Neuropsychological evidence for dimensional schizotypy: Implications for creativity and psychopathology

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Abstract

Schizotypal personality is characterized by a variety of traits, such as magical thinking, unusual perceptual experiences, and anhedonia. Factor analytic studies have shown that these characteristics tend to cluster into at least two separate dimensions (positive and negative schizotypy). Schizotypy is associated with vulnerability to schizophrenia. However, it is also related to higher scores on measures of creativity and increased right-hemisphere brain activity. In a series of recent studies investigating the behavioral, neuropsychological, and neuroimaging correlates of positive and negative schizotypy, positive schizotypy was associated with better performance on measures of creativity, enhanced responsivity to threatening emotional stimuli, and more rightprefrontal cortical activity. These results support earlier psychological studies suggesting that positive schizotypy is related to patterns of cognitive and emotional function (e.g., divergent thinking, heightened emotion) that are common to both creativity and psychopathology.

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Creativity has been associated with mental illness for centuries. Biographical accounts of famous musicians, philosophers, scientists, writers, artists, and poets describe psychotic episodes and suicides (Brod, 1997). In addition, psychological studies have shown that, on average, highly creative people have higher scores on measures of psychopathology than less creative people (for a review, see Andreasen, 1996). Relatives of schizophrenic or other psychotic patients have a higher incidence of creative achievement (for a review, see Brod, 1997). However, the relationship between characteristics of ‘genius’ and symptoms of ‘madness’ is not straightforward. The majority of people who suffer from chronic mental illness experience a wide range of symptoms and deficits that interfere with the production of substantive work. Moreover, creativity is often defined as the ability to produce new ideas and adapt, improve, or create new functions for existing products (Kirton, 1989), skills that are impaired in most patients with schizophrenia. Indeed, the productive periods of most famous creative individuals occurred when their symptoms of mental illness were less severe (Brod, 1997). It therefore seems useful to examine whether creativity is associated with certain emotional, cognitive, or personality traits that may also predispose one to mental illness.

Research focused on the traits that may be associated with both creativity and mental illness has identified schizotypal personality as a candidate for vulnerability to schizophrenia as well as a potential contributor to creativity. Much of this work emerges from the study of schizophrenia and its predispositions and hence is biased to represent the relevant personality traits as pathological.

Schizotypal personality consists of traits that lead to a variety of cognitive, emotional, and social behaviors that are perceived by others to be unusual. For instance, individuals with schizotypal personality are often described as “odd” or “eccentric” and they may report an elevated rate of unusual perceptual experiences. Odd ideas or magical beliefs, inappropriate or constricted affect, and social and/or physical anhedonia are also commonly observed in schizotypal individuals. Many of these characteristics are thought to be milder versions of symptoms observed in schizophrenia that could lead to significant impairment in emotional, social, and vocational functioning, even if they do not manifest as psychosis. Indeed, schizotypal personality disorder includes a constellation of characteristics whose link to schizophrenia has been theoretically and empirically supported (e.g., Chapman, Chapman, Kwapis, Eckblad, & Zinser, 1994; Fernandes & Miller, 1995).

However, other researchers have argued that at least some schizotypal traits are continuously distributed throughout the population and may be associated with enhanced adaptive functioning (McCreery & Claridge, 2002). In particular, unusual perceptions and magical beliefs may be linked to enhanced spirituality and creativity. For example, schizotypy scale items such as “It has seemed at times as if my body was melting into my surroundings” and “Sometimes I have had the feeling that a part of my body is larger than it usually is” are both common experiences of people who practice meditation (Kabat-Zinn, 1990). Items such as “It is not possible to harm others merely by thinking bad thoughts about them” belie a growing belief among scientists, scholars, and physicians that thoughts can influence events and objects in the material world (e.g., Dossey, 1993). Jung wrote extensively about
synchronicity, the idea that events co-occur in a meaningful way, a topic that has been taken up by more recent writers (Hopke, 1997). Individuals who believe in the concept of synchronicity might endorse items such as “I have felt that there were messages for me in the way things were arranged, like in a store window.” Studies have suggested that a spiritual propensity, as reflected in such beliefs, can provide an adaptive advantage to individuals when dealing with stress, such as change and loss (for a review, see Levin & Vanderpool, 1987; McFadden, 1999). Along these lines, high scorers on an ‘aberrant perceptions and beliefs’ factor reported having out-of-body experiences but did not find them distressing. This group tended to have lower scores on anhedonia scales, suggesting more pleasurable perceptual experiences than the general population. Such unusual perceptual experiences were interpreted as adaptive and consistent with out-of-body experiences leading to greater tolerance in instances of post-operative pain and reports of ‘reassuring apparitions’ serving to relieve people during times of stress (McCreery & Claridge, 2002). It can be noted that the importance of these empirical relationships does not depend on assumptions about the reality basis of such events or experiences.

Unusual perceptions and magical thinking have also been associated with divergent thinking and creativity in students, professors, writers, and actors (e.g., Brod, 1997). Divergent thinking is considered to be an important component of the creative process. Although it cannot be equated with creativity, it can predict creative potential (Runco, 1991). Schizotypy has also been associated with a greater number of unique responses on divergent thinking measures (Green & Williams, 1999). Other evidence illustrating ‘creative’ traits in a nonclinical population comes from family histories. For instance, first-degree relatives and offspring of people with schizophrenia tend to be more creative and enter more creative occupations than controls (e.g., Karlsson, 1984), implying that such traits may be genetically mediated.

Schizotypy is thus a complex construct that seems to be related to maladaptive as well as adaptive functioning. Early on, schizotypy was often conceptualized via the positive/negative symptom dichotomy used in the schizophrenia literature. Positive traits are characteristics that the general population presumably does not experience (e.g., delusions, hallucinations, etc.), and negative traits (e.g., anhedonia, flat affect, etc.) are the absence of experiences that are normally present in the general population. More recent factor-analytic studies have yielded three to four factors to account for the dimensions of schizophrenia and schizotypy (Reynolds, Raine, Mellingenm, Venables, & Mednick, 2000). The three-factor models include dimensions related to positive schizotypy, disorganization, and negative schizotypy (e.g., Vollema & Hoijth,ink, 2000), whereas four-factor models include an additional asocial behavior/non-conformity dimension (e.g., Vollema & van den Bosch, 1995). Despite these refinements, the positive and negative dimensions continue to be fundamental to the construct.

Dimensions of schizophrenia and schizotypy have also been consistently associated with other personality traits. Schizophrenia has been associated with high pecu- liarity and neuroticism and with low extraversion (Berenbaum & Fujita, 1994). Positive schizotypy has been associated with high neuroticism and openness to experience and with low agreeableness, whereas negative schizotypy has been associated
with high neuroticism and with low extraversion, openness, and agreeableness (Ross, Lutz, & Bailley, 2002).

The association of schizotypy with both adaptive and maladaptive functioning is clarified, to some degree, by examining how positive and negative schizotypy relate to cognitive and emotional variables. The majority of the literature suggests that aspects of positive but not negative schizotypy are associated with creativity. For instance, in a series of studies enrolling 1108 college students, positive symptoms were positively correlated with creativity, whereas negative symptoms were negatively correlated (for a review, see Schulberg, 2001).

Given the links between schizotypy and creativity, it is not surprising that there has been interest in investigating the neural correlates of schizotypy, as a diagnostic category, in addition to its specific personality dimensions. Theoretical and empirical studies of creativity have consistently linked functions of the right hemisphere to greater creativity (for a review, see Heller, 1994). Neuropsychological studies indicate that schizotypal individuals display an asymmetry in hemispheric processing favoring the right hemisphere. For example, a relative deficit in verbal functions (Voglmaier et al., 2000) and a tendency to show right hemispatial inattention (Taylor, Zach, & Brugger, 2002) have been documented, suggesting either left-hemisphere dysfunction or a right-hemisphere bias in cognitive processing. In addition, people who had high scores on Magical Ideation (MI, Eckblad & Chapman, 1983) made more correct responses on a lexical decision task when words were presented to the right hemisphere (Leonhard & Brugger, 1998). As the right hemisphere is involved in holistic processing of information, this right-hemisphere bias may also account for the tendency of schizotypes to make remote or ‘loose’ associations among concepts. For instance, high scorers on MI judged unrelated words to be more closely related than lower MI subjects (Mohr, Graves, Gianotti, Pizzagalli, & Brugger, 2001). Belief in paranormal phenomena has also been associated with producing more original associations to unrelated stimuli (Gianotti, Mohr, Pizzagalli, Lehmann, & Brugger, 2001). Linking uncommon ideas, which is facilitated by right-hemisphere activation, may be part of creative thinking, but in extreme cases it could foster delusions (Leonhard & Brugger, 1998). Along these lines, schizotypal subjects scored better on nonverbal creative tests than did controls (Poreh, Whitman, & Ross, 1994). Furthermore, within the schizotypal group, those with a left-ear (right-hemisphere) preference in a dichotic listening task had higher scores on both the schizotypy scale and on the verbal tests.

In a series of studies, we investigated the behavioral, neuropsychological, and neuroimaging correlates of positive and negative schizotypy. In the first study (Fisher, Heller, & Miller, in preparation), 20 participants with schizotypal personality (who scored at least 2 SD above the mean on either the Perceptual Aberration, (Chapman, Chapman, & Raulin, 1978) or the Magical Ideation scales or at least 1.5 SD above the mean on both scales) and 16 controls were administered a battery of questionnaires (including the Schizotypal Personality Questionnaire, SPQ; Raine, 1991), neuropsychological measures (verbal and nonverbal information processing), and a semantic association task. Regression analyses across all 36 participants indicated that the combination of magical ideation, perceptual aberration, odd beliefs
(SPQ), and unusual perceptions (SPQ) significantly predicted scores on figural fluency, a design fluency task sensitive to right-hemisphere functioning (Ruff, Light, & Evans, 1987). As fluency tests are firmly rooted in the neuropsychological tradition and have been considered the best single indices of creativity (Dudek, 1993), these figural fluency data support the association of right-hemisphere functioning and creativity in positive schizotypy.

The right hemisphere is also involved in emotional information processing (for a review, see Heller, 2004). An aspect of emotion processing that engages the right hemisphere involves monitoring for and responding to threatening information (for reviews, see Nitschke & Heller, 2002; Nitschke, Heller, & Miller, 2000). We employed an emotional Stroop task that has been well validated by previous studies in our laboratory as a measure of emotional responsivity (e.g., Compton, Heller, Banich, Palmieri, & Miller, 2000; Compton et al., 2003). The emotional Stroop task consists of blocks of positive, negative, and neutral words, and the participant is asked to respond as quickly as possible to the color of the word, ignoring its meaning. As this task requires the inhibition of task-irrelevant information (the emotional meaning of the word) to respond accurately to task-relevant information (the color of the word), prefrontal cortical functions of selective attention and the maintenance of contextual information are involved (for a review, see Banich, 2004).

A behavioral study of 169 undergraduates investigated the relationship between dimensions of schizotypy, personality traits, emotional dispositions, and interference on the Emotional Stroop test (Mohanty et al., 2001). Positive but not negative schizotypy was associated with interference on the emotional Stroop task for negative words. Importantly, this relationship was not mediated by anxiety or depression. These results suggest that positive schizotypy is associated with a heightened response to emotional information, particularly information that could be perceived as threatening.

In a subsequent study, 16 individuals who had high scores on Perceptual Aberration and/or Magical Ideation and 16 controls participated in a neuroimaging study (Mohanty et al., submitted). Consistent with findings from behavioral and neuropsychological studies, participants high on positive schizotypy showed greater activity in right prefrontal cortex and less activity in left prefrontal cortex than did controls (see Fig. 1).

These neuropsychological, neuroimaging, and behavioral findings are consistent with studies indicating that aspects of schizotypal personality are associated with better performance on tasks related to divergent thinking and creativity. Across studies, higher scores in figural fluency and increased right prefrontal cortical activity for emotional compared to neutral words in the Stroop task were associated with positive schizotypy, providing support for increased right-hemisphere activity in individuals with characteristics of positive schizotypy. These findings are also consistent with a more intense emotional response to negative words in positive schizotypy.

The fact that specific subscales of schizotypy rather than a global measure were associated with right-hemisphere function provides support for a multidimensional perspective regarding schizotypal personality. Without this perspective, characteristics of
schizotypy cannot be readily differentiated and understood. In addition, this approach will lead to a better understanding of the multiple factors involved in the development of schizophrenia.

These data and those examining the association with creativity suggest the possibility of a ‘healthy schizotypy’ (McCreery & Claridge, 2002), which may explain the persistence of genes related to schizophrenia in the population despite its many maladaptive aspects. The link between mental illness and creativity is likely due to common cognitive features involving the right hemisphere. To confirm this, it will be important in future research to examine the relationship between schizotypy, creativity, and right-hemisphere activity in the same experimental manipulations. This hypothesized process may be adaptive in some circumstances but may become problematic at extreme levels when other cognitive, social, emotional, or environmental resources are diminished. As such adaptive and maladaptive characteristics are investigated and better understood, the construct of schizotypy will be better defined, leading to improved methods of diagnosis and treatment, as well as a greater appreciation for what lies behind creative inspiration.

References


