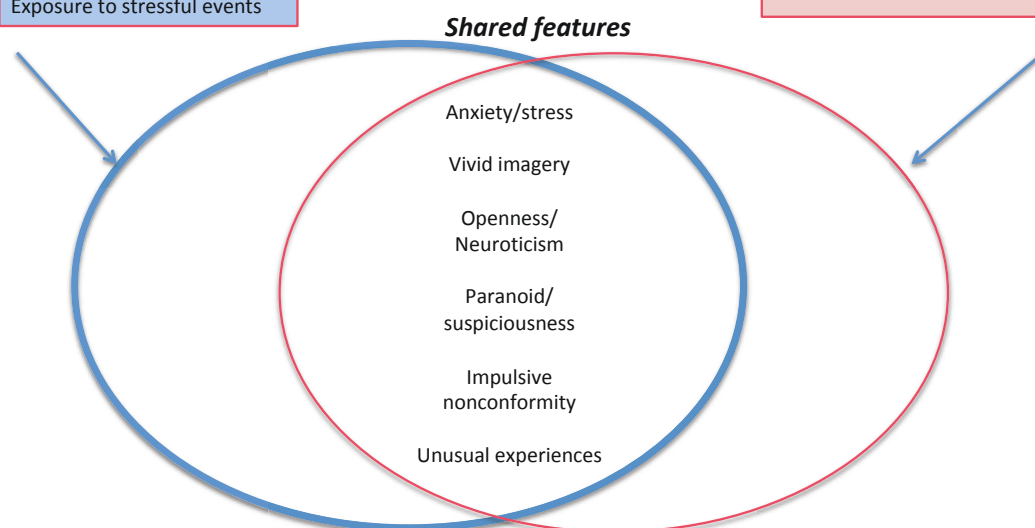


Figure 7: Prodrome model of shared vulnerability

7.2 Prodrome model of shared vulnerability

Similarity in emotion, personality and schizotypy

Although reporting similarly high overall paranoia/suspiciousness, impulsive non-conformity, unusual experiences, neuroticism/openness, stress and anxiety, the ‘*at risk*’ group could manage these cognitive, emotional and personality features and retain the ability to be creatively productive. Cognitively there were no differences in IQ, executive function or reduced filtering between ‘*at-risk*’ and early psychosis group with the only cognitive difference recorded in spatial working memory being *between errors* and *strategy*. These differences between the two populations will be examined in detail below.

Differences in spatial working memory

As indicated in chapter five, unlike the early psychosis cohort the '*at risk*' group recorded in tact spatial working memory and superior strategy. Spatial Working Memory strategy is thought to be associated with visual planning and the ability to adopt a systematic spatial search approach. Unlike other studies, which measured spatial working memory within clinical Ultra High Risk (UHR) and first episode populations (FEP), in this thesis a comparison was made between clinical and three control groups (ARCC, CC and NCC). Based on a comparison of mean scores for spatial working memory *between errors and strategy*, the early psychosis cohort recorded similar deficits in spatial working memory when compared to Ultra High Risk (UHR) and first episode (FEP) clinical groups reported in other studies (Goghari et al., 2014; Wood et al., 2003). The CC and NCC groups also performed similarly on spatial working memory to healthy control cohorts in other studies, however the ARCC appear to display a significantly superior strategy. This superior strategy, demonstrated by the ARCC was observed along-side evidence of enhanced creative imagination and mental imagery.

These findings should be considered in parallel with other related research into visuo-spatial ability and creative imagination. In particular, those with schizophrenia show a particular aptitude for creative visuo-spatial tasks (Wang et al., 2017) and those with schizophrenia have an increased likelihood of being engaged in visual arts occupations (Kyaga et al., 2011), but not other forms of creativity. Although visual creativity and overall creative achievement are also associated with those with

bipolar disorder, it seems those with schizophrenia may only translate their creative imagination and aptitude into visual arts creative achievement (Kyaga et al., 2011). Cortical blindness is also considered to be a protective factor for psychosis as it is asserted that visuo-cognitive impairments are essential to the development of the disorder (Landgraf & Osterheider, 2013). To summarise visual creativity and imagination are associated with both the highly creative (not specifically visual artists) and those with psychosis. This visual creativity and imagination predict creative achievement in both populations. The early psychosis individuals who present with enhanced mental imagery, which may lead to imaginative flights of fancy, also exhibit aberrations in visual pre-frontal functioning. These aberrations then become critical to the aetiology of psychosis (Landgraf & Osterheider, 2013). Figure 8 presents a flow chart of similarities and differences in visual-perceptive ability between the two populations.

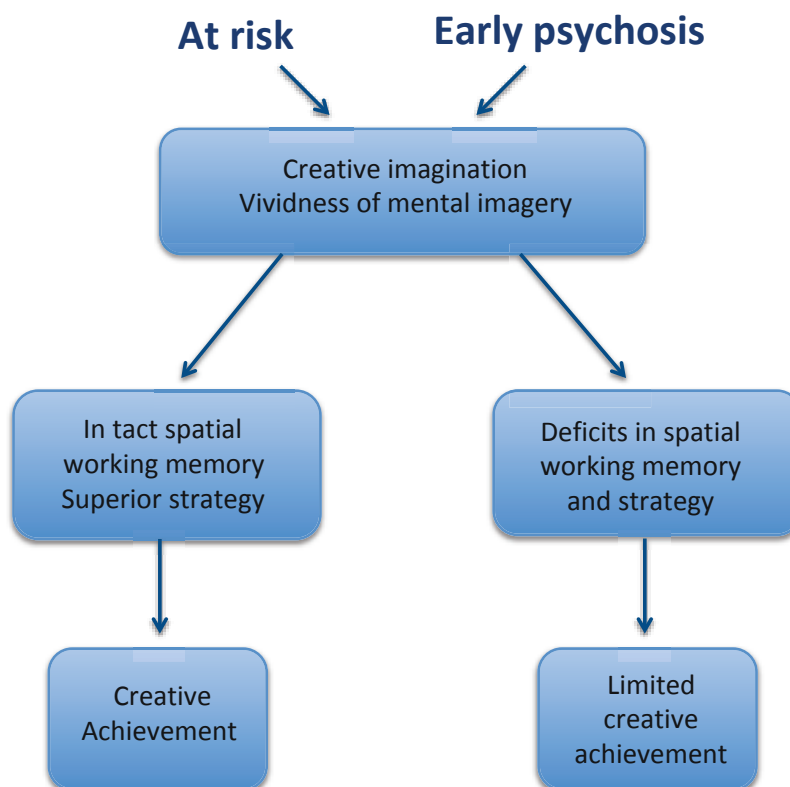


Figure 8. Flow chart of similarities and differences in visual-perceptive ability between ARCC and EP cohorts

Carson (2011) in her model of shared vulnerability proposed that high IQ and superior working memory (verbal) in the creative population enable the creative individual to sift through and manipulate an array of additional internal and external stimuli.

Alternatively, rather than IQ and verbal working memory our findings suggest that superior spatial working memory ability and strategy may assist the highly creative individual process internal stimuli from their creative, vivid imagination and external stimuli associated with an open and interpersonally sensitive personality without becoming confused, overwhelmed or perhaps delusional. Further longitudinal studies

need to be undertaken to clarify whether spatial working memory is a vulnerability marker for psychosis or an early indicator of transition to psychosis (Wood et al., 2003).

These findings raise the question of whether spatial working memory can be enhanced in clinical populations with emerging deficits. Spatial strategies employed by highly creative individuals may provide avenues for innovative treatment approaches for clinical populations. An example of a possible approach to managing deteriorating spatial working memory strategy was provided by one of the early psychosis participants and his comment is noted below. His comment is indicative of an externalised and ritualised strategy used to sift through an array of imaginative ideas. It is also suggestive of the internal process suggested by Carson (Carson, 2011) i.e. cognitive flexibility or the ability to sift through an array of stimuli. It may be that in this instance, the early psychosis participant has externalised that process.

The researcher recorded his comments at the time of testing.

“I have all these ideas and I want to know if I can use them. I spend time every month going through the webpages I have book marked to see if the ideas are fanciful or could be of value.” **Clinical ID: 100_CCP_AT; Male; 33 years**

Future research would benefit from examining possible innovative avenues of intervention for the early psychosis population. These results may also explain why the early psychosis had limited creative achievement and vocational outcomes.

Another factor that differentiated the ‘at risk’ and early psychosis cohort was paranoia. This factor will be examined below.

Paranoia – similar and different

Paranoia in clinical populations

As indicated in chapter six, both the ‘at risk’ and early psychosis populations reported significantly high overall paranoia and suspiciousness scores on the paranoid suspiciousness questionnaire (PSQ), compared to non-creative controls. The only significant difference between the two samples was on subscale measures of *perceived hardship*. This subscale reflects underlying resentment and a belief that the person is being unduly punished or persecuted in life. The PSQ, which was used in this research, was described in a recent systematic review of self-report measures of paranoia as primarily assessing lower order paranoid hierarchy (Statham et al., 2019). Lower paranoid hierarchy refers to measures designed to assess normal, non-pathological paranoia reflecting concerns about ideas of reference and social evaluation and may be related to perceptions of increased threat, particularly social threat. Stratham et al (2019) argued that these ideas of reference and social reference thoughts assessed in the PSQ were commonly found in the general population. Conversely paranoia associated with persecutory ideas was more evident in clinical populations and as such are different from paranoia associated with lower order paranoia hierarchy (Freeman et al., 2018) (Figure 9 represents a reproduction of Freeman’s paranoid hierarchy). The authors of the review suggest that paranoid thoughts that are more frequent and distressing with a stronger sense of persecution and perseveration are evident in clinical populations (Statham et al., 2019). Although the other subscales of the PSQ may be addressing lower order paranoia, it may be argued that the *perceived hardship* subscale is measuring a persecutory belief that is

more indicative of higher order paranoia; namely where the world is considered unjust and the individual is subject to persecution. The *perceived hardship* subscale of the PSQ was derived from existing measures of clinical paranoia such as the MMPI –paranoia scale (Rawlings & Freeman, 1996). It includes questions such as:

5. “Do you often feel that you have been punished without cause?”

6. “Would you have been more successful if others had not put difficulties in your way?”

It may be argued that this subscale may be more discriminating of paranoia in clinical populations.

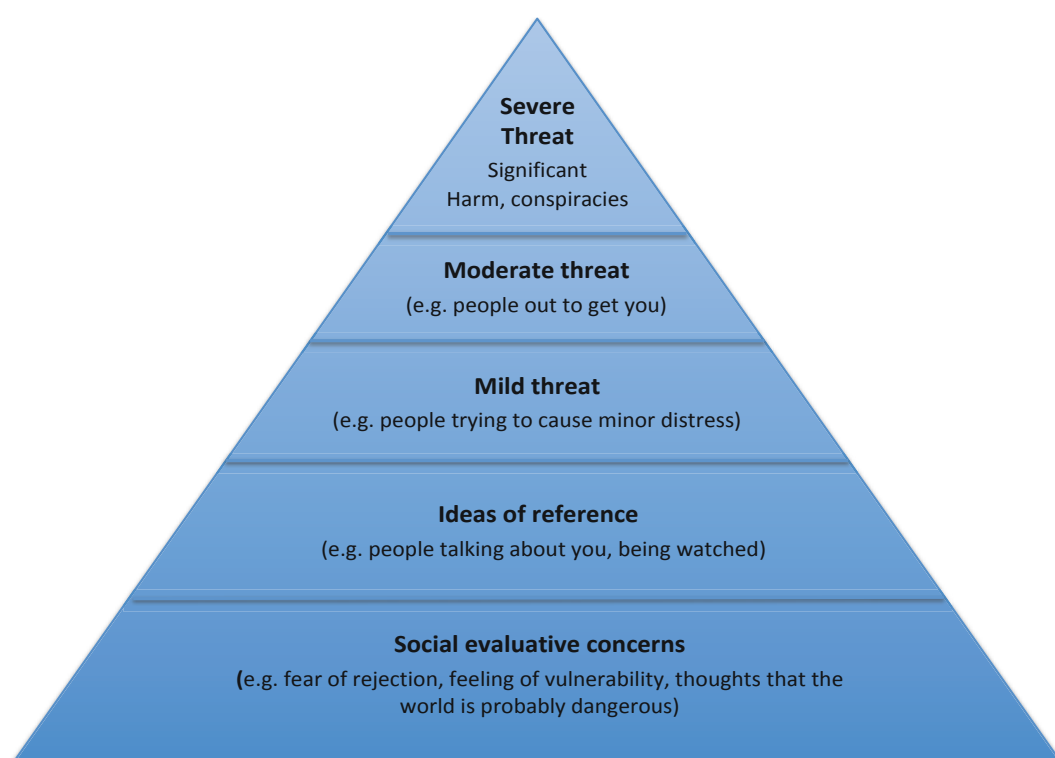


Figure 9 The Paranoia Hierarchy (Freeman et al., 2018)

Paranoia in at risk creative populations

Although little research has examined paranoia in creative populations, based on this hierarchy, there is support for the notion that a creative population is vulnerable to aspects of paranoia (Freeman & Fowler, 2009; Masillo et al., 2017). This paranoia

around social evaluation concerns is associated with increased anxiety, particularly social anxiety (Rapee & Heimberg, 1997). For example, as previously reported in chapter four, the creative individual has high neurosis or high interpersonal sensitivity and these factors have been associated with the development of both anxiety (Rapee et al., 2009) and paranoid thinking (Freeman & Fowler, 2009; Freeman et al., 2007). Although an examination of whether professional rejection increases social evaluation concerns in creative individuals has not been directly examined, it may be hypothesised that the creative individual would be more sensitive to social evaluative concerns such as a fear of rejection or feeling of vulnerability. The rationale for this assertion is that the creative individuals operate in an environment where rejection (such as rejection following auditions; audience rejection and so on) is an associated aspect of creative achievement (Van den Eynde et al., 2016). Therefore, paranoia about negative social evaluation may emerge, particularly with the added gaze of social media and this paranoia may lead to heightened anxiety.

Differences in stressful life events also discriminated the two groups. This is particularly significant, as trauma has been found to increase both anxiety and paranoia, which has been found to develop into psychotic-like experiences (Freeman & Fowler, 2009). Differences in stressful life events are examined below.

Differences in stressful life events

Although 'at risk' participants reported more overall stressful events, unlike the early psychosis group, they did not record significantly high levels of childhood sexual and

physical assault. Childhood adversity is emerging as a factor associated with the development of psychosis (Bell et al., 2018; de Vos et al., 2019) and has been discussed in detail in chapter six. These factors will not be elaborated here, as attention will be given instead to adverse life events in the 'at risk' cohort. In the findings reported in chapter six, the trauma profile of the 'at risk' group appeared to differ from the profile of the early psychosis group. The stressful life events scale did not fully discriminate all aspects of the trauma reported by the 'at risk' group, however there is evidence that creative professionals report increased adverse events and in the literature these adverse events have largely been associated with difficult work environments and lifestyle choices (Bellis et al., 2012; Kenny & Asher, 2016). Although the 'at risk' group had a higher overall mean score for trauma, this was primarily derived from a high 'other' score i.e. parents divorced, recent difficult breakup and other incidence associated with possible exploratory behaviour. Our findings of personality and schizotypal features (outlined in chapter four) describe the creative population as experiencing elevated openness and unusual experience. This is described in the literature as novelty seeking (Carson, 2011). Also as reported in chapter four, alongside this exploratory behaviour is elevated neurosis. These personality factors may underlie both, an increased possible exposure to adverse events and/or reporting of distress associated with adverse events.

In the stressful life events scale, the higher overall mean score recorded for the 'at risk' population did not adequately discriminate whether this may arise from exploratory behaviour, as suggested by other researchers or higher reporting of events that were perceived as distressing.

7.3 Summary of factors associated with the early psychosis sample

What is evident from the research reported in the previous chapters and other recent studies is that the early psychosis population report a higher incidence of early childhood sexual and physical abuse (van Nierop, 2015) and this has been associated with the development of psychotic thinking (Bell et al., 2018). Our findings also indicate that this population had an elevated sense that the world is a difficult, dangerous and unjust place where they feel persecuted. It may also be surmised that these beliefs arise from the early trauma (de Vos et al., 2019) and are accompanied by elevated anxiety. Furthermore our findings indicate that although the early psychosis group has a creative and vivid imagination, they experience deterioration in their visuo-spatial ability. Moreover this deterioration has been associated with the development of psychosis (Landgraf & Osterheider, 2013). Despite these emerging deficits, they were able to maintain some creative ability although limited to achieve creatively (Kyaga et al., 2011).

7.4 Summary of factors associated with the 'at risk' sample

Our findings support other research that reports the highly creative population experiencing elevated incidence of adverse life events (Thomson & Jaque, 2018). The available data from the study reported in chapter six, does not confirm whether these incidents of adverse life events arise from an exploratory and risk-taking

personality (openness and unusual experiences), perception of increased distress around events (high neurosis) or both. Accompanied by a higher incidence of adverse events, are elevated social evaluative concerns (paranoia/suspiciousness) and anxiety. Despite these levels of emotional distress, the 'at risk' group is highly imaginative and has a superior ability to manage and plan their internal and external visual environment. In doing so they can achieve creatively and it may be hypothesised, they can harness these levels of negative distress.

With respect to the two populations, their shared traits and differences have clinical implications. These will be discussed below.

7.5 Clinical Implications

Early psychosis clinical implications

Clinical intervention to enhance creative aptitude and improve vocational outcomes

One of the surprising findings of this research was the early psychosis group's elevated interest, aptitude and engagement with creative pursuits. Unlike the creative control group, the early psychosis participants were not recruited for their creativity in as much as they were approached from an existing large study into the shared phenotypes associated with bipolar 1 disorder and schizophrenia patients. Only those who satisfied the criteria for early psychosis and were between 18 and 35 years old were approached. Of those contacted, only four failed to respond (due primarily to a current psychotic episode) therefore it cannot be asserted that this population self-selected based on an interest in creativity. An interest in creativity may not translate into creative aptitude and achievement, however 67% of the early

psychosis sample scored high or substantial on the ATTA measure of creative thinking (It should also be noted that 20% had minimal or poor creativity). The scoring manual for the ATTA identifies only 16% of adults as those exhibiting high (12%) or substantial (4%) creativity. Moreover those who score at the upper end of the scaled scores (leading to a creativity index that is high or substantial) are seen as “accelerators”.

“Accelerators are plugged into this creative ability, utilizing it as a way of life. Accelerators tap this creative ability to reduce development time and speed up processes. Accelerators excel at expressing this creative ability.” (Torrance, 1990 p27)

The ATTA is recognised as a measure of creative potential (Torrance, 2000) and does not indicate creative achievement, however the CAQ (Carson et al., 2005) is a well-recognised measure of achievement. The early psychosis population, while not reaching the achievement of their creative professional cohort, did record significantly higher creative achievement than the non-creative controls. With respect to creative achievement, a number of early psychosis participants made comments about their creativity during the test battery. Researchers noted these comments at the time of testing:

“I trained and worked as a film director and I am trying to continue working”

“I had a career in music and sound but I had to stop following the episode”

“My psychiatrist advised me not to do anything creative as it would trigger an episode”

“I used to draw but I am scared of another episode and so I don’t do anything creative now”

“Because of the stigma (of my mental illness), I spend most of my time alone, except when I work as a street performer and fire eater”

The data identifies this group as having significantly higher creative thinking and achievement compared to the non-creative controls. However, the data are unable to illustrate the motivation demonstrated by this cohort in trying to pursue meaningful creativity in paid or unpaid creative professions. As discussed in the introduction, the Survey of High Impact Psychosis (SHIP) study highlighted that the most important factors affecting the lives of people with psychotic disorders included loneliness (37%), and lack of employment (35%) (Morgan & Jablenksy, 2010). Beyond using creativity as a form of therapy for those with psychosis (Xia & Grant, 2009), this research intimates that future, novel therapeutic intervention may include the role of “creative agents” to assist those ultra high risk and early psychosis individuals who have creative aptitude maintain their creative productivity (Schildkraut et al., 1994). Creative professions have ‘acting agents’, ‘music managers’, gallery owners’ who assist creative individuals interface with the industry (Csikszentmihalyi, 1996) and these roles have assisted gifted creative individuals with psychopathology to maintain productivity in the past (Milligan & Clare, 1994; Poole, 2003; Post, 1994). With creativity and psychopathology genetically and epidemiologically associated (Jamison, 2011; Kyaga et al., 2011; Power et al., 2015), targeted intervention, which maintains meaningful, productive and professional creative expression in emerging creative ‘at risk’ and early psychosis populations is an avenue for future exploration.

Clinical implications for deficits in spatial working memory

Regarding cognitive deficits in this population, the spectrum model of shared vulnerability presented in chapter two proposed that deterioration in executive function and IQ would differentiate the creative, 'at risk' creative and early psychosis populations. Another surprising finding was that spatial working memory distinguished the 'at risk' and early psychosis groups. Although executive function deficits are present as this population ages (Fucetola et al., 2000), this research supports other studies, which found the emergence of spatial working memory as an early indicator of cognitive decline (Goghari et al., 2014; Landgraf & Osterheider, 2013). Unique to the present research is the ability to compare two populations that are analogous on vividness of mental imagery, creative imagination, high neurosis, positive and disorganised schizotypy, heightened paranoia, elevated stress and anxiety. The 'at risk' group with a history of sub-clinical symptoms of hypomania and psychosis, recorded in tact spatial working memory and superior strategy, while the early psychosis group had significant deficits in this area. These findings point to an emerging area of clinical intervention, specifically assessing and developing spatial working memory in ultra high risk and early psychosis populations. There is an opportunity to introduce the development and testing of innovative treatment protocols. This may include the development of computer programs to cultivate spatial working memory in ultra high risk and early psychosis populations. The aim of these computer-based trials would be to determine if spatial working memory can improve with rehearsal and practice or if the deterioration in spatial working memory can be preserved. A randomised trial of a cognitive remediation programme (not specifically addressing spatial working memory) has had limited success (d'Amato et al., 2011). Additional treatment protocols specific to spatial working memory may

include regimens to teach those with emerging psychosis how to visually ‘reality test’ their internal and external environment. The early psychosis participant discussed above who had developed a protocol to evaluate “good ideas” from “fanciful ideas” is an example of such a regimen.

Clinical implications for differences in incidence of childhood trauma

An additional finding consistent with other recent, related research (Bell et al., 2018; de Vos et al., 2019), was the early psychosis group’s significantly increased incidence of childhood assault compared to controls. Although sample sizes were small, and both the ‘at risk’ and early psychosis group recorded significantly high overall trauma, it was the childhood abuse that differentiated the two populations. A leading researcher in the area (de Vos et al., 2019), advocates for further research in to all types of trauma that may be associated with psychosis. Particular to the present research was the comparison between a similar ‘at risk’ group with a history of stressful events and an early psychosis group with an elevated history of childhood assault. Childhood trauma leads to unique “hardwired” sensitivities to stress that change how our HPA system responds to stress. This can lead to an over or under activation of the HPA system (Faravelli et al., 2012). It may be speculated that this trauma changes the individual’s normal HPA response to perceived threat, which may lead to a more severe, paranoid and conspiratorial response to benign situations. In the presence of a creative imagination (Carr, 2010) and with deterioration in SWM, delusions may form to “protect” against this misaligned threat (Grillo, 2018). Without further supporting research, this can only be inferred.

Therefore early intervention with children and adolescents who have a history or suspected history of early childhood trauma that addresses trauma specifically is also of critical importance. The recent NSW child development study, which examined records for a sample of 86,668 children between 6 and 13 years old, reported an association with early childhood developmental vulnerabilities i.e. childhood adversity and later mental health disorders (Green M. J. et al., 2019). These studies point to a need for future longitudinal studies, which monitor 'at risk' children over time. This present research highlights the need for early childhood abuse to be included in any longitudinal study of risk factors for future psychosis vulnerability.

Screening for vulnerability factors

The Australian Child and Adolescent Survey into Mental Health and Wellbeing conducted between June 2013 and April 2014 estimated that 14 % of young people aged 4-17 years experienced a mental illness in the twelve months prior (AIHW (Australian Institute of health and welfare), 2019). The Australian Youth Mental Health Report 2012 – 2016 (Yeomans, 2016) shows a more concerning picture where in 2016, just under one in four young people (15-19 years) who participated in the survey met the criteria for having a probable serious mental illness. Youth mental health screening is a possible area for consideration. Voluntary youth mental health screening programmes have met with some success in the United States, although there has been some limited evidence of false positives (Husky et al., 2011). In Australia youth mental health screening does not appear to be part of the recent Australian Government mental health initiative (AIHW (Australian Institute of health and welfare), 2019). Notwithstanding implications of the research suggest there may

be some value in introducing voluntary youth mental health screening. For example at age twelve and sixteen years (mean age of onset for psychosis rarely begins before fourteen years with increased prevalence fifteen to seventeen years (Kessler et al., 2007)) identifying youth with a history of childhood adversity, who score highly on creativity measures could be screened for deficits in spatial working memory. This may identify those youth at particular risk for psychosis presentation so that they may benefit from early intervention (McGorry, Killackey, et al., 2009b).

Clinical implications for creative controls

This present research also illustrates the need for early assessment and careful monitoring of those within creative arts high schools and creative arts training institutions, as those who are identified as highly creative are more at risk of mental health concerns, such as affective disorder and risk for psychosis. As reported in chapter one, the survey into mental health within the performing arts industry examined help seeking behaviour and found that while 59% sought assistance from psychologists, only 19% indicated this assistance was very satisfactory (Van den Eynde et al., 2016). Although the authors of the study do not provide a rationale for the lack of satisfaction reported by the respondents, one explanation for the disparity between seeking assistance from mental health professionals and satisfactory intervention, is that the mental health professionals may fail to appreciate the particular vulnerabilities and inherent strengths (outlined in this research) exhibited by this cohort. This would indicate that traditional methods of intervention are insufficient for this population and targeted programs that address the identified vulnerabilities are needed.

A pilot programme, entitled ***Building mental resilience*** has been developed to improve the wellbeing of creative individuals. It targets each of the key vulnerabilities identified in this thesis that may place a creative individual at risk of poor mental health. The programme is based on the theoretical model presented in chapter two and revised in this chapter and as such used existing evidence bases strategies to address cognitive and personality vulnerabilities, schizotypy, divergent thinking, reduced pre-attentive filtering, spatial working memory, and anxiety. This programme is outlined in Appendix 1V.

In summary, therefore the present study has clinical implications for emerging creative artists.

1. Creative arts students are a unique 'at risk' group who are more vulnerable to mental health issues than the normal population and who share cognitive, personality and affective similarities with early psychosis populations;
2. Early indications are that targeted programmes, which address specific issues for this population, may reduce symptoms and improve psychological outcomes for this group.

7.6 Limitations

Sample

At the time of formulating a methodology for these studies, the question of whether there was a clear association between creativity and psychopathology was still being

debated. The shared vulnerability model proposed by Shelley Carson (2011) was the first systematic attempt to delineate the similarities and differences between these populations. It was in this climate that a cross sectional study was devised to identify the cognitive and personality protective and vulnerability factors differentiating creativity and psychopathology. Furthermore the study aimed to recruit an early psychosis population alongside professional creative and non-creative populations. Many of the methodological problems identified by previous researchers (Richards, 2001; Rybakowski et al., 2008) had centred on the problem of using university students to delineate creativity (using a standard measure of creativity to identify high and low creativity) and a clinical cohort, (schizotypy measures to identify university students with high schizotypy extrapolated to a clinical population). Specifically, these studies recruited participants from a non-clinical student population but the results of the research were extrapolated to creative professional and clinical populations (Carson et al., 2003; Claridge & Blakey, 2009). In this thesis, it was decided to address these issues by recruiting an early psychosis population and a creative professional/creative student population. Consequently one of the significant limitations of the study was the small sample size, particularly with respect to the clinical population. Clinical populations derived from an age specific and early psychosis population are difficult to recruit due to the instability of this population. Studies that successfully recruit 'at risk' and early psychosis populations are associated with youth specific outpatient and treatment programmes. This study was recruited from an existing larger study (without age restrictions) and unsuccessfully sought to recruit from the Australian Schizophrenia Research Bank (ASRB) (unfortunately there were no eligible participants within the age range). From both

of these large clinical data banks, the available sample for recruitment was limited to twenty-five clinical individuals and highlights the need (in retrospect) to partner with youth and early intervention outpatient and treatment programmes. As a result this study may have been underpowered to detect certain effects and may lead to a type 2 error.

Furthermore, while the results reported may be statistically significant ie have a p-value of .05 or less, the results may not be clinically significant ie reflect an impact on clinical practice. It should be noted however that the significant results reported in the three studies do point to the need for further research, which would include research into clinical trials where the clinical significance of the treatment would need to be rigorously evaluated for clinical significance. Notwithstanding the factors identified as significantly different between the early psychosis and at risk creative controls, namely spatial working memory and adverse life events were also recorded in studies that included larger sample sizes. (de Vos et al., 2019; Goghari et al., 2014). Similarly there is ongoing debate in the literature regarding whether effect sizes are a more valid determinant of a significant difference and the questions was raised whether this may be a more appropriate way of quantifying the difference between groups (Mertens, 2020). However, it was decided to report tests of statistical significant difference alone as this was the more established method reported in the relevant psychiatric journals.

Self report measures providing insufficient discrimination

Self report measures are widely used in quantitative research however these measures are dependant on an individuals' self assessment of their knowledge, attitudes or behaviour. Therefore validity of the measure is dependant on the memory, honesty and self-awareness of the participant. Critics of self-report measures also point to a participant's propensity to want to be seen in the best possible light (impression management) and to respond to a questionnaire in order to perpetuate and reinforce their view of themselves (Paulhus & Vazire, 2007). Critics also point to a bias toward participants agreeing with a statement (acquiescent responding) and to respond in the extreme (extreme responding). The problem of cultural bias in self-report measures has also been widely attested, which further leads to concerns about the efficacy of self-report instruments.

These issues could certainly have influenced the responses i.e. the creative individual who over inflates their creative achievement (impression management); the individual who represses their memory of an adverse event (distorted memory); the compliant participant who responds affirmatively with all questions (acquiescent responding). The researchers selected a face-to-face format to deliver the self-report measures, rather than an online surveys format in order to mitigate these issues. Where distortions in responses were observed (such as acquiescent responding) the researcher was able to clarify the responses. It should be noted that the researchers did not observe any acquiescent or extreme responding. Notwithstanding there are specific concerns regarding two self-report measures used in the research. These measures are discussed below.

Although the measures selected for the research battery had good validity and reliability, a recent meta-analysis into measures of paranoia (Statham et al., 2019), highlights that these measures that may be insufficient to fully discriminate the clinical/non-clinical population. For example with respect to the paranoia/suspiciousness scale, a more discerning measure may have identified clearer distinctions between the early psychosis and 'at risk' creative samples. This has previously been discussed in this chapter (see pp208). As one of the surprising factors of the research was how similar the 'at risk' and early psychosis population appeared to be, a more discriminating measures may have identified differences between the two populations that the measures used in the studies failed to identify.

A further example of limitations with the measures used, is the CAQ measure (Carson et al., 2005), which was developed in 2005, prior to significant changes in creative industries (Hughes et al., 2016). The CAQ was based on research into creativity which was developed in the 1970"s (Colangelo et al., 1992) and as such includes questions such as: *"How many records have you sold?"* and *"Have you been reported in a local or major newspaper?"* as indicators of creative achievement. The questionnaire included creative domains associated with scientific pursuits (e.g. *How many scientific papers have you had published?*), sport and culinary achievement. These domains were established in the 1970's and were indicative of thinking at the time, however they do not reflect our current understanding of artistic creativity. A contemporary measure of creative achievement would include items that assessed online and digital creative achievement, for example *"How many plays have you had on Apple music/Spotify?"* While the CAQ was amended for the purposes of this research by

including questions about relevant online and digital creative achievement, a limitation of this present study was still the use of the CAQ. Unfortunately a more discriminating measure has not yet been developed.

Cross-sectional rather than longitudinal methodology

As earlier indicated, a cross-sectional methodology was selected based on our understanding of the conflicting research into creativity and psychopathology. The methodology was also informed by our research question, which aimed to delineate similarities and differences between the populations. A cross-sectional methodology cannot determine causality and following the epidemiological studies previously discussed (MacCabe et al., 2018), it became evident that a longitudinal methodology which examines creative arts students over time is critically needed to contribute to a discussion on causality. One of the key questions arising from this series of studies is whether the at-risk creative group developed later psychosis. It is a limitation of this present study that a follow-up of the 'at risk' group could not be undertaken. Future longitudinal research which recruits creative arts students and identifies those who may be 'at risk', from those who are psychologically well to determine whether this group may develop later psychosis is a critical future direction for research in this field. It was therefore a limitation of this present study that a follow-up study was not possible due to a lack of foresight at the time of developing the methodology to gain the necessary ethical permissions to recontact the participants.

Creativity and substance abuse not addressed

Creativity and substance abuse have been associated in the literature (Bellis et al., 2012) and Carson (2011) in her shared vulnerability model proposed that alcoholism may be indicative of shared vulnerability. She cited the increased incidence of alcoholism amongst a group of writers (Andreasen, 1987) as evidence of this possible shared vulnerability. Furthermore substances, specifically cannabis have been associated with psychosis (Arendt, Rosenberg, Foldager, Perto, & Munk-Jørgensen, 2005) and increased schizotypy (Schafer et al., 2012) in creative individuals. It was therefore a limiting factor that substance abuse was not addressed in this thesis. Substance abuse and its possible association with psychosis and creativity is a complex area and it was considered beyond the purview of this thesis. Moreover in the epidemiological study which found increased odds of creative arts students developing bipolar disorder or schizophrenia (MacCabe et al., 2018) the authors dismissed drug misuse as a confounding factor, citing an earlier epidemiological study into creative professions and mental illness (Kyaga et al., 2013) which found reduced alcohol and drug use in the creative population. As the aforementioned research indicates, there is conflicting literature on the subject. Future longitudinal studies into the creativity/psychopathology association should therefore address the issue of substance abuse as a possible confounding factor.

7.7 Contribution to the field

This thesis aimed to examine similarities and differences in a clinical and professionally creative sample and sought to carefully identify and recruit these populations to avoid previously cited methodological problems. In discriminating

these two populations and alongside other significant epidemiological and genetic research into the creativity/psychopathology association, this research provides evidence for a clear association between professional creativity and risk for psychosis. Furthermore this research provides confirmation of aptitude for creativity, as evidenced by the study of creative arts, being a risk factor for psychopathology. With respect to the research aims, the study endorses that creativity is associated with psychosis vulnerability. Similar to other studies, our professional creative population recorded significantly elevated neurosis, compared to non-creative controls. Our study was able to further examine this finding and identify elevated levels of anxiety and paranoia compared to non-creative controls. This is a unique contribution to the field.

A comprehensive structured neuropsychiatric examination was undertaken of all control participants. This led to the identification of sub-clinical levels of hypomanic and psychotic symptoms in a large cohort of creative control participants. Although other studies have reported psychotic symptoms in non-clinical populations (Kelleher et al., 2012; G. Murray & Jones, 2012) and hypomanic symptoms in creative populations (Strong et al., 2007), this is the first reported structured neuropsychiatric examination in a professional creative population and as such is unique to the field. As discussed earlier, the prevalence of these sub-clinical symptoms in the creative (not NCC sample) provides a clear avenue for further research of professional creative cohorts.

Although IQ, negative priming and executive function have all been examined with respect to creativity, this is the first study that has investigated spatial working memory and vividness of mental imagery in professional creative populations. In the presence of sub-clinical psychotic symptoms the finding that SWM may discriminate 'at risk' creative from early psychosis populations is a unique contribution to the field and provides clear pathways for further research.

Unique to this research is the finding that underlying trauma may be associated with both populations, however the early psychosis group reported a significant incidence of early childhood trauma while the 'at risk' group reported an increased incidence of adverse events that may be related to other factors such as high neurosis or risk taking behaviour. These findings are tentative, however the possible delineation of this trauma is a unique contribution to research into creativity and psychopathology.

Finally as this thesis aimed to investigate similarities and differences between an early psychosis and creative control population, a model of shared vulnerability was introduced in chapter two, based on existing research and conjecture. The research concluded with a prodrome model of shared vulnerability. This model identified three factors, which have not previously been examined in these populations and proposed a possible pathway to prodromal presentation. This model presented two populations with similar unusual behaviours, comorbid anxiety and identified three possible inter-related factors that may shift a population from unspecific at risk symptoms to patterns of prodromal disturbance. Moving forward, the prodrome

model of shared vulnerability provides a basis for further targeted research into the transition to prodromal presentation.

7.8 Conclusion

The introduction to this thesis reported a call to arms by Guilford, a leading proponent of creativity research at a symposium hosted by the American Psychological Association in 1957 (Guilford, 1967). This call to arms advocated for increased research into creativity. This thesis has been a response to that call to arms (albeit fifty years later). Based on emerging research into epidemiological and genetic associations between creativity and psychopathology, the study posed the question of whether creativity is associated with psychosis vulnerability. Specifically, through the theoretical paper and various studies the research aimed to examine similarities and differences in factors across an early psychosis and creative professional sample, compared to non-creative controls. The findings reported a group of clinical and creative individuals, who were surprisingly more similar than different. The results of the study reported similarities in personality, namely openness and neuroticism; schizotypy specifically unusual experiences and impulsive non-conformity, aspects of paranoia, creative cognition and achievement, anxiety and incidence of adverse life events. These similarities across personality, schizotypy, anxiety and adverse life events have implications for future research and treatment programmes for both populations. In as much as differences between the clinical and creative groups also have implications for the development of innovative treatment programmes for the early psychosis population. This thesis concludes with a respectful call to arms to

continue research into not just creativity but the clear association between creativity and psychosis vulnerability.

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Appendix 1

CREATIVITY RESEARCH JOURNAL, 28(1), 24–32, 2016 Copyright © Taylor & Francis Group,
LLCISSN: 1040-0419 print/1532-6934 onlineDOI: 10.1080/10400419.2015.1030305

Creative Cognition and Psychosis Vulnerability: What's the Difference?

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Evidence from experimental psychology provides unequivocal support for enhanced creativity among individuals who are prone to psychotic and mood disorders. At the same time, there is strong epidemiological evidence for greater incidence of creative achievement among those diagnosed with bipolar disorder (but not schizophrenia). This review examines the evidence for common factors predisposing an individual to creativity and psychosis, as well as factors that distinguish the capacity for creative achievement from the creative potential that may be inherent in psychosis vulnerability. Factors implicated as common to creative potential and psychosis vulnerability include enhanced divergent thinking, reduced latent inhibition and preattentive filtering mechanisms; on the other hand, greater cognitive flexibility, motivation, and openness to experience tend to be associated with creative achievement, but not psychosis. This evidence is considered with respect to the utility of tailored vocational interventions to effectively harness creative potential, which may be useful for young individuals in the early stages of illness or their unaffected family members.



Creativity has traditionally been defined as the ability to generate new and original ideas that have value or effectiveness in a particular context (Barron, 1955; Runco & Jaeger, 2012; Stein, 1953; Torrance, 1993). The creative process thus implicates unique cognitive abilities that enable innovation and problem solving, for which accurate measurement has remained elusive in terms of fully encapsulating creativity. At the same time, creative processes

have become recognised as important for societal and organizational value (Basadur & Basadur, 2011); adaptive creative qualities are necessary for the development human mental capital, now understood as one of the most important economic resources of our time (Beddington et al., 2008; Centre for International Economica, 2009).

Perhaps ironically in this context, creative processes have traditionally been associated with madness. Recent epidemiological evidence of greater creative potential (higher prevalence of creative occupations) in individuals with bipolar disorder, and the psychologically well offspring of patients with schizophrenia or bipolar disorder (Kyaga et al., 2011) follows several decades of research in experimental psychology that has provided incontrovertible evidence for common cognitive processes among creative capacity and psychosis vulnerability (Claridge & Blakey, 2009; Eysenck, 1994; Jamison, 2011; Rybakowski, Klonowska, Parrzala, & Jaracz, 2008). Yet, there has been little empirical investigation of the adaptive utility of the predisposition to creative thinking for the early treatment of young individuals who are vulnerable to developing psychotic and mood disorders, and who may be displaying signs of emergent cognitive and temperamental features of illness. This may reflect insufficient study of differential features of cognition or temperament that may separate the capacity for creative achievement from the propensity for creative thinking (while the latter is strongly associated with vulnerability to psychosis, the former appears to be limited to those without severe expression of psychosis). It is, therefore, possible that neurocognitive and/or

motivational factors associated with chronic forms of psychotic disorder impede the potential for creative achievement, despite shared information processing styles among psychosis-prone and psychotic individuals that facilitate creative thinking. These ideas are explicated with reference to the available literature in this review.

The particular cognitive style associated with creativity has been described as over-inclusive and characterized by obscure, remote, or ‘divergent’ associations (Carson, Peterson, & Higgins, 2003; Eysenck, 1993a, 1993b; Mednick, 1962), and, more recently, has implicated cognitive flexibility among other domains of cognition traditionally associated with intellectual ability (Carson et al., 2003; Travis, Harung, & Lagrosen, 2011). The majority of research on the similarities between creative cognition and psychosis vulnerability has thus focused on the common feature of defective filtering (inhibitory) processes (Beech, Baylis, Smithson, & Claridge, 1989) within the a limited capacity information processing system. The defective filtering process ironically affords an increased flow of information into preconscious awareness (such that otherwise unlikely associations between elements may be made, in line with enhanced performance on creative tasks; Peters, Pickering, & Hemsley, 1994). This model is supported by evidence from two parallel streams of experimental

psychology, which show that faulty filtering mechanisms are associated with both the predisposition to psychosis and with enhanced divergent thinking (Claridge & Blakey, 2009; Ottemiller, Elliott, & Tania, *in press*), and that the most commonly employed definition of creative cognition (divergent thinking) is enhanced in psychosis-prone individuals (Dykes & McGhie, 1976).

However, an important question remains as to whether the adaptive cognitive features of psychosis vulnerability offer creative advantage only in the context of other specific cognitive or personality features (which, incidentally, may be found to play a preventative role in relation to psychosis transition). This proposal suggests that fulfilment of creative potentiality may be dependent on specific cognitive features that are not necessarily related to psychosis-proneness. Alternatively, the absence of particular cognitive impairments that are usually associated with illness (and are therefore not present in unaffected biological relatives of patients) may be important for creative potential to be expressed in creative achievement. The aim of this review was thus to review available evidence in relation to distinguishing those ‘adaptive’ cognitive features associated with creativity that may simultaneously represent vulnerability to psychotic-spectrum conditions (i.e., bipolar disorder, schizoaffective disorder, schizophrenia) and creative information processing, from those cognitive features which are required to achieve creative outputs (i.e., creative productivity).

CREATIVE COGNITION AND PSYCHOSIS VULNERABILITY 25 CREATIVITY AS AN ADAPTIVE ENDOPHENOTYPE

FOR SCHIZOPHRENIA AND BIPOLAR DISORDER?

In recent years, it has been acknowledged that schizophrenia and bipolar disorder share some genetic vulnerability (Lichtenstein et al., 2009; Purcell et al., 2009) and demonstrate stable deficits in common cognitive domains (including verbal ability, memory, motor performance, attention, and executive function; Bora, Yücel, & Pantelis, 2010; Frommann et al., 2011). Notably, these are not the cognitive domains usually associated with the creative processes, but it is of interest that cognitive capacities that are associated with increased creativity have been noted in both disorders. Creative cognition might thus plausibly represent an adaptive endophenotype for psychotic and mood disorders, consistent with previous proposals (Claridge, 1997; Kinney et al., 2001), which may be influenced by independent mediating factors (potentially associated with familial liability to psychosis) to contribute to creativity and pathology (Richards, 2001).

The association between creativity and psychosis-vulnerability has been unequivocally demonstrated in recent epidemiological evidence from a large Swedish study of the professional occupations of family members of individuals with schizophrenia, bipolar disorder, or unipolar depression (who received inpatient care between 1973 and 2003); this study showed significant overrepresentation of creative professions among individuals with bipolar

disorder, as well as the unaffected siblings of people with either schizophrenia or bipolar disorder, relative to healthy controls (Kyaga et al., 2011). Interestingly, individuals with a diagnosis of schizophrenia did not have an increased rate of overall creative professions, suggesting that severe psychotic illness impedes creative expression (notably, this could have been confounded by other illness factors contributing to the ability to maintain employment); in addition, there was no evidence of greater rates of creative professions among individuals with unipolar depression or their unaffected relatives. These recent findings may be seen to concur with previous studies suggesting that severe psychosis may impede creative achievement. In this vein, it is interesting to note that the adoptees of biological parents diagnosed with schizophrenia have demonstrated higher levels of vocational and nonvocational creativity in association with higher schizotypal personality features, compared to healthy control participants (Kinney et al., 2001); here, the schizophrenia probands showed greater social anxiety and nonvocational creativity (for example, realising their creativity in nonprofessional areas). It is therefore possible that more severe social anxiety (and/or introversion) in schizophrenia may limit creative potential, unlike in bipolar disorder which tends to show a greater degree of extraversion (Akiskal et al., 2006; Barnett et al., 2011).

In summary, the familial cosegregation of both schizophrenia and bipolar disorder with creativity suggests that the

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very vulnerability to these conditions confers a tendency toward creative endeavor that may be inherent in the shared genetic predisposition to these disorders (Lichtenstein et al., 2009), but at the same time suggests that the adaptive expression of this potential may be inhibited by other mechanisms of full-blown (schizophrenic) psychosis. Related studies of ‘trait-creativity’ and psychosis-proneness (Brod, 1997), or those using actual creative achievement to index creativity in healthy individuals (Andreasen, 1987; Barron, 1993; Richards, 1993) have also provided consistent evidence of a link between artistic talent and vulnerability to (but not the expression of) psychosis.

EVIDENCE FROM EXPERIMENTAL PSYCHOLOGY-I: “DIVERGENT THINKING” AND INHIBITION

Divergent thinking describes a loosening of boundaries between concepts and a consequent widening of the associative horizon to form new and useful associations. The most widely accepted definition of divergent thinking encompasses several forms of creative thought, involving (a) fluency, (b) flexibility, (c) originality, and (d) elaboration (Guilford, 1968; Torrance, 1993). Divergent thinking has been proposed as a necessary, but not sufficient, causal mechanism for creative achievement (Eysenck, 1993b), and has been the most frequently adopted construct to characterize the defining features of creative potential in the majority of experimental studies to date. This type of research has provided substantial evidence of increased schizophrenia-proneness

(schizotypy) in association with greater divergent thinking capacities (Brod, 1997; Burch, Hemsley, Pavelis, & Corr, 2006; Claridge & Blakey, 2009; Green & Williams, 1999; Ottemiller et al., *in press*). Notably, it is the unusual perceptual experiences and anti-social/nonconformity aspects of schizotypy that have been most strongly associated with greater divergent thinking, while the cognitive disorganization aspects of schizotypy have shown negative associations with divergent thinking (Batey & Furnham, 2008; Claridge & Blakey, 2009).

Reduced Preattentive Filtering

The cognitive processes underlying divergent thinking have been explored in relation to poor attentional filtering mechanisms associated with 'cognitive inhibition', which may form the basis of creative thinking by providing the individual with a larger sample of ideas (Eysenck, 1993a, 1993b). Cognitive inhibition refers to the process of inhibiting irrelevant stimuli that is a concomitant of selective attention (Neill & Westberry, 1987; Tipper, 1985); faulty inhibitory processes may result in an individual being inundated with an increased array of precepts' or 'loose' associative links. Reduced cognitive inhibition has been shown to be associated with both creativity (Dykes & McGhie, 1976) and schizotypy (Brod, 1997).

In experimental studies of reduced cognitive inhibition, Tipper's (1985) negative priming paradigm has typically been used to investigate preattentive inhibitory (filtering) processes. This paradigm usually employs a modified version of the Stroop color-word ink-naming task, in which the target color hue corresponds to the color word (i.e., distractor, to-be-ignored) on the previous trial; under these priming conditions, longer response latencies are observed in normal subjects, and this effect is referred to as negative priming (Neill, 1977). Normally, healthy individuals show longer response latencies under these specific conditions of the Stroop task (i.e., negative priming effect), but a lack of negative priming has been consistently demonstrated in schizophrenia patients (Beech, Powell, McWilliam, & Claridge, 1989; Laplante, Everett, & Thomas, 1992) and highly schizotypal individuals (Beech, Baylis, et al., 1989; Beech & Claridge, 1987; Ferraro & Okerlund, 1996; Moritz & Mass, 1997; Steel, Hemsley, & Jones, 1996). That is, psychosis-prone (and overtly psychotic) individuals show shorter latencies under conditions of negative priming, relative to healthy controls, owing to the increased availability of unfiltered information for faster retrieval on subsequent trials. The mechanism at play here is the inability to successfully inhibit distractor (color word) stimuli on preceding trials, which makes the distracting information available for immediate use on the subsequent trial (whereas healthy individuals take time to retrieve previously inhibited stimuli, and hence demonstrate the negative priming effect). This reversal of the usual negative priming effect has been interpreted as evidence of reduced cognitive inhibition in individuals with schizophrenia or schizotypal features and in creative individuals (Dykes & McGhie, 1976). Comparatively few studies fail to report a significant asso-

ciation between high schizotypy and reduced cognitive inhibition (Bullen, Hemsley, & Dixon, 1987; Green & Williams, 1999; Laplane et al., 1992; Lipp, Siddle, & Arnold, 1994), potentially attributable to the use of relatively small student samples. Interestingly, on a standard Stroop color-word task, healthy individuals display longer reaction times to name the ink color of word stimuli when the words displayed are color-words (e.g., GREEN, RED) compared to task-unrelated (XXX) stimuli. This is due to interference of the automatic processes involved in reading the color-word, which must be actively inhibited to perform the task (Tipper, 1985). On this task, professional musicians have demonstrated significantly less color-word interference than amateur musicians (Travis et al., 2011).

Reduced Latent Inhibition

Another type of inhibitory deficit associated with both creativity and psychosis refers to the integration of previous information stored about contingencies between events in the execution of current goal-directed behaviour, demonstrated by reduced latent inhibition (LI; Gray, Feldon,

Rawlins, Hemsley, & Smith, 1991; Hemsley, 1994). The term latent inhibition refers to the effect of a previously unattended (or purposefully irrelevant) stimulus as less effective in establishing new learned associations than a novel stimulus, as is evident in psychosis and psychosis-prone populations (Burch et al., 2006; Carson et al., 2003; Gray et al., 1995; Lubow, Ingberg-Sachs, Zalstein, & Gewirtz, 1992); thus, the LI effect is latent in that it is a dormant effect noticeable only in the test phase, and inhibition here connotes that the effect is expressed in terms of inhibiting new learning. Interestingly, reductions in LI can result in the capacity to more effectively utilize stimuli previously learned to be irrelevant. Investigation of the effects of learned irrelevance on original thinking include meta-analysis of two available studies conducted in youth samples (aged under 21 years), which demonstrated that high lifetime creative achievers had significantly lower LI scores than low creative achievers ($d = .31$); moreover, those with unusually high scores in a single domain of creative achievement were seven times more likely to have low LI scores (Carson et al., 2003).

Collectively, these studies from experimental psychology point to the existence of a cognitive style that may be associated with both creative propensity and the predisposition to psychosis (Brod, 1997). Only two previous studies have attempted to directly address this hypothesis; that is, that high levels of schizophrenia proneness and greater divergent thinking are both associated with reduced cognitive inhibition (Green & Williams, 1999; Stavridou & Furnham, 1996). However, neither study confirmed this prediction; in the former, levels of psychosis-proneness were related to reduced inhibition, but divergent thinking scores were not significantly associated with cognitive inhibition; in the latter, levels of psychosis-proneness were related to increased divergent thinking, but schizotypy scores were not significantly associated with cognitive

inhibition. These null results are likely due to the sampling characteristics of these studies, including small sample sizes, and the use of ostensibly healthy individuals assessed for psychosis-proneness and divergent thinking rather than clinical and/or highly creative populations. Future studies that specifically address these sampling issues are needed to enrich the qualities of cognition under investigation, to delineate both similarities and differences in among creative individuals with different styles of artistic expression (i.e., among musicians, visual artists, designers).

EVIDENCE FROM EXPERIMENTAL PSYCHOLOGY- II: THE ROLE OF TEMPERAMENT

In addition to cognitive processes, increasing evidence suggests that features of temperament (i.e., enduring personality style) may modulate the expression of creative potential conferred by the cognitive processes described previously.

Similarities of temperament among people diagnosed with bipolar disorder, in particular, and the creative artist are well established (Claridge, Robinson, & Birchall, 1983; Rybakowski & Klonowska, 2011). These include tendencies toward increased openness to experience (e.g., novelty seeking) and neuroticism, alongside decreased conscientiousness with respect to assessment of personality features in bipolar disorder (Nowakowska, Strong, Santosa, Wang, & Ketter, 2005). For example, one study of bipolar participants using the Revised Art Scale (RAS) and the inventiveness part of the Berlin Intelligence Structure Test (BIS) to index creativity, showed higher creativity (on the BIS, but not the RAS) in bipolar patients, and further demonstrated significant positive relationships between the unusual experiences and impulsive nonconformity subscales of the O-LIFE and creativity in bipolar disorder (Rybakowski & Klonowska, 2011).

Although these similarities of temperament between bipolar disorder probands and highly creative individuals are well researched, the interaction of temperament in creative cognition is not well understood. Several recent studies have begun to investigate this potential interaction between affective temperament (Akiskal, Akiskal, Haykal, Manning, & Connor, 2005) and creative cognition in clinical populations. For example, two recent studies have investigated associations between temperament and creativity among cases with bipolar disorder, unipolar depression, creative (healthy) controls, and healthy noncreative controls (Srivastava et al., 2010; Strong et al., 2007). Both of these studies showed that bipolar disorder patients and creative controls had higher levels of neuroticism, cyclothymia, openness, and intuition scores (relative to noncreative healthy participants); in addition, both studies found that neuroticism and cyclothymia scores (of all participants) were positively correlated with Barron-Welsh Art Scale (BWAS)-Dislike (and Total; Barron, 1963) scores; openness scores and intuition (at least in the Srivastava et al., study) were positively correlated with BWAS-Like (and Total) scores.¹ These studies suggest that features of temperament (measured by the high BWAS

Dislike) might contribute to creative cognition through negative discrimination, in which both the ability to access intense and often negative and varied shifts in emotion (neuroticism and cyclothymia) promotes innovation through dissatisfaction with the status quo. In addition, high BWAS Like scores might reflect openness to embrace the complexity of change. Moreover, the association of intuition with creative potential has been suggested to reflect a bias toward positive internal discrimination of sensory information, or the unconscious

¹ The BWAS index is calculated on ratings of approval and disapproval of images in which high like (approval) ratings for complex figures and dislike ratings for simple drawings are interpreted as the ability to embrace complexity and perceptual openness.

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ability to know what is relevant from the array of unfiltered sensory information (Metcalf, 2000).

Other studies in student populations have examined the relationship between psychosis-proneness and measures of affective temperament (Akiskal et al., 2005) and creative cognition assessed with divergent thinking measures (Wallach & Kogan, 1965). For example, using the Oxford- Liverpool Inventory of Feelings and Experiences (O-Life; Mason & Claridge, 2006) to assess the associations of temperament and divergent thinking with four factors of schizotypy (i.e., unusual experiences, impulsive nonconformity, cognitive disorganization, and introverted anhedonia) Claridge & Blakey (2009) showed that affective temperament features were more effective in predicting creative potential (i.e., greater divergent thinking scores) than schizotypal features, with impulsive nonconformity the only schizotypal feature to be significantly associated with divergent thinking. These findings support the notion that positive affect (shared by the highly creative and those with bipolar disorder, but not schizophrenia patients) might be associated with efficient use of increased cognitive material associated with 'defective' filtering mechanisms.

In a more recent study of professional comedians (Ando, Claridge, & Clark, 2014), compared to both professional actors (non-comedians) and a healthy control group, both professional (creative) groups scored higher on all four factors of schizotypy relative to the healthy control group; interestingly, the comedians also scored significantly higher on the introverted anhedonia dimension (i.e., reflecting depressive-like lack of pleasure in social activities), alongside the more extroverted and manic-like traits found in both comedian and actor populations (impulsive nonconformity). The authors of this study noted that these differences might relate to distinct approaches or motivations toward performance (i.e., engagement vs. disengagement with audiences) in these two creative samples.

Collectively, these studies converge to suggest that temperamental features of openness, impulsivity, emotional lability, and intuition likely play a role in modulating the effective use of creative cognitive potential; these aspects of temperament are more associated with bipolar populations (Barnett et al., 2011; Nowakowska et al., 2005; Rybakowski & Klonowska, 2011) and may, therefore, contribute to this population's ability to translate creative potential to creative product. Clearly the recent study by Ando et al. (2014) raises questions for further research: Do specific creative domains align more strongly with different temperament factors and in what way might these modulate distinct aspects of the creative process?

Reward Sensitivity

The pursuit of creative endeavors—and especially the ability to manage frustration and rejection along with momentary high of creative success (Klotz, Wheeler, Halvesleben,

Brock, & Buckley, 2011)—by implication assumes individuals exhibit well developed intrinsic motivation and/or the ability to tolerate delayed rewards. It is therefore plausible that regulation of reward systems would be a necessary characteristic of successful creative individuals. Notably, both schizophrenia and bipolar disorder patients have been shown to value smaller, immediate rewards, compared to healthy controls (Ahn et al., 2011; Heinz, 2013; Simon et al., 2010). However, increased motivation and sensitivity to the anticipation of reward has been implicated in bipolar disorder, but not schizophrenia (Murray & Johnson, 2010; Nusslock et al., 2012; Trost et al., 2014). It may be that goal-directed behavior represents factors that distinguish the highly creative as those who are able to regulate reward systems to pursue and sustain motivation. These proposals deserve further investigation in the context of findings suggesting that those with bipolar disorder have high reward sensitivity but poor outcome motivation (Alloy et al., 2012); schizophrenia populations exhibit even greater deficits in reward processing that may be associated with apathy and poor motivation (Nielsen et al., 2012). Further consideration of cognitive factors associated with intrinsic motivation and creative potential is, therefore, warranted (Richards, 2001).

The Role of IQ

The results from a meta analysis of variables associated with creativity further support the role of increased executive control in creative thought (Ma, 2009). This meta-analysis included 111 studies in which creativity was defined according to creative product (described as ideas, solutions, performances or products), the creative person (personality characteristics; cognitive ability), and/or the creative process (creative problem solving defined as experience; ideation; thinking; evaluation; Ma, 2009). The largest effects sizes were reported for variables associated executive functions, namely the problem solving ability to find (Cohen's $d = 0.93$) and retrieve knowledge (Cohen's $d = 0.86$). Given that standard estimates of intelligence (i.e., the Intelligence

Quotient or IQ) depend on the capacity to manipulate and effectively (or adaptively) utilize information it has been contended that high IQ, enhanced working memory capacity, and cognitive flexibility differentiate highly creative individuals from psychotic individuals (Carson, 2011). This follows the empirical study of eminent creative achievers (Carson et al., 2003) comprising Harvard undergraduate psychology students reporting high scores on a single domain of creative achievement, 30% of the variance in creative achievement scores between was accounted for by reduced LI and high IQ (with IQ measured using WASI–R verbal and block design subtests). However, this strong association between IQ and creativity has not been supported in other nonstudent-based studies, indicating possible bias in the sampling characteristics of this study. In addition, the recent epidemiological study reporting greater incidence

of creative professions in the relatives of individuals with schizophrenia and bipolar disorder (and in bipolar disorder probands), specifically investigated whether IQ mediated the association between creativity and psychopathology; although the IQ data were available for men only, no significant effect of IQ could account for this link between creativity and psychopathology (Kyaga et al., 2011).

Although poor IQ is strongly associated with schizophrenia, evidence in studies with bipolar disorder patients is less equivocal (Hill, Harris, Herbener, Pavuluri, & Sweeney, 2008). Poor IQ may thus account for the inability of schizophrenia patients to translate their greater divergent thinking, reduced LI and preattentive filtering, into creative output, and this is consistent with epidemiological evidence. Conversely, patients with bipolar disorder do not have such severe decrements in IQ as seen in schizophrenia (Hill et al., 2008).

It is, therefore, understandable that there is conflicting data on the role of IQ as a primary mediating factor between creativity and psychopathology, as proposed by Carson (2011). Interestingly, a recent study by Furnham & Bachtar (2008) examined both personality and intelligence as predictors of creativity in a nonclinical group; they reported that IQ (Wonderlic, 1992) failed to explain any of the variance in scores of creative potential as measured by a divergent thinking task (Guilford, 1967). The collective literature thus points to the need to more carefully delineate the role of specific mediating factors, including temperament and reward processing systems that may explain previous associations between creativity and IQ.

CLINICAL IMPLICATIONS FOR THE CREATIVE PSYCHOSIS SPECTRUM POPULATION

Given the considerable support for an association between creativity and psychopathology, it is somewhat surprising that little attention has been given to the clinical applications of this shared vulnerability, beyond the use of creative therapies to enhance treatment in those with bipolar disorder and schizophrenia (Carson, 2011; Xia & Grant, 2009). For example, leading

proponents of targeted intervention for creative individuals with bipolar disorder (Carson, 2011; Jamison, 2011) proffer changes to treatment regimes that minimize the negative impact of medication on creative mood, and point to the development of specific nonpharmacological interventions for these populations (Murray & Johnson, 2010), such as psycho-education and cognitive behavioral treatments (Murray & Johnson, 2010).

An alternative view is that, if creative people depend on these vulnerability factors to enhance their work, then psychosis-prone individuals might also find a successful vocational niche in learning to utilize such vulnerability factors to advantage. Indeed, the cognitive features considered deficits in psychosis have been promoted and cultivated in creative

populations (Dane, Baer, Pratt, & Oldham, 2011; Madjar, 2011). Should we thus be asking whether it is possible to enhance creative potential in vulnerable youth or those with emerging first episode psychosis? For example, there may be scope to develop individual and preventative, early intervention programs, which enhance cognitive flexibility (the rapid shift from divergent to convergent thinking) and awareness, self-management and reprocessing of overwhelming sensory information in highly creative psychosis vulnerable youth. Furthermore, as the spectrum model for shared vulnerability unfolds, clinical intervention programmes may also be amenable for a creative bipolar but not schizophrenia patient population; further research is required to delineate the precise targets for remediation, versus enhancement, in these disorders.

The model illustrated in Figure 1 summarizes a spectrum model of shared vulnerability for creativity and psychosis-proneness, on the basis of the evidence reviewed above. Overwhelmingly, the evidence to date demonstrates similarities in cognition and temperament among creative and psychotic individuals evident in enhanced divergent thinking, reduced preattentive filtering, attenuated LI, and increased levels of openness to experience and neuroticism. At the same time, epidemiological evidence suggests that extreme expressions of schizophrenic psychosis are not conducive to creative achievement (Kyaga et al., 2011). Thus, differences among creative and noncreative individuals on the psychosis spectrum will likely reflect reduced cognitive flexibility and motivational aspects of cognition (i.e., concerned with reward processing), alongside less extraversion, agreeableness and conscientiousness in psychosis-prone individuals, compared to highly creative individuals. In terms of biological significance, shared vulnerability to psychosis and creative thinking suggests that these aspects of cognition and temperament might be recognized as an adaptive intermediate phenotype for psychosis, among the many maladaptive candidates in the current literature (e.g., Hill et al., 2008).

New therapeutic strategies to increase resilience in the face of risk for psychosis might involve maximizing the adaptive capacity of cognitive anomalies

associated with risk and creativity alike, rather than remediating all cognitive deficits associated with psychosis predisposition. This requires, first, the elucidation of adaptive aspects of temperament and cognition that are utilized by highly functional individuals to engage in creative endeavours. If, indeed, it is possible to extricate the cognitive basis of creative potential from creative achievement, targeted remediation of appropriate cognitive processes that render increased creative ability (in the context of sparing remediation of some apparent attentional deficits that serve, in fact, to enhance creative processes), may be an appropriately benign first line treatment for young individuals with signs of emerging psychotic disorder. Learned utility of cognitive deficits and positive

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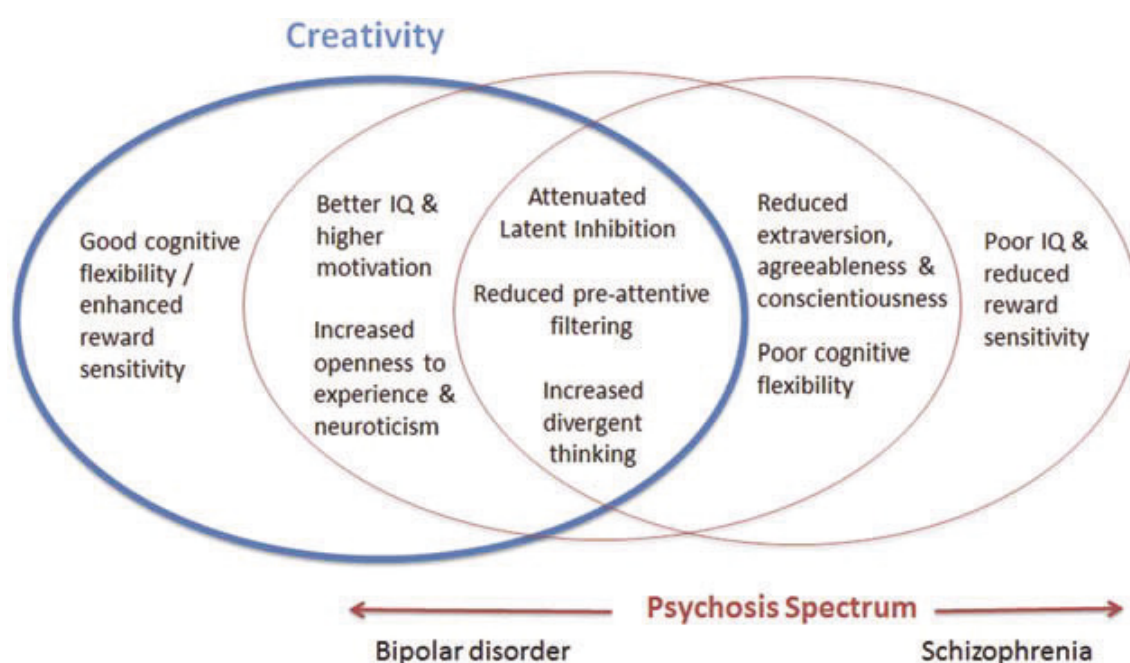


FIGURE 1 Spectrum model of shared vulnerability for creativity and psychosis.

application of features of creative temperament may assist in averting negative vocational trajectories associated with first episode psychosis and chronic sub-threshold psychotic conditions.

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Appendix 11



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To cite this article: Julie Crabtree & Toby RO Newton-John (2018): Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis

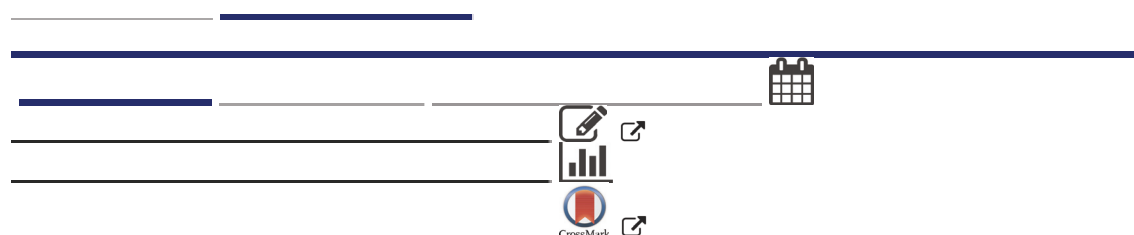
participants, Psychosis, DOI: 10.1080/17522439.2018.1542021

To link to this article: <https://doi.org/10.1080/17522439.2018.1542021>

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PSYCHOSIS <https://doi.org/10.1080/17522439.2018.1542021>

Comparisons and associations between personality, creative potential and achievement in creative, non-creative and early psychosis participants

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Journal of Psychosis



ABSTRACT

Epidemiological evidence supports common genetic determinants between psychosis spectrum populations and creative individuals. Aspects of personality may contribute to protecting the creative artist from psychosis vulnerability. This study examines the similarities and differences in personality within a sample of early psychosis (EP), creative control (CC) and non-creative control (NCC) participants. Findings indicated that the CC group shared closer personality commonalities with the EP group than with NCC participants, on traits such as Neuroticism, Openness and Impulsive Non-Conformity as well as on variables such as Unusual Experiences, Cognitive Disorganisation and Paranoia/Suspiciousness. However, the CC group may better manage their emotional sensitivity and interpersonal suspiciousness than the EP participants. In separate analyses, CC and EP participants recorded higher creative cognition than NCC participants. Unsurprisingly, the CC group reported significantly

higher creative achievement than the EP and NCC samples. Of note, the findings indicate that EP participants recorded significantly higher creative achievement than NCC, suggesting that EP patients demonstrate some capacity for creative cognition and creative achievement. These preliminary findings may encourage further research and promote avenues of treatment for at-risk creative individuals and EP individuals.

Introduction

Similarities between highly creative individuals and those with bipolar disorder and schizophrenia have been well documented (Andreasen, 1987; Brod, 1997; Jamison, 1995; Ma, 2009; Rybakowski, Klonowska, Parrzala, & Jaracz, 2008); however, there is ongoing debate over what aspects of these schizophrenia and bipolar disorder populations contribute to this association. Three large Swedish epidemiological studies provide support for the assertion that there are common genetic determinants between bipolar disorder and schizophrenia (Kyaga et al., 2011; Lichtenstein et al., 2009; MacCabe et al., 2018), and that creativity and creative professions are overly represented among those with bipolar disorder and among the family members of those with schizophrenia and bipolar disorder (Kyaga et al., 2011). Furthermore, a recent study also found common polygenetic risk scores between creativity and those with bipolar disorder and schizophrenia (Power et al., 2015) providing additional genetic evidence supporting the association between creativity and mental illness.

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ARTICLE HISTORY

Received 23 July 2018 Accepted 25 October 2018

KEYWORDS

Creativity; early psychosis; personality; schizotypy



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In considering these associations, a unitary psychosis theory has been proposed (Carson, 2011; Claridge & Blakey, 2009; Sass, 2001) which argues that the apparently distinct clinical classifications with bipolar disorder and schizophrenia in fact have common underlying processes that differentially contribute to creativity. Specifically, Carson proposed a model of shared vulnerability between those with high creativity and individuals with psychopathology (Carson, 2011) based on existing research into molecular biology. The author suggested that hyper-connectivity, or the unusual neural linking of uncommon brain areas (often associated with psychosis), a preference for novelty and attenuated latent inhibitions are shared vulnerability factors operating below the level of consciousness between those with high

creativity and those with psychopathology. High intelligence quotient (IQ), working memory skills and cognitive flexibility are thought to help protect the high creativity population from developing psychosis by providing a meta-cognitive control over bizarre, unusual thoughts. In contrast, she suggests risk factors such as low IQ, perseveration and poor working memory may render the creative individual vulnerable to developing psychopathology. Carson acknowledges that this is an incomplete list and suggests additional studies would extend this model. Further clarification is particularly apt as the factors proposed are generic and too broad to have specific clinical application. Since this model was proposed, vulnerability factors for those ‘at risk’ for psychosis have been an area under increasing investigation (Fusar-Poli et al., 2017), with risk factors such as childhood trauma, early adolescent low functioning and socio-demographic factors along with cognitive deficits such as verbal learning impairments (Carrión et al., 2018) also associated with transition to psychosis. However, these additional vulnerability factors have not, as yet, been considered in relation to a specific creative population.

Carson’s shared vulnerability model proposed novelty seeking as the only personality trait common to the creative individual and those with psychopathology. This study will examine if aspects of personality beyond the factor outlined by Carson contribute to “protecting” the creative population from psychosis. Specifically, do aspects of personality and schizotypy differentiate the highly creative from those with expressed psychosis? Schizotypy is considered to be an aggregate of personality traits that lie along a continuum from normality to schizophrenia (Cochrane, Petch, & Pickering, 2012) (Siddi, Petretto, & Preti, 2017). Genetic, cognitive and brain functional Magnetic Resonance Imaging (fMRI) studies provide supportive evidence for an overlap between schizophrenia and schizotypy (Wang et al., 2017). Aspects of positive schizotypy such as Impulsive Non-Conformity and Unusual Experiences along with personality features such as Openness and Neuroticism have consistently been associated with both the highly creative, bipolar and schizotypal populations (Batey & Furnham, 2008; Srivastava et al., 2010).

The authors, Nelson and Rawlings (2010), investigated psychopathology and personality indicators of creative experience in a study of 100 creative artists. Aspects of positive schizotypy (Unusual Experiences) were found to be the strongest predictor of creative experience, along with the “Big Five” personality dimensions of Openness to Experience and Neuroticism, when compared to normative data. This is consistent with a number of other studies associating in particular Openness to Experience with creative cognition (Jung, Grazioplene, Caprihan, Chavez, & Haier, 2010; Jung, Mead, Carrasco, & Flores, 2013). As it has been postulated, Openness provides creative individuals with a deeper memory bank of experiences, thoughts and problem-solving strategies for creative thinking (Ma, 2009).

While the research discussed above has primarily investigated personality in non-clinical populations, a small number of studies have analysed personality

and cognitive features in clinical and creative samples. In a comparison of personality similarities and differences between participants with a diagnosis of Bipolar 1 Disorder (BD), unipolar depression diagnosis (MDD), creative arts students (CC) and healthy controls (HC), Nowakowska, Strong, Santosa, Wang and Ketter (2005) reported the most prominent personality similarities were between BD and CC populations. In particular the authors found novelty seeking, self-transcendence (the experience of oneself as an integral part of the universe (Cloninger, 1994)) and the affective temperament factor, cyclothymia, were similar across BD and CC populations. This finding of common personality traits between Bipolar (BD) and Creative (CC) populations has been supported in two similar studies (Srivastava et al., 2010; Strong et al., 2007).



Both these studies record similarly high scores on Neuroticism and Openness in BD and CC populations, which Strong suggests implicates an affective (e.g. Neuroticism) and cognitive/flexibility (e.g. Openness) component to creativity. Strong et al. (2007) hypothesised that these tendencies may assist creative expression through the ability to tolerate intense and often negative and varied shifts in emotion (Neuroticism), associated with driving innovation through dissatisfaction with the status quo (Strong et al., 2007). In contrast, she suggests Openness (which she associates with cognitive flexibility) may contribute to creative achievement and interpersonal relationships.

Taken together, these studies suggest that particular personality traits and certain positive schizotypal traits may differentially contribute to creative cognition. Mason's review of the assessment of schizotypy (Mason, 2015) noted that research into schizotypal personality characteristics should include a measure of paranoia/suspiciousness. Paranoid ideation has also been associated with those 'at risk' for psychosis (Masillo et al., 2017; Valmaggia et al., 2015); however, most research has examined the relationship between positive schizotypy and creativity (e.g. Nettle, 2006) rather than paranoia.

Similarly, while many studies have researched creative inclination and creative potential with both bipolar and schizophrenia populations (Wang et al., 2017), few studies have investigated creative production or the ability to follow through with creative inclination to actually produce and deliver creative outputs (Andreasen, 1987). Further investigation is warranted into which aspects of personality and schizotypy (including paranoia/suspiciousness) are associated with creative production (or the lack of it) in populations with these clinical disorders, in the presence of creative cognition (Kyaga et al., 2011).

Therefore, the aim of the present study is to further investigate relationships between personality and creativity across clinical, creative control (CC) and non-creative control (NCC) samples. Based on previous research, we hypothesise:

- . (1) Non-significant differences in specific personality traits will be observed between highly creative and clinical populations, such that individuals with

early psychosis (EP) will report similar levels of Neuroticism and Openness, Impulsive Non-conformity and Unusual Experiences to individuals defined as highly creative; however, both groups will show significantly elevated levels of these traits compared to NCC individuals.

. (2) Personality traits such as paranoia and suspiciousness will be more evident in EP participants when compared to CC and NCC individuals.

. (3) The CC and EP participants will demonstrate significantly higher creative thinking scores compared to NCC participants, but CC participants will record significantly higher levels of creative achievement when compared to both NCC and EP individuals.

Methods

Recruitment and study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 11279) and ratified by the University of Technology (HREC UTS ETH16-0532). All participants provided written consent prior to participation. Participants were aged 18–35 as we were interested in first episode psychosis and epidemiological studies suggest the age of onset of psychosis ranges from 15 to 35 with the median age of initial presentation in the mid twenties (Kessler et al., 2007). All participants were given a \$AUD40 monetary reimbursement for travel costs.

Participants

EP participants N = 21

EP participants were recruited from a previous study (Rowland et al., 2012), and had given consent to be approached for further studies. Twenty-five participants were approached for the study and

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21 agreed to participate. Of the four who declined to participate, two reported active psychotic symptoms and two failed to respond to invitations to participate. All were recruited from either an inpatient or outpatient hospital clinic and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis, administered by an experienced clinician. All EP participants met criteria for psychotic disorder according to ICD-10 criteria and had recorded a first episode psychosis or hospitalisation. Active psychotic symptoms were an exclusion criteria for the study; hence, a PANSS (Positive and Negative Syndrome Scale for Schizophrenia (Kay, Fiszbein, & Opler, 1987) measure was given at the time of testing. No participants were excluded due to the presence of acute psychotic symptoms.

CC participants N = 55

CC participants were recruited following a brief presentation by the lead researcher (JC), to several Creative Art Colleges around Sydney, Australia. The recruitment sites included tertiary creative training institutions such as music colleges (contemporary, classical music, composition, vocals), visual arts colleges as well as advertising on relevant creative websites (e.g. livingwithacreative-mind.com). Individuals were presented with an outline of the research and gave written consent to take part in the study. CCs were screened for past or present psychotic symptoms using a MINI (brief structured psychiatric questionnaire) (Lecrubier et al., 1997). None were found to have past or present syndromal psychiatric disorders. Of those recruited, 27 were primarily engaged with music; 15 were visual or graphic artists, 12 were actors or involved in the theatre and 1 was engaged in web development and design.

NCC participants N = 24

Healthy NCCs were recruited via a university website. The online information asked for psychologically healthy volunteers to participate in research into creative cognition, and 33 individuals initially responded. Nine participants were excluded because they met either of the following three exclusion criteria: (1) no personal or family history of mental illness; (2) an inability to communicate proficiently in spoken and written English and (3) receipt of more than rudimentary training in any field of creative arts. Using the MINI (Lecrubier et al., 1997), the normal NCCs were also screened for any current mental illness and one participant was excluded (eating disorder). These participants were reimbursed for their time.

Measures

All participants completed a series of tests including self-report questionnaires, mood assessment and intellectual ability testing.

Weschler abbreviated scale of intelligence (WASI)

In order to screen for IQ, the two-scale version of the WASI was administered to all participants (Wechsler & Zhou, 2011). The WASI has been found to be a brief but valid measure of intelligence in both healthy adult and clinical populations (Ryan et al., 2003). The two-scale version comprises a 42-item test of vocabulary and a 35-item matrix reasoning test. The measure was administered and scored according to standard protocols.

Abbreviated Torrance Test for Adults (ATTA)

All participants were administered the ATTA (Goff & Torrance, 2002). This test comprises three tasks where participants are asked to respond to each challenge using imagination and problem-solving ability. The measure was selected as longitudinal studies support the consistent relationship between test

behaviour and creative achievement, and the Torrance test is the most widely used and well-researched creativity measure (Torrance, 2000). Two scorers (JC and SG) evaluated each ATTA and where scores differed, the average was used.



Creative Achievement Questionnaire (CAQ)

To evaluate creative output, the CAQ (Carson, Peterson, & Higgins, 2005) was administered to all participants. In the CAQ, participants were asked to indicate their creative accomplishments in 8 separate domains: visual arts; music including both instrument and voice; dance; theatre, film including acting and creative direction; architecture including graphic design; creative writing; humour; inventions including computer and web design. Weighted scores indicating the achievements within each domain were calculated.

Neuroticism Extraversion and Openness Scale Five Factor Inventory (NEO-FFI-R)

Participants were administered a self-report personality measure NEO-FFI-R (Costa & McCrae, 1985; McCrae & Costa, 2004) which rates five aspects of personality, namely Neuroticism, Extroversion, Openness, Agreeableness and Conscientiousness. The NEO-FFI-R is a 60-item, widely used measure of personality.

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE)

The O-LIFE (Mason & Claridge, 2006) is a well-used measure of schizotypal personality in schizophrenic patients and healthy controls ($\alpha = .87$) (Ando, Claridge, & Clark, 2014; Burch, Pavelis, Hemsley, & Corr, 2006; Cochrane, Petch, & Pickering, 2010; Yaghoubi & Mohammadzadeh, 2012). It comprises 104 items across four scales; Unusual Experiences (Un Ex), which describes perceptual aberrations and magical thinking and is linked to positive aspects of schizotypy; Impulsive Non-Conformity (ImpNon) describes eccentric forms of behaviour including impulsivity and a lack of self-control; Introverted Anhedonia (InAn) associated with avoidance of intimacy and discomfort in social and physical environments and is associated with negative schizotypy; and Cognitive Disorganisation (CogDis) which contains items describing thought disorder and poor decision-making along with aspects of social anxiety.

Paranoia/Suspiciousness Questionnaire (P/SQ)

The P/SQ was designed to support the O-LIFE as a measure of schizotypy in largely non-clinical populations (Rawlings & Freeman, 1996). It is a 47-item questionnaire specifically assessing cognitions involving paranoia and suspiciousness. It also includes five subscales: interpersonal suspiciousness/hostility (IS), negative affect/withdrawal (NA), anger/impulsiveness (AI), mistrust/wariness (MW) and perceived hardship (PH) (Rawlings & Freeman, 1997).

Procedures

All participants were tested individually, at a single session, in a dedicated confidential space either within a hospital environment (EP) or on student campus at a creative arts (CC) or a university setting (NCC). Participants presented themselves at the testing room and completed a written consent form prior to testing. The testing period ranged from 2 to 3 h. Standardised test administration protocols were followed for all tests including the two-scale version WASI IQ (Wechsler & Zhou, 2011). Multiple test administrators were used and all were professionally trained in standardised intelligence testing.

Data analysis

Data were initially screened for missing values, and less than 5% of the data set found to be missing which is within recommended limits for non-correction (Tabachnick & Fidell, 2007). A series of data normality of distribution checks were then run (presence of outliers, skewness/kurtosis), as well as Levene's test for homogeneity of variance, and all variables found to meet criteria for parametric statistical analyses. A post hoc power calculation was carried out using G*Power

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(Erdfelder, Faul, & Buchner, 1996), which confirmed that assuming a small to medium effect size (0.4), and using an alpha rate of 0.05, the study was powered at 0.9 to detect a significant difference between groups with the present sample. A Bonferroni correction was applied to all comparative analyses, given the multiple tests conducted in this study. All statistical analyses were conducted using SPSS version 23.

Results

Descriptive statistics

A total of 100 participants took part in the study (EP: 21; CC: 55; NCC: 24). Mantel–Haenszel chi-square tests of significance were used to test for differences in the bivariate associations between demographic variables (age, sex and IQ), and are presented in Table 1. There were no significant differences in age, gender or IQ between the three groups of participants. The sample was predominantly female (61.4%), the mean age of the participants was 23.71 (SD = 4.19; Median = 23), and 53.5% of all participants were in the younger age group (<23 years).

Hypothesis 1: Non-significant differences in specific personality traits will be observed between highly creative and clinical populations, such that individuals with EP will report similar levels of Neuroticism and Openness, Impulsive

Nonconformity and Unusual Experiences to individuals defined as highly creative; however, both groups will show significantly elevated levels of these traits compared to NCC individuals.

Group differences on NEO-FFI-R

Group means and standard deviations for NEO results are summarised in Table 2. To examine group differences, we conducted a series of ANOVAs with group (NCC; CC; EP) as the independent variable and the NEO-FFI-R subscales (Extraversion, Neuroticism, Openness, Agreeableness and Conscientiousness) as the dependent variables. The CC and EP groups both reported significantly higher scores on the Neuroticism and Openness subscales compared to NCC ($p < .001$). The EP population also reported significantly higher scores on the Neuroticism subscale compared to the CC (and NCC groups). The NCC group was significantly more Conscientious than the EP group ($p < .05$).

Table 1. Sample description.

	EP	CC	NCC	Statistical value for main effect
<i>N</i>	21	55	24	
Age	25.4 ± 4.2	23.4 ± 4.3	22.8 ± 3.6	($F_{2,101} = 2.433, p = .093$)
Female (%)	57.1	63.6	62.5	($\chi^2 = 0.201, p = .904$)
IQ	107.9 ± 15.2	109.4 ± 10.3	104.9 ± 13.4	($F_{2,97} = 1.101, p = .337$)

Table 2. Means and standard deviations for all groups on the NEO variables.

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	55	24	
Neuroticism	30.4 ± 8.6	24.6 ± 8.3	17.0 ± 6.9	$F_{2,99} = 15.90, p < .001^a$
Extraversion	29.3 ± 7.9	30.3 ± 6.4	29.2 ± 4.8	$F_{2,99} = .346, p = .709$
Openness	33.9 ± 7.2	33.4 ± 6.8	24.2 ± 5.8	$F_{2,99} = 17.90, p < .001^b$
Agreeableness	28.1 ± 5.3	31.7 ± 7.1	31.0 ± 5.9	$F_{2,99} = 2.45, p = .091$
Conscientiousness	26.8 ± 7.5	29.7 ± 6.9	32.4 ± 7.3	$F_{2,99} = 3.45, p < .05^c$

a = EP > CC > NCC**

b = EP, CC > NCC**

c = NCC > EP*

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



Group differences on the O-LIFE

Whereas the NEO-FFI-R is a measure of “normal” personality features, the O-LIFE measures schizo- typical personality traits. Results of the one-way ANOVA comparing the three groups on the O-LIFE subscales are presented in Table 3. These show the EP and CC participants scored significantly higher on Unusual Experiences (Un ex), Impulsive Non-Conformity (ImpNon) and Cognitive Disorganisation (CogDis) compared to the NCC participants (all $p < .001$), but were not significantly different from each other. In relation to Introverted Anhedonia (IA), although the ANOVA just met statistical significance, none of the post hoc tests were significantly different from each other. This casts doubt

on the reliability of the omnibus test; hence, we have not included this variable among the group of significantly different group comparisons.

Considering NEO and O-LIFE together, Openness, Impulsive Non-Conformity, Unusual Experiences and Cognitive Disorganisation are similarly associated with EP and CC populations (see Figure 1). Results on the Neuroticism personality factor in the NEO-FFI-R present a slightly different picture. Similar to the above factors, both clinical and creative participants recorded significantly higher scores on Neuroticism when compared to the NCC group; however, the EP sample recorded significantly higher results again when compared to the CC group.

Hypothesis 2: Negative personality features such as paranoia and suspiciousness will be more evident in EP participants, when compared to CC and NCC participants.

Group differences on the P/SQ

The P/SQ measures negative personality feature such as general suspiciousness and hostility in interpersonal communication, alongside mistrustful and wary tendencies and resentment towards perceived hardship. To test the hypothesis that there would be a difference in positive and negative schizotypal features between EP, CC and NCC groups, a one-way ANOVA was conducted on P/SQ scores (see Table 4). The overall paranoia/suspiciousness mean score was significantly

Table 3. Means and standard deviations for all groups on the O-LIFE variables.

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	55	23	
Unusual Experiences	12.4 ± 7.6	13.3 ± 6.4	3.4 ± 4.0	$F_{2,98} = 20.89, p < .001^a$
Cognitive Disorganisation	14.8 ± 5.1	12.3 ± 5.0	5.7 ± 5.1	$F_{2,98} = 19.96, p < .001^a$
Introverted Anhedonia	8.2 ± 5.3	5.6 ± 3.9	7.6 ± 5.0	$F_{2,96} = 3.30, p = .042$
Impulsive Non-Conformity	9.6 ± 4.9	9.4 ± 4.0	5.1 ± 3.3	$F_{2,98} = 10.05, p < .001^a$

a = EP, CC > NCC**

** $p < .01$.

Table 4. Means and standard deviations for all groups on the P/SQ variable.

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	56	23	
Total Paranoia/Suspicious	24.9 ± 9.2	19.1 ± 7.9	14.2 ± 7.2	$F_{2,99} = 9.83, p < .001^a$
Interpersonal Suspicious	6.6 ± 3.4	5.5 ± 2.7	3.1 ± 2.6	$F_{2,99} = 9.18, p < .001^{b,c}$
Negative Mood	4.5 ± 1.7	3.7 ± 1.6	2.8 ± 1.2	$F_{2,99} = 6.33, p < .05^d$
Anger/Impulsiveness	4.3 ± 3.2	3.3 ± 1.7	2.3 ± 1.2	$F_{2,99} = 5.36, p < .05^d$
Mistrust/Wariness	3.6 ± 2.0	2.8 ± 1.9	2.6 ± 1.9	$F_{2,99} = 1.76, p = .176$
Hardship	3.5 ± 2.2 ^e	2.1 ± 2.1	1.7 ± 1.5	$F_{2,99} = 5.36, p < .05^e$

a = EP > CC > NCC**

b = EP > NCC**

c = CC > NCC*

d = EP > NCC*

e = EP > CC, NCC*

** $p < .01$; * $p < .05$.

Table 5. Means and standard deviation for all groups on creative achievement (CAQ) and creative thinking (ATTA).

	EP	CC	NCC	Statistical values for main effects
<i>N</i>	21	54	23	
Creative achievement	25.1 ± 25.6	48.2 ± 29.4	3.4 ± 4.7	$F_{(2,97)} = 27.11, p < .001^{a,b}$
Creative thinking	76.5 ± 12.5	79.7 ± 8.8	67.5 ± 9.2	$F_{(2,97)} = 12.68, p < .001^{b,c}$

a = CC > EP, NCC**

b = EP > NCC*

c = CC > NCC**

** $p < .01$; * $p < .05$.

higher in the EP and CC groups compared to the NCC ($p < .001$); however, a significant difference ($p < .001$) was also recorded between the EP and the CC groups, supporting our hypothesis that negative schizotypal personality characteristics, measured by the P/SQ, will be more prevalent in the EP population. Within the subscale comparisons, a comparative pattern of results was found for the Interpersonal Suspiciousness domain, with the NCC group reporting significantly lower scores than the other two groups ($p < .001$). The EP participants reported significantly greater negative personality features on Negative Mood and Anger Impulsiveness compared to the NCC participants ($p < .001$); however, they were not significantly elevated compared to the CC group. Finally, scores on the Hardship/Resentment subscale were significantly higher among the EP group compared to both the CC and the NCC groups.

To summarise, this cluster of shared personality features indicates adaptive character traits typically associated with positive schizotypal features that were found with both EP and CC populations. However, the EP population is distinguished from the CC both by an increase in Neuroticism and Interpersonal Suspiciousness symptoms, and the presence of additional negative schizotypal features. The presence and intensity of these negative traits may either impede creativity or prevent this creative potential converting to creative achievement in the EP population.

Hypothesis 3: The CC and EP participants will record significantly higher divergent thinking (creative potential) scores compared to NCC participants, but CC participants will record significantly higher levels of creative achievement when compared to both NCC and EP individuals.

Group differences of the ATTA and CAQ

A series of one-way ANOVAs were conducted to determine if there were any group differences in creative potential as measured by the divergent thinking (ATTA measure) and in creative

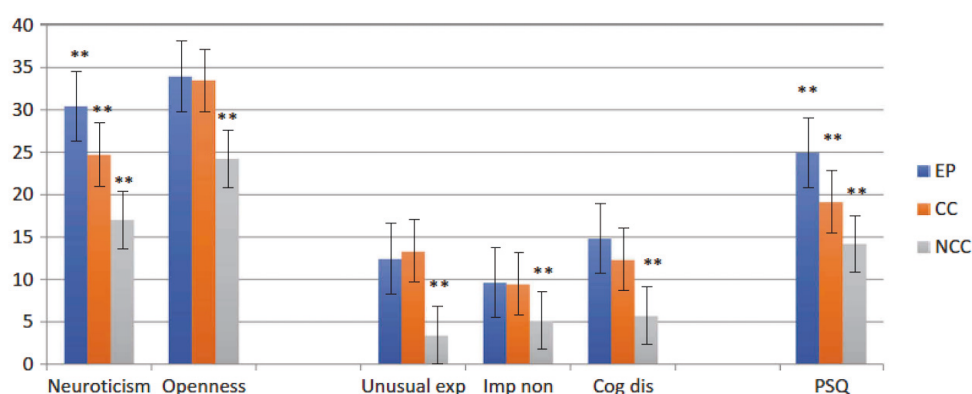


Figure 1. Graph of means for NEO-FFI-R (Neuroticism, Openness), O-LIFE (Unusual experiences, impulsive non-conformity, cognitive disorganisation) and Paranoid/Suspiciousness Questionnaire (Total score).

** $p < .01$.

A series of one-way ANOVAs were conducted to determine if there were any group differences in

creative potential as measured by the divergent thinking (ATTA measure) and in creative

achievement as measured by the CAQ (see Table 5) (Goff, 2002; Carson et al., 2005). Not surprisingly, the CC individuals scored significantly higher on the divergent thinking and CAQ measures, compared to the NCC group. While there was no significant difference between the CC and the EP population on the divergent thinking task, there was a significant difference between CC and EP on the CAQ. Of particular note however is the finding that the EP population scored significantly higher than the NCC on the CAQ. These results suggest that while the EP population has similar creative potential (divergent thinking) to the creative population, they are less able to translate this into creative achievement. However, some creative achievement was still evident.

Discussion

This research aimed to delineate the similarities and differences in personality between highly creative and EP populations, using a non-creative but similarly intellectually capable control group. Before discussing the results, it is important to note that as our research was cross-sectional rather than longitudinal and so our comments are preliminary in nature. These results support previous assertions that the personality and schizotypal traits of highly creative individuals are more closely aligned with clinical patients than the

normal population (Claridge & Blakey, 2009; Strong et al., 2007). Furthermore, these results lend additional support to the widely held view that both affect (Neuroticism) and aspects of cognitive flexibility (Openness) contribute to creativity (Richards, 2001; Rybakowski et al., 2008; Srivastava et al., 2010; Strong et al., 2007). Both creative and clinical populations share personality traits that are exploratory, seek new experiences, are non-conformist and prone to challenge social norms. Furthermore, both demonstrate a propensity for disorganised thinking, emotional sensitivity and general interpersonal suspiciousness.

There are of course a range of biological, social and motivational inhibitors to the psychosis population not achieving the creative output that their creativity scores in this study would suggest they have the capacity for (Richards, 2001). However, one additional difference between the two populations suggested by these data may lie in the ability to regulate heightened emotions for the purposes of maintaining social connectedness. On the one hand, emotional intensity is required for creative expression (Feist, 2006), while on the other hand self-management of emotions is needed in collaborative social interactions necessary for creative achievement. Csikszentmihalyi (1999) hypothesised that an individual's ability to achieve creativity involves not simply the ability to produce outstanding creative products, but implicates personality traits that enable access to a network of contacts and highly developed interpersonal skills that make it possible for the creative product to have influence. The high functioning creative individual may have the ability to sufficiently regulate their sensitivity in the social relationships necessary for creative influence. Figure 2 summarises these results.

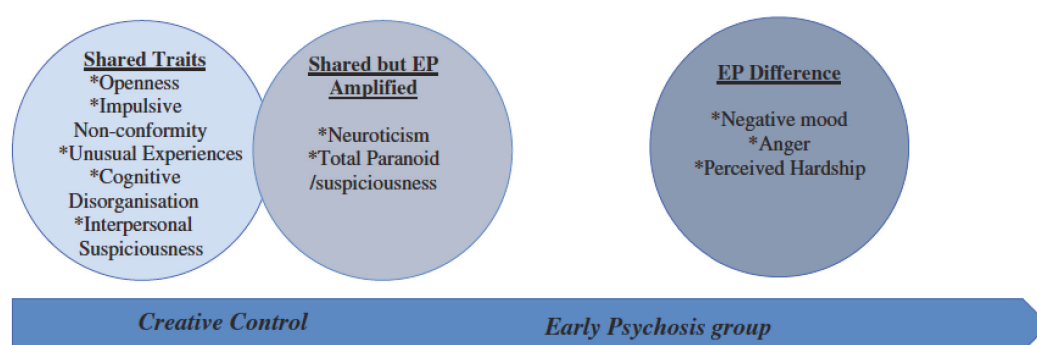


Figure 2. A model of shared and distinct personality and schizotypal traits mapped to CC and EP populations.

Nevertheless, limited creative achievement is possible for psychosis patients, as evidenced by the EP group's significantly higher scores on creative achievement compared to NCCs. This suggests that those with EP have a capacity for creative achievement. It may be in part that psychosis patients' elevated emotional sensitivity, suspiciousness and defensiveness impede their ability to effectively communicate and collaborate with others within their creative network. Elevated emotional sensitivity is of particular relevance in

creative achievement as rejection (of creative work) is an associated aspect of a creative vocation (Van Den Eynde, Fisher, & Sonn, 2015). Mature creative artists learn to manage this rejection (Czikszentmihalyi, 1999); however, this may be difficult for the equally talented but emotionally vulnerable EP individual. Difficulties with managing this type of rejection inherent in creative industries are likely to have a reciprocal relationship with the characteristics of hypersensitivity, suspiciousness and defensiveness found in this study.

This may prove to be a new avenue for intervention for EP patients; in that EP patients with proven creative ability may benefit from interventions aimed at enhancing communication skills and building resilience in the face of rejection. This in turn may increase their ability to maintain creative networks and improve vocational outcome. Therefore through research, which focuses on creative outcomes for EP populations, rather than cognitive deficits, it may lead to an associated reduction in stigma for this population (Serafini et al., 2011).

Limitations

Our findings are limited by the relatively small sample size and by the cross-sectional nature of the research. Moreover, the challenge of defining a creative and EP sample has been articulated by other researchers (Breitborde, Srihari, & Woods, 2009; Kaufman & Ronald, 2009; MacCabe et al., 2018). While we have sought to address these issues, the ongoing discourse in determining operational definitions for these populations remains a concern for researchers in the field. The lack of clarification in defining these populations contributes to difficulty in comparing studies and therefore is a limiting factor for the current research. Further research to elucidate these differences will be important future area of investigation.

Conclusion and implications

Our findings support the need for further targeted longitudinal research into young, at-risk, creative populations and EP patients (McGorry, Killackey, & Yung, 2009). In particular, our results underscore the need to research and develop programmes to foster and strengthen resilient, personality features in young, vulnerable, creative populations. These programmes would promote emotional self-management, along with interpersonal skills to challenge negative, suspicious patterns of thinking and behaviour.

Finally, the current results provide additional support for the development of preventative treatment protocols for creative populations, consistent with other recent studies that have identified the unique psychological vulnerability of creative populations (Gostoli, Cerini, Piolanti, & Rafanelli, 2017; Van Den Eynde et al., 2015). The recent McCabe epidemiological study (MacCabe et al., 2018) provides additional compelling support for this assertion as they conclude that artistic creativity is a risk factor for mental illness which is analogous to other well-documented risk factors for psychosis.

Acknowledgements

The authors would like to acknowledge Shannon Gostelow and Nicole O'Reilly who were research assistants for the project and Rob Brockman for his contribution to the research.



Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The authors would also like to acknowledge The National Health and Medical Research Council (NHMRC) Project grant [APP630471] and the Australian Research Council (ARC) Future Fellowship [FT0991511] both grants held by Melissa J Green (UNSW).

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Received: 7 June 2019 Revised: 13 November 2019 Accepted: 14 December 2019 DOI: 10.1111/eip.12909

ORIGINAL ARTICLE

Spatial working memory, not IQ or executive function, discriminates early psychosis and clinically vulnerable creative individuals

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Abstract**Aim:** While associations between creativity and psychopathology have been well researched, the specific cognitive processes that distinguish highly creative from those with psychopathology warrant further investigation. This study will examine whether IQ, executive function, cognitive inhibition or spatial working memory differentiate individuals with early psychosis, clinically vulnerable creative individuals, creative controls and non-creative controls.**Methods:** The study sample consisted of 110 participants: early psychosis (n = 21); clinically vulnerable creative controls (n = 25); creative controls (n = 30) and non-creative control (n = 34). The Diagnostic Interview for Psychosis assessed early psychosis participants and the Mini Neuropsychiatric Interview was used to screen for psychopathology in the remaining groups. Several cognitive tests were administered: IQ, neurocognitive measures of executive function and spatial working memory. Creativity was assessed using the Torrance Test of Creativity and Creative Achievement Questionnaire. A measure of vividness of mental imagery was also given.**Results:** Across all cognitive tests, spatial working memory differentiated the early psychosis group from both creative and non-creative control groups. Spatial working memory predicted group membership but vivid imagery was a better predictor of creative achievement. The early psychosis, clinically vulnerable creative and creative groups all recorded significantly higher results on creative achievement and creative cognition compared to non-creative controls.**Conclusions:** Our results provide further support for spatial working memory as an early neuro-cognitive marker for early psychosis. Spatial working memory, rather than IQ or executive function, may also be an early protective factor for clinically vulnerable young creative individuals.

KEYWORDS

cognition, creativity, early psychosis, spatial working memory

1 | INTRODUCTION The association between creativity and psychopathology has been the subject of speculation and conjecture since antiquity when Aristotle

first commented on melancholy among those who were prominent in society at the time (Becker, 2014). More recent studies provide evidence of a strong link between creativity and mood disorder and thought disorder similar to psychotic thinking (Rybakowski,

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Klonowska, Parrzala, & Jaracz, 2008). This association has been corroborated in recent genetic and epidemiological studies, which suggest shared genetic roots between creative professionals and those with a diagnosed psychosis (Kyaga et al., 2011; Parnas, Sandsten, Vestergaard, & Nordgaard, 2019). Notably, epidemiological evidence suggests that this association is particularly found between artistic creativity and psychosis. A recent large population based case-controlled study (MacCabe et al., 2018) found that students who studied artistic subjects (such as art and performance) at university had significantly increased odds of developing schizophrenia and bipolar disorder. Moreover the authors conclude that the association between creativity and psychopathology represents risk factors similar to other identified risk factors for psychotic illness. Similarly, a genetic study from Iceland (Power et al., 2015) reported that both bipolar and schizophrenia polygenic risk scores were associated with professional creative artists, and that this association was not found in five other professions. Although research in this area has focused on the similarities between creativity and psychopathology (Claridge & Blakey, 2009), the question of what enables a young artistic, creative student to follow a career of creative expression rather than a trajectory of pathology invites a closer examination of possible cognitive distinguishing factors that may protect young creative artists from psychopathology (Carson, 2011). Although previous research has examined some aspects of cognition, visuo-cognitive factors have not been studied. This investigation into what cognitive (including visuo-cognitive) similarities and differences exist between the highly creative individual and those with early psychosis is of increased importance as it may lead to innovative treatments and early remediation of those presenting as at risk for psychosis and young clinically vulnerable creative individuals.

1.1 | Cognitive and schizotypal similarities between artistic creative and psychosis populations

A number of studies have found personality and cognitive similarities between the creative and those with psychopathology, with similarities in schizotypy in particular extensively examined. Schizotypy refers to aspects of personality and perceptual beliefs that indicate a person's proneness to schizophrenia and psychosis (Siddi, Petretto, & Preti, 2017). It is usually defined as three factors: positive, negative and disorganized (Debbané et al., 2015) with creativity strongly associated with positive schizotypy, namely impulsive non-conformity and unusual experiences (Ando, Claridge, & Clark, 2014; Nelson & Rawlings, 2010; Nettle, 2006). With respect to cognition, similarities in divergent thinking (Claridge & Blakey, 2009; Srivastava et al., 2010) and cognitive inhibition (Beech, Powell, McWilliam, & Claridge, 1989; Carson, Peterson, & Higgins, 2003) have been reported in both highly creative and psychosis populations (Richards, 2001; Sass & Schulberg, 2001). Divergent thinking is rapid, fluid thinking in which the person is able to

make unique associations (Guilford, 1967; Torrance, 1993) and underlies both schizotypal and manic thought (Claridge & Blakey, 2009; Srivastava et al., 2010). Decreased cognitive inhibition, or the reduced ability to filter out irrelevant information and bring more stimuli into conscious awareness, is thought to be a

process underlying divergent thinking (Eysenck, 1994) and has been linked with both schizotypy and creativity (Brod, 1997; Ottemiller, Elliott, & Tania, 2014).

1.2 | Proposed cognitive differences between artistic creative and psychosis populations: IQ, executive function

General intellectual functioning (IQ) has been mooted as a possible cognitive protective factor for highly creative individuals (Carson, 2011; Rybakowski et al., 2008) where it is thought that those with high IQ are better able to process and manipulate additional stimuli arising from reduced cognitive inhibition. However, few studies support this assertion (Kyaga et al., 2011; Miller & Tal, 2007; Soeiro-de-Souza, Dias, Bio, Post, & Moreno, 2011). If not high IQ, then executive function may differentiate the two populations. Executive functions are those subserved by the frontal lobes of the brain and refer to cognitive skills such as planning, organizing and shifting mental set (often termed cognitive flexibility) (Baddeley, 1996). However, while executive function deficits are found in both bipolar and schizophrenia populations (Bora, Yucel, & Pantelis, 2009), age (Fucetola et al., 2000), onset and duration of illness are key factors in assessing executive function. Rather than declining executive function, a meta-analysis of cognitive deficits in ultra-high risk and early psychosis populations found stable and improved executive function across both “at risk” and early psychosis populations (Bora & Murray, 2013). This research suggests that executive function deficits are not as evident in “at risk” or early stage psychosis, which is the population of most concern in discriminating possible risk factors in creative arts students.

Executive function in the context of creativity and psychosis has been investigated in one previous study. Soeiro-de-Souza et al. (2011) tested a group of 18–35-year-old, un-medicated participants experiencing manic, depressed and mixed (mania and depression) episodes. In this study, creativity was higher in manic and mixed states, compared to those experiencing a depressive episode and importantly, higher creativity was associated with greater executive function in manic state only. IQ did not influence creativity across all three, mood states. Based on this study, where the manic group had elevated creativity and executive function, early indicators are that executive function may not differentiate the creative from those with psychopathology. However, a comparison of executive function in early psychosis and creative populations would provide more clarity of the role of executive function as a protective factor for the creative population. Notwithstanding there are additional visuo-cognitive factors that warrant attention.

1.3 | Visuo-cognitive factors: Does spatial working memory differentiate between artistic creativity and psychosis?

One important area of cognitive functioning that has received relatively less research attention in understanding the creativity/

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psychopathology nexus is visuospatial working memory. Visuospatial working memory refers to the ability to keep spatial information active for a period of time, involving spatial orientation and

the recording of information about one's environment. Although not investigating creativity specifically, a group of researchers (Goghari et al., 2014), examined the role of spatial working deficits and IQ in those at ultra-high risk (UHR) for psychosis and first episode psychosis patients (FEP), compared to controls (HC). All three groups were compared on WASI Verbal and Performance IQ (Canivez, Konold, Collins, & Wilson, 2009), and spatial working memory. The spatial working memory (SWM) task was taken from Cambridge Neuropsychological Test Automated Battery (CANTAB) (Sahakian & Owen, 1992) and requires retention and manipulation of visuospatial material. The SWM task is able to differentiate two of the components of working memory, namely the short-term maintenance of material (in the visuospatial sketchpad) and the use of task strategy. This study found that, controlling for IQ the short-term maintenance of material in the visuospatial sketchpad differentiated the UHR from the HC groups. Furthermore, it was impaired SWM, rather than IQ, that significantly predicted global functioning in both the UHR and FEP groups. The assertion that deficits in spatial working memory may be an early risk factor for psychosis and a more reliable neurocognitive marker for psychosis, compared to other cognitive factors, (Carrión et al., 2018), has been supported in other studies (Badcock, Michiel, & Rock, 2005; Brewer et al., 2006; Pirkola et al., 2005). In addition to this, a number of recent reviews have proposed that aberrations in visual functioning, such as deficits in spatial working memory are associated with early psychosis (Landgraf & Osterheider, 2013; Uhlhaas & Mishara, 2007), which may in turn drive delusion formation (Grillo, 2018). Further research into these visuo-cognitive impairments is needed. Whilst the role of spatial working memory as a possible vulnerability marker for psychosis is an emerging area of research, its relationship to creativity has not been examined.

1.4 | Similarities in vividness of mental imagery in artistic creative and psychosis populations

Associated with spatial memory and common to both creative and psychosis populations is enhanced vividness of mental imagery. Vivid mental imagery is defined as the degree of perceptual detail experienced in visualizing scenes and objects (Oertel et al., 2009). It has been associated with hallucinations in schizophrenia and has been proposed as a trait marker for schizophrenia (Sack, van de Ven, Etschenberg, Schtztz, & Linden, 2005). Moreover it is one of the indicators of creativity (Michalica & Hunt, 2013; Thomson & Jaque, 2018; Wang et al., 2017). It may be that there is also a relationship between those with strong mental imagery and spatial working memory such that those with heightened mental imagery may utilize it to aid performance in visuospatial working memory tasks (Keogh & Pearson, 2011). Aspects of this association have been examined in recent studies using small clinical populations and healthy controls (Benson &

Park, 2013; Matthews, Collins, Thakkar, & Park, 2014). Benson and Park (2013) investigated visuospatial ability and mental imagery in a population of 18 patients with schizophrenia (Scz) matched to 18 controls. The clinical population demonstrated enhanced mental imagery but impaired spatial working memory, indicating that the clinical population were unable to recruit their superior mental imagery in spatial working memory tasks. No studies have explored this question in a creative and early psychosis population and this will be investigated in this study.

1.5 | Aims

The aims of this study are to investigate whether spatial working memory rather than IQ and measures of executive function differentiate creative and non-creative controls, from early psychosis populations. We hypothesize that IQ, cognitive inhibition and executive function will not differentiate early psychosis and control groups, however, early psychosis participants will record greater SWM deficits than both control groups. Furthermore the early psychosis cohort will retain similarly enhanced vividness of mental imagery and creative cognition but not creative achievement compared to creative controls.

2 | METHODS

Recruitment and study procedures were approved by the Human Research Ethics Committees of the University of New South Wales (HREC UNSW Protocol No. 11279) and ratified by University of Technology (HREC UTS 16-0532). All participants provided written consent prior to participation. As the study sought to focus on first episode psychosis, only participants aged between 18 and 35 were recruited. All participants were given an AUD\$40 monetary reimbursement for travel costs.

2.1 | Participants

2.1.1 | Early psychosis participants (EP) N = 21

Early psychosis participants were recruited from a previous study (Rowland et al., 2012), and had given consent to be approached for further studies. All were recruited from either an inpatient or outpatient hospital clinic and had undergone a psychiatric assessment using a comprehensive Diagnostic Interview for Psychosis (DIP) (Castle et al., 2006), administered by an experienced clinician. All early psychosis participants met criteria for psychotic disorder according to ICD-10 criteria and had recorded a first episode psychosis or hospitalization. All were under regular psychiatric supervision. Active psychotic symptoms were an exclusion criterion for the study (see Table 1 for positive and negative symptom scale scores), however no participants were excluded due to the presence of acute psychotic symptoms.

TABLE 1 Sample description

	EP	CVCC	CC	NCC	Statistical value for main effect
N	21	25	30	34	
Age	25.4 ± 4.2	23.8 ± 4.8	23.1 ± 3.9	23.7 ± 3.7	$F_{2,111} = 1.40, P = .246$
Female (%)	57.1	56.0	68.8	58.8	$\chi^2 (3; N = 112) = 1.06, P = .738$
Years of education	14.95 ± 2.78	15.53 ± 1.77	14.56 ± 2.39	15.91 ± 1.86	$F_{2,109} = 1.07, P = .394$
Employment status	N (%)	N (%)	N (%)	N (%)	
Student	7 (33.3)	14 (56.0)	21 (70.0)	28 (82.4)	
Employee	6 (28.6)	2 (8.0)	2 (6.7)	6 (17.6)	
Part time employment	6 (28.6)	7 (28.0)	6 (20.0)	0 (0)	
Unemployed	2 (9.5)	2 (8.0)	1 (3.3)	0 (0)	
PANSS—positive	9.38 ± 2.97				
PANSS—negative	11.24 ± 4.81				
PANSS—general	21.00 ± 4.16				
Age at onset	16.58 ± 2.91				
Age at first diagnosis	19.10 ± 3.53				

Abbreviations: CC, creative control; CVCC, clinically vulnerable creative control; EP, early psychosis; NCC, non-creative control; PANSS: positive and negative symptom scale.

2.1.2 | Creative control participants (CC) N = 30

Creative control participants were recruited from several Creative Art Colleges around Sydney, Australia. The recruitment sites included tertiary creative training institutions; music colleges (contemporary, classical music, composition, vocals), visual arts colleges, as well as advertising on relevant creative websites (such as livingwithacreativemind.com). Creative controls were screened for past or present psychotic symptoms using a MINI Plus 5.0 (structured psychiatric questionnaire) (Lecrubier et al., 1997). None were excluded for past or present syndromal psychiatric disorders.

2.1.3 | Clinically vulnerable creative control (CVCC) N = 25

In administering the MINI Plus 5.0 structured psychiatric interview, it was observed that 25 of the creative participants reported past symptoms of hypomania or psychosis symptoms that failed to reach criteria for diagnosis. Due to the high number of creative participants who reported these symptoms, it was decided to undertake further analysis and consider this a possible clinically vulnerable creative group. Assessment of clinically vulnerable and at risk mental states for psychosis is commonly undertaken in help seeking patients who attend outpatient or inpatient services where symptoms can be assessed over time (Brewer et al., 2006). In contrast this clinically vulnerable creative group was not treatment seeking and recruited as a control group from several creative arts institutions and therefore could not be considered to satisfy the normal criteria for “at risk” mental states (Yung et al., 2005).

However as schizotypal personality is one of the CAARMS (Comprehensive assessment of “at risk” mental states) vulnerability

factors for determining “at risk” for psychosis (Debbané et al., 2015; Yung et al., 2005), we examined schizotypy scores taken from the O-Life and Paranoia Suspiciousness scale. Only the CVCC had a schizotypal profile that was more aligned to the EP group, when compared to the creative and non-creative groups (Table A1). Both CVCC and EP recorded significantly higher scores on positive negative and disorganized schizotypy compared to creative and non-creative participants. These findings lend support for the conjecture that this clinically vulnerable creative group may be more closely related to the early psychosis population. It was therefore decided to investigate this group as a separate more vulnerable creative subgroup. Moreover it was hypothesized that this group may be more cognitively aligned to the early psychosis population.

2.1.4 | Non-creative control participants (NCC) N = 34

Healthy, non-creative controls were recruited via a university website. The online information asked for psychologically healthy volunteers to participate in research into creative cognition, and 33 individuals initially responded. Nine participants were excluded because they met either of the following three exclusion criteria: (a) no personal or family history of mental illness; (b) an inability to communicate proficiently in spoken and written English and (c) receipt of more than rudimentary training (defined as 3 years of less) in any field of creative arts. Using the MINI Plus 5.0 (Lecrubier et al., 1997) the normal non-creative controls were also screened for any current mental illness and one participant was excluded (presence of an eating disorder). These participants were reimbursed \$AUD 40 or their time.

TABLE 2 Means and standard deviations for all groups on creative thinking (ATTA), creative achievement (CAQ) and vivid imagery (VVIQ)

	EP	CVCC	CC	NCC	Statistical values for main effects
N	21	25	30	33	
WASI IQ	107.9 ± 15.2	108.3 ± 10.2	110.2 ± 10.2	103.5 ± 13.1	$F_{3,109} = 1.8, P = .15$ ns
IED total errors adjusted	22.67 ± 20.94	15.79 ± 11.81	26.83 ± 22.13	27.50 ± 22.59	$F_{3,101} = 1.83, P = .147$ ns
Negative Priming	.0188 ± .069	-.0081 ± .107	-.0170 ± .061	-.0081 ± .089	$F_{3,90} = .764, P = .517$ ns
Interference	.0387 ± .090	.0297 ± .075	.041 ± .060	.0578 ± .087	$F_{3,88} = 1.26, P = .292$ ns
SWM Between errors	29.6 ± 21.6	14.0 ± 12.3	14.8 ± 11.9	15.5 ± 12.9	$F_{3,93} = 5.42, P < .01^a$
SWM Strategy	32.9 ± 4.6	28.8 ± 4.5	29.7 ± 4.7	30.3 ± 5.3	$F_{3,93} = 2.92, P < .05^b$
ATTA	76.5 ± 12.5	81.92 ± 7.0	77.4 ± 9.9	65.0 ± 11.5	$F_{3,108} = 14.5, P < .001^c$
CAQ	25.1 ± 25.6	55.8 ± 32.1	40.9 ± 26.6	2.6 ± 4.1	$F_{3,108} = 26.9, P < .001^{b,c}$
VVIQ	62.8 ± 12.0	63.7 ± 9.4	63.3 ± 9.3	52.6 ± 11.8	$F_{3,106} = 7.6, P < .001^c$

Note: All analysis made with bonferroni correction.

Abbreviations: CC, creative control; CVCC, clinically vulnerable creative control; EP, early psychosis; IED, Intra-extra Dimensional Shift; NCC, non-creative control; SWM, spatial working memory; WASI, Weschler Abbreviated Scale of Intelligence.

^aEP > CC,CVCC,NCC*.

^bEP > CVCC*.

^cEP,CC,CVCC. > NCC**.

Screenshot

3 | MEASURES

All participants completed a series of tests including cognitive measures, self-report questionnaires, mood assessment and intellectual ability testing.

3.1 | Intelligence Quotient-Weschler Abbreviated Scale of Intelligence (WASI) (Wechsler & Zhou, 2011)

In order to test for IQ, the two-scale version of the WASI was administered to all participants.

3.2 | Executive function (cognitive flexibility)- Intra-extra Dimensional Shift (IED) (Sahakian & Owen, 1992)

The IED is an attentional set-shifting neuropsychological assessment from the CANTAB battery. There are nine stages and the participant advances through the stages by learning the “rule” at each stage. The number of stages completed was the primary index used to measure executive function (Fagerlund, Pagsberg, & Hemmingsen, 2006; Luciana & Nelson, 1998).

3.3 | Cognitive Inhibition-Negative Priming Task

The negative priming task is a computer generated modified version of the Stroop task based on a procedure outlined by Beech (Beech et al., 1989). Reaction times on a priming distractor (PD); neutral distractor (ND) and unrelated distractor (UD) are calculated and a negative priming effect calculated by subtracting PD-UD. The interference or Stroop effect is calculated by subtracting UD-ND.

3.4 | Spatial Working Memory: SWM (Sahakian & Owen, 1992)

Spatial working memory was assessed using the Cambridge Neuropsychological Test Automated Battery. In this task a number of coloured boxes were displayed on the screen with several of the boxes containing hidden tokens. The participant was required to search through the boxes to find these hidden tokens. In each trial the participant, had to remember where the tokens had been located and search in alternate boxes. Strategies used by the participant to remember the location of the tokens were also recorded and each trial increased in difficulty. Between search errors occur when a participant returns to a box in which a token had already been found and strategy score based on the participant following a predetermined search sequence were the primary indicators used for analysis. A high strategy score indicated an inefficient strategy. All participants completed

the battery however a small number of CC and NCC did not have their results recorded on IED/SWM task due to faulty equipment.

3.5 | Divergent (creative) thinking task: Abbreviated Torrance Test of Adults (ATTA) (Goff & Torrance, 2002)

All participants were administered the Abbreviated Torrance Test for Adults (ATTA; (Goff & Torrance, 2002)). This test comprises three tasks; the first calls for a verbal response to a hypothetical problem and the following two tasks require figural responses. Participants are asked to respond to the challenge using imagination and problem solving ability. Their responses are scored according to four normative referenced and 15 criterion referenced indicators to obtain an overall creative indicator.

3.6 | Creative achievement: Creative Achievement Questionnaire (Carson, 2005)

To evaluate creative output, the Creative Achievement Questionnaire (CAQ); Carson, Peterson, & Higgins (2005) was administered to all participants. As young, developing professional creative artists were the focus of the creative participant group, an amended form of the CAQ questionnaire was administered to include relevant early achievement and achievement associated with contemporary outputs in online and digital creativity.

3.7 | Vivid mental imagery: VVIQ (Marks, 1973)

In this pen and paper questionnaire, participants were asked to imagine 16 items and provide ratings of the vividness of their images using a five-point rating scale where 5 indicated the least vivid image (no image at all) and 1 the most vivid (perfectly clear and vivid as normal vision).

4 | STATISTICAL METHODS

Statistical analyses were conducted using SPSS 25. Descriptive analysis including mean and SD were performed on all continuous variables and χ^2 on categorical variables. ANOVA with Bonferroni correction was used to determine between group differences on all cognitive and creative variables. Effects of spatial working memory, vividness of mental imagery, IQ and IED were independently explored by a hierarchical regression. Creative achievement, as measured by the creative achievement questionnaire, was the outcome variable. Demographic covariables and then clinical predictors were entered into the model. For each step of the model, R square and R square change were reported. To further investigate the importance of spatial working memory relative to executive function/IQ and as a discriminatory

TABLE 2 Means and standard deviations for all groups on creative thinking (ATTA), creative achievement (CAQ) and vivid imagery (VVIQ)

	EP	CVCC	CC	NCC	Statistical values for main effects
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^aEP > CC,CVCC,NCC*.

^bEP > CVCC*.

^cEP,CC,CVCC. > NCC**.

Screenshot

5 | RESULTS

5.1 | Participants

A total of 110 subjects participated in the study (PSD = 21; CVCC = 25; CC = 30; NCC = 34). No participants reported any visual impairment or colour blindness. The socio-demographic and clinical characteristics of the sample are shown in Table 1. More than half the participants were female (67%) and the mean age was 23.9 (SD = 4.1). A total of 63.6% were students and had completed an average of 15.3 (SD = 2.09) years of education. With respect to occupation, due to the small sample size the cells were recoded (part-time/unemployed vs other; EP, CCxNCC)

(Fishers exact $P < .001$) and a significant difference was recorded. This was considered to be possibly indicative of the clinical and creative individual's unpredictable employment (Van den Eynde, Fisher, & Sonn, 2016), however, it was not deemed critical to further analysis.

5.1.1 | Comparison between groups on cognitive and creative tests

In Table 2, the ANOVA revealed a between group differences on creative thinking (ATTA), creative achievement (CAQ), vividness of mental imagery (VVIQ) and spatial working memory, between errors and strategy scores (Table 2). There were no significant differences between groups on IED, IQ and Negative Priming (NP) tasks. IQ, executive function, set shifting and cognitive inhibition did not discriminate EP and control groups. SWM between errors discriminated EP from all control groups however strategy was the only significant indicator of difference between EP and CVCC groups. These results indicate that compared to the early psychosis group, the clinically vulnerable creative group had significantly higher creative achievement and employed better spatial working memory strategy.

TABLE 3 Stepwise regression with creative achievement as the dependant variable and IQ, executive function-set shifting, spatial working memory and vivid mental imagery as predictors

	<i>B</i>	<i>SE B</i>	β	<i>P</i>
Step 1				
Constant	18.51	19.67		.31
Age	.17	.80	.02	.87
Gender	10.72	6.43	.18	.09
Step 2				
Constant	−39.80	31.58		.21
Age	.21	.78	.03	.80
Gender	10.87	6.26	.18	.08
WASI IQ	.59	.25	.25	.02
IED	−.22	.15	−.16	.14
Step 3				
Constant	−95.49	35.90		<.01
Age	.06	.72	.01	.93
Gender	9.89	5.82	.16	.09
WASI IQ	.57	.23	.24	.02
IED	−.25	.14	−.18	.07
SWM between errors	−.07	.19	−.04	.73
SWM strategies	.13	.66	.02	.85
Vivid mental imagery	.99	.25	.39	<.01

Note: $R^2 = .03$ for step 1 ($P = .25$) $\Delta R^2 = .08$ for step 2 ($P = .02$) $\Delta R^2 = .16$ for step 3 ($P < .01$).

Abbreviations: IED, Intra-extra Dimensional Shift; SWM, spatial working memory; WASI, Weschler Abbreviated Scale of Intelligence.

5.1.2 | Predicting creative achievement and group membership

Results from the stepwise regression analysis (Table 3) indicated that while the cognitive factors of IQ, and executive function (IED) made some contribution to creative achievement, it was vividness of mental imagery ($\beta = .39$, $q < .01$) that was the stronger predictor, contributing 16% of

the variance.

Stepwise discriminant functional analysis was used to determine what variables; WASI IQ, executive function (IED total errors adjusted) and spatial working memory between errors and strategy best discriminated the four groups. Only the between errors spatial working memory variable significantly discriminated groups (Wilks' $\lambda = 0.85$, $\chi^2[1 \text{ N} = 90] = 13.72$, $P = .003$; canonical discriminant coefficients: between search errors = 0.06, constant = -1.2; functions at group centroids: EP = 0.74, CVCC = -.34, CC = -.21, NCC = -0.10). These results indicate that while spatial working memory is not a strong predictor of creative achievement, poor SWM does predict membership in the early psychosis group.

6 | DISCUSSION

This research aimed to investigate specific cognitive differences between early psychosis, clinically vulnerable creative, creative and non-creative populations. The early psychosis, creative control and clinically vulnerable creative groups, compared to non-creative controls, recorded significantly higher scores on creative potential (ATTA), creative achievement (CAQ) and vividness of mental imagery (VVIQ). The clinically vulnerable creative group performed better on creative cognition and achievement than the other groups.

There were no significant differences on IQ, negative priming or executive function (IED) across all four groups. This suggests that these global measures of cognitive function do not discriminate between those in the early stages of psychotic illness, those who may be more clinically vulnerable and those with no psychotic illness. However it should be noted that as the psychosis population ages a significant decline in executive function (abstraction), IQ and visual skills is reported (Fucetola et al., 2000) and this is impacted by age at onset of the illness (Bora et al., 2009). Similarly, there are differences in negative priming presentation between acute and those in remission with inhibition being reduced in florid psychosis but restored in those under remission (Minas & Park, 2007). Within a younger psychosis population, at the early stage of illness presentation and in remission, our results indicate that spatial working memory was significantly impaired. This finding is in line with results from a similar study (Goghari et al., 2014) discussed earlier, which found that between errors and strategy on the CANTAB spatial working memory task differentiated UHR and FEP from HC. Similarly, the early psychosis

group differed from all three control groups on the between errors score which measures short-term maintenance of visuospatial memory; indicating some initial decline in visuospatial working memory. However, it was only the clinically vulnerable creative group that recorded a significantly higher strategy score when compared to the early psychosis group, indicating superior executive function on visuospatial planning.

It has previously been suggested (Pirkola et al., 2005) that spatial working memory may be a better neuro-cognitive marker for psychosis than verbal processing skills. In our population, early psychosis participants recorded deficits in short term spatial working memory. However, unlike the UHR group investigated in the Goghari study, the creative clinically vulnerable group, alongside the creative and non-creative group recorded similar results on between errors indicating stable short-term spatial memory. Also, unlike the UHR group in the aforementioned study, the clinically vulnerable creative group had more efficient strategy than the early psychosis group. The creative and non-creative did not record any significant difference on strategy. This is a measure of executive working memory that reflects planning and integration of spatial information. Is it the superior ability to remember, plan and integrate spatial information that assists the clinically vulnerable group to manage their heightened creative imagination and vivid mental imagery to achieve creatively in the presence of positive and negative schizotypal symptoms and with sub clinical symptoms? The early psychosis group in comparison has similar positive and negative schizotypal symptoms, creative imagination and vivid imagery but has deficits in spatial memory

and planning and so was unable to achieve to the same extent creatively.

These results are considered in juxtaposition to the epidemiological study by MacCabe et al. (2018), which concluded that artistic creativity was as significant risk factor for psychotic disorders as other comparable risk factors. Our results support the view that creative artists and early psychosis participants share personality and cognitive risk factors. Our results point to spatial working memory as a possible cognitive “protective factor” for the clinically vulnerable artistic student. While these results are tentative, the role of spatial working memory as a possible cognitive factor that may prevent transition to psychosis in vulnerable creative populations warrants further investigation. One mechanism by which spatial working memory may act as a protective factor for creative artists may be that as spatial working memory deteriorates in early psychosis, vividness of imagery and creative imagination becomes more dominant (Matthews et al., 2014) and so may lead to delusions. Carr (2010) proposed the notion that delusion formation shares similarities to the creative process. He suggests that delusions start with an aberrant protopsychotic anomalous experience in which the individual searches for meaning to explain the experience. This search for meaning occurs under reduced pre-frontal functioning (such as when SWM is impaired) where the delusion becomes the dominant belief. Carr likens this initial protopsychotic anomalous experience to the altered state and loosening of associations that occurs in the initial stages of creativity (Csikszentmihalyi, 1996; Eysenck, 1994) and supports other evidence that proposes a relationship between creativity and risk for psychosis (Abraham 2014). Following the initial loosening of associations, he suggests that the second part of the creative process involves a problem solving exercise to assign significance to this flight of ideas. It may be for the creative individual, with intact spatial working memory, creative product occurs. For the early psychosis individual with impaired spatial working memory (ie, impaired visual memory and problem solving ability), this may lead to inappropriate salience assignment and delusions (Grillo, 2018).

Clearly more research into the role of spatial working memory with early psychosis populations is needed. This study provides current evidence in support of the aforementioned epidemiological findings (MacCabe et al., 2018) indicating creativity as a vulnerability factor for psychosis. Our analysis identified a clinically vulnerable group of creative artists in training who show similar schizotypal vulnerabilities to early psychosis patients, without evidence of visuospatial cognitive decline. These findings lend support to further longitudinal research into identifying and monitoring vulnerable creative individuals in areas of schizotypy and spatial working memory.

7 | LIMITATIONS

These results should be interpreted in view of the limitations of the research. One of the limiting factors for this study is the small sample size and cross-sectional methodology; therefore without follow up data we cannot draw any conclusions or implications on transition to psychosis. The clinically vulnerable creative control group developed out of observing a pattern of symptomatology in a sub-set of creative controls. Future research should seek to identify and provide longitudinal data on at risk creative populations. Although the pilot study by Burkhardt et al. (2018) did not advocate screening for Bipolar Disorder in creative populations, our research suggests that further longitudinal studies are needed with this population to identify and determine risk over time. Due to the small creative sample size we were not able to distinguish between different domains of creativity for analysis. For example, are visual artists, rather than musicians more clinically vulnerable and do visual artists have superior spatial working memory and strategy compared to other creative artists? These are questions that warrant further investigation.

The authors would also like to acknowledge the National Health and Medical Research Council (NHMRC) Project grant (APP630471), and the Australian Research Council (ARC) Future Fellowship (FT0991511) both grants held by Melissa J Green (UNSW). Melissa J Green was

responsible for this project as executed at UNSW and is affiliated with UNSW, Neuroscience Research Australia (NeuRA), the Black Dog Institute, and the Macquarie Centre for Excellence in Cognition and its Disorders.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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FUTURE DIRECTIONS

This research supports the call for further research into visuo- cognitive impairments in individuals at risk and individuals transitioning to psychosis. It also provides support for innovative treatment protocols (Valmaggia, 2017) for early psychosis patients that use visual mediums such as computer-based and virtual reality programs that may develop and strengthen visuospatial working memory.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Shannon Gostelow and Nicole O'Reilly who were research assistants for the project.

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How to cite this article: Crabtree J, Hudson JL, Brockman R, Newton-John T. Spatial working memory, not IQ or executive function, discriminates early psychosis and clinically vulnerable creative individuals. *Early Intervention in Psychiatry*. 2020; 1–10.

<https://doi.org/10.1111/eip.12909>

APPENDIX

TABLE A1 Schizotypy measured from Oxford Liverpool inventory of feelings and experiences (O-Life) and paranoid suspiciousness scale

	EP	CVCC	CC	NCC	Statistical value for main effect
N	21	25	32	34	
Positive (ImpNon)	9.57 ± 4.87 ^b	11.42 ± 3.5 ^b	7.84 ± 3.71 ^b	5.09 ± 3.4 ^b	($F_{3,98} = 11.04, P < .001$)
Positive (UnExp)	12.38 ± 7.59 ^a	15.5 ± 5.68 ^a	11.50 ± 6.38 ^a	3.41 ± 4.03 ^a	($F_{3,98} = 16.28, P < .001$)
Disorganized (CogDis)	14.81 ± 5.14 ^a	13.54 ± 5.3 ^a	11.06 ± 4.78 ^a	5.91 ± 5.18 ^a	($F_{3,98} = 13.07, P < .001$)
Negative (Paranoid)	6.62 ± 3.4 ^b	6.36 ± 2.44 ^b	4.75 ± 2.65 ^b	3.18 ± 2.68 ^b	($F_{3,99} = 7.36, P < .001$)

^aEP, CVCC, CC > NCC**.

^bEP, CVCC > NCC** *Schizotypy measured from O-Life and Paranoid suspiciousness scale.

Appendix 1V

Building Mental Resilience Programme

It is anticipated that the programme could be conducted for two hours over six weeks and an outline of the programme is included below (Table 13).

Table 13: ***Building Mental Resilience Programme:***

Program outline			
Week	Topic	Evidence based intervention	Vulnerability Factor
1	Overview of creative vulnerabilities	* Psycho-education * Mindfulness	* Cognitive and personality vulnerabilities
2	Understanding the creative person	* Self awareness * CBT –challenging negative self-appraisal * Establishing cognitive flexibility with creative vs. self identity	*Openness/neuroticism * <i>Schizotypy</i> : impulsive non and unusual experiences * <i>Paranoid ideation</i> : Addressing negative evaluation and ideas of reference
3	Creative Thinking	*CBT *Cognitive flexibility, *Mindfulness	*Divergent thinking * Reduced pre-attentive filtering
4	Creative imagination	*CBT –challenging anxious thoughts *Reducing anxiety sensitivity *Imagery reappraisal	*Spatial working memory *Anxiety *High neurosis *Creative imagination
5	Managing emotions	*Emotion regulation vs. emotional adaptation *ACT exposure therapy	*High neurosis *Negative affect

6	Making behavioural changes	* CBT goal setting and behaviour change * ACT Committed action	* Openness, novelty seeking and impulsive non conformity. * Destructive novelty seeking behavioural patterns.
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The programme provides an example of a clinical treatment program that addresses the unique vulnerabilities of highly creative individuals.

1. **Week one** of the programme provides psycho-education around the cognitive and personality factors associated with those with creative aptitude. Week one also outlines how these vulnerability factors require careful understanding and management as they contribute both to mental health vulnerability and the creative process and cognition.

2. The material presented in **week two** addresses vulnerabilities of the creative person. The session discusses tools to identify and maintain a strong stable identity and provides techniques for increasing self-awareness and challenging negative self-appraisal. This session in particular addresses issues of paranoid tendencies with tools to mitigate a propensity toward paranoid ideation and negative social evaluative concerns.

3. **Week three** addresses the area of creative cognition. In this session the participant is introduced to research associated with divergent thinking and the concept of cognitive flexibility. Divergent thinking is associated with humour and improvisation but it can also drive rumination and over-driven anxious thinking. Using an ACT approach, which encourages psychological flexibility and draws on the participant's

ability to be cognitively flexible, the participant would be taught how to defuse from negative self-judgements. Similarly how to contact the present moment (psychological flexibility) would be included in this session. Other CBT based mindfulness techniques would also be taught as a protective psychological intervention for the creative individual's rapid creative cognitive processes.

4. **Week four** follows on from the material introduced in week three and addresses issues of creative imagination, high neurosis and anxiety, which were discussed in chapter four, five and six of this thesis. This session reflects the findings presented in chapter four where the concept of emotional adaptation was introduced as a way of managing emotional intensity. Emotion adaptation refers to the ability to be emotionally flexible depending on environment and it would employ spatial working memory and strategy. For example, an actor who is required to portray an intense rape scene over the duration of a theatre production would be required to draw on his or her memory or understanding of intense emotion in order to portray the scene. The scene would require spatial working ability to establish context and creative imagination to imagine the character. After finishing the production, the actor would need the ability to emotional and psychologically adapt to healthy relationships and normal interaction; drawing on spatial working memory and context to stimulate this emotional adjustment.

5. **Week five** follows from week four to further discuss issues of managing intense emotions. This session addresses the factors arising from the findings presented in chapter two, four and six regarding high neurosis, reduced pre-attentive filtering and anxiety. In the literature the word *skinlessness* is used to describe these thin mental boundaries (Claridge & Blakey, 2009). Skinlessness is a term that was first coined by

Virginia Woolf's father to describe the creative individual as *doing life with one layer of skin missing* (Milligan & Clare, 1994). It is a colloquial expression in reference to the high neurosis, anxiety and reduced pre-attentive filtering (discussed in chapter two) associated with the creative individual. The participants would be taught to manage these negative intense emotions and overwhelming sensory input using techniques such as emotion regulation, mindfulness and acceptance and commitment therapy (ACT) exposure techniques. Using ACT exposure therapy, participants would be trained in how to contact their distressing emotions without defence while moving toward valued goals and in this way increase their ability to tolerate negative emotion such as anxiety. For a creative population whose emotions may be associated with their creative expression (Jamison, 1994), an ACT approach (rather than a CBT approach that is associated with challenging negative beliefs and graded exposure) was therefore considered a more appropriate treatment for this population. In randomised trials, it has been found to be as effective a treatment for anxiety, when compared to CBT (Forman, 2007).

6. **Week six** introduces concepts of creative behaviour and examines interventions associated with behavioural change and goal setting. This would follow on from material discussed in chapter four and six in which the creative person is known to engage in exploratory, novelty seeking and often to risky behaviour, participants would be taught to evaluate their propensity for novelty in the context of their values. The session would discuss adaptive and non-adaptive ways to harness those aspects of character and personality for creative expression rather than more self-destructive application. The program would conclude with strategies for goal setting and behaviour change.

The pilot program outlined above is intended to provide targeted clinical intervention for 'at risk' creative arts students.