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Schizotypy and specificity of negative emotions on an emotional Stroop paradigm in the general population

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ABSTRACT

Attentional-interference using emotional Stroop tasks (ESTs) is greater among individuals in the general population with positive (versus negative) schizotypal traits; specifically in response to negatively (versus positively) valenced words, potentially capturing threat-sensitivity. Variability in attentional-interference as a function of subcategories of negatively valenced words (and in relation to schizotypal traits) remains underexplored in EST studies. We examined attentional-interference across negative word subcategories (fear/anger/sadness/disgust), and in relation to positive schizotypy, among non-clinical individuals in the general population reporting varying degrees of schizotypal traits. As hypothesized, performance differed across word subcategories, though the pattern varied from expectation. Attentional-interference was greater for fear and sadness compared to anger; and analogous for fear, disgust, and sadness. In the high schizotypy group, positive schizotypal traits were directly associated with attentional-interference to disgust. Attentional-interference was comparable between high- and low-positive schizotypy. Results suggest negative emotion subcategories may differentially reflect threat-sensitivity. Disgust-sensitivity may be particularly salient in (non-clinical) positive schizotypy. Findings have implications for understanding negative emotion specificity and variability in stimulus presentation modality when studying threat-related attentional-interference. Finally, disgust-related attentional-interference may serve as a cognitive correlate of (non-clinical) positive schizotypy. Expanding this research to prodromal populations will help explore disgust-related attentional-interference as a potential cognitive marker of positive symptoms.

1. Introduction

Schizophrenia is a neurodevelopmental psychiatric disorder characterized by positive, negative, and disorganized psychotic symptoms and impairments in cognition, affect, behavior, and social functioning (Walker et al., 2004). In line with Meehl's (1962, 1990) seminal taxonomic model of psychopathology, schizotypal traits across the schizophrenia spectrum are experienced along a continuum and believed to be partly contingent upon degree of predisposition. The psychosis spectrum may be conceptualized as including schizotypal traits in the general population, at-risk psychotic states, and acute and chronic illness. For example, positive and negative psychotic symptoms that characterize patients (Strauss et al., 1974; Walker et al., 2004) have been observed in attenuated form among at-risk (Cannon et al., 2008; Cadenhead et al., 2010) and non-clinical (Kendler et al., 1991; Siever et al., 1993; Walder et al., 2012) samples. Evidence suggests that prominent attenuated positive symptoms are associated with greater psychosis conversion risk in at-risk samples (Kwapil et al., 1997; Van Os et al., 2000; Cannon et al., 2008; Walder et al., 2013). Studying at-risk and non-clinical populations with schizotypal traits may help identify etiological risk factors for psychosis, with the advantage of circumventing confounds associated with acute illness such as hospitalization and medication effects (Gruzelier, 2003). Thus, it is not surprising that there has been a recent escalation of studies examining a wide range of clinically relevant variables (e.g., symptoms, social functioning, affective state) and neurobiological factors (such as neurocognition, neuroanatomic integrity) among individuals at-risk for psychosis and non-clinical individuals endorsing varying degrees of schizotypal traits.

1.1. Attention-related deficits, affective disturbance and psychotic symptoms across the psychosis spectrum

Attention is one among several cognitive domains that is well established as disrupted in psychosis (Kuperberg and Heckers, 2000; Walder et al., 2000; Gold, 2004), psychosis risk (Faraone

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et al., 1995; Green et al., 2000; Barrantes-Vidal et al., 2002; Bergida and Lenzenweger, 2006; Walder et al., 2008; Mesholam-Gately et al., 2009), and (more recently) among individuals in the general population self-reporting schizotypal traits (Dinn et al., 2002). Consistent with this, attention is associated with psychotic symptoms (Hepp et al., 1996; Filbey et al., 2008) and schizotypy (for review see Cornblatt and Keilp, 1994).

Attention also is adversely impacted by negative emotion across the psychosis spectrum (Dochtery et al., 1994; Mohanty et al., 2008; Anticevic, et al., 2012). This is noteworthy given that emotional disturbance is a core clinical feature of schizophrenia (Bleuler, 1950; Kraepelin, 1971) and negative emotion exacerbates positive psychotic symptoms (Malla and Norman, 1992; Docherty et al., 1994; Docherty 1996).

The interplay of attention with emotional processes, particularly attentional bias to negative stimuli, has been proposed as a possible mechanism involved in the development, maintenance, and exacerbation of (specifically) positive psychotic symptoms (Garety et al., 2007). This is supported by evidence demonstrating that selective attention to threatening stimuli (measured by visual scan paths) is linked with positive psychotic symptoms among schizophrenia patients with persecutory delusions (Freeman et al., 2000; Phillips et al., 2000).

The interaction of attention with emotional processes (in general) is known as 'attentional interference' (Mckenna and Sharma, 1995). Attentional interference is often measured using ESTs (variants of the traditional color-word Stroop task), aimed at capturing disruption in attentional processes as a function of emotional interference (Mckenna and Sharma, 1995). Attentional interference is believed to serve an adaptive survival function given that quick detection of emotions such as threat can assist in avoidance of life endangering outcomes (Mckenna and Sharma, 1995).

Attentional interference has been examined widely in psychosis (Bentall and Kaney, 1989; Epstein et al., 1999; Green et al., 2001; Wiffen et al., 2014). The interaction of attention with threat perception (Green et al., 2001), where threat-related stimuli evoke fear or signal danger in the environment (Van Hooff et al., 2013), has galvanized particular attention. Literature suggests that increased attentional interference to threatening words ('threat-sensitivity') is associated with positive symptoms in psychosis (Bentall and Kaney, 1989).

Less well understood is the association of attentional interference with psychosis proneness (or schizotypal traits) in non-clinical populations; particularly the interaction of distinct negative (threat-sensitive) emotions with attention. Greater attentional interference (using EST paradigms) in response to negatively (rather than positively) valenced words has been associated with positive (not negative) schizotypal traits among non-clinical samples. This includes unaffected relatives of psychosis patients (Besnier et al., 2009) and individuals with high positive schizotypy (Mohanty et al., 2008). Such findings were speculated to be due to increased threat-sensitivity, influenced by increased stress reactivity in this population (Mohanty et al., 2008). This line of investigation points to threat-related attention bias as a potential cognitive correlate of illness risk across the psychosis spectrum, including among non-clinical samples. Moreover, this research highlights the need for closer examination of differential patterns of association of attentional interference with psychotic symptom dimensions, towards elucidating vulnerability markers of psychosis risk.

Taken together, existing literature suggests that attentional interference is greater for negative (than positive) words (Mohanty et al., 2008; Van Strien and Van Kampen, 2009) among clinical and non-clinical populations (Williams et al., 1996), though studies with non-clinical samples are at a relatively incipient stage. Moreover, attention bias along the psychosis spectrum tends to be specific to positive (not negative) psychotic symptoms. Findings to date have been conceptualized as bolstering the possibility of heightened sensitivity to threat (and threat-relevant stressors) among individuals across the psychosis spectrum.

1.2. Specificity of threat-related negative emotions and variability across presentation modalities

The emotion processing literature suggests that discrete negative emotions (fear, anger, disgust) may underlie threat, though negative valence specificity has not been systematically explored. This is reflected in the International Affective Picture System (IAPS) (Lang et al., 1997), a widely used database for visual emotional stimuli (Mckenna and Sharma, 1995; Davis and Whalen, 2001). The majority of IAPS scenes reflect a combination of negative emotions (e.g., sadness, anger, disgust, fear) rather than single discrete emotions (Mikels et al., 2005; Libkuman et al., 2007). Moreover, the visual images classified as 'threat' often reflect physical injuries, mutilations, and burn victims that may elicit disgust rather than (or in addition to) fear (Mikels et al., 2005; Libkuman et al., 2007; Van Hooff et al., 2013). Recent studies have begun to parse categorization of IAPS images into discrete emotions (Libkuman et al., 2007; Mikels et al., 2005).

Definitions of threat vary throughout the literature (Van Hooff et al., 2013), possibly as a function of underlying negative emotion specificity, which appears to vary across modalities of stimulus presentation (e.g., facial expressions, visual scenes, words). Anger and fear appear to underlie threat in the context of emotional facial expressions (Davis et al., 2011), whereas fear (Krusemark and Li, 2011) and disgust (Cisler et al., 2009; Krusemark and Li, 2011; Van Hooff et al., 2013) underlie threat when using visual scenes. One study using word stimuli suggested that disgust may underlie threat (Charash and McKay, 2002), though the majority of such studies collapsed across negative stimuli (e.g., sadness, anger, disgust, fear), without considering negative emotion specificity (Mohanty et al., 2008; Van Strien and Van Kampen, 2009).

Evaluating discrete negative emotions underlying threat is important, as distinct emotions may be linked with different consequential behavior and neurobiological underpinnings. For example, fearful faces signal threat in the environment, without providing clear information about the threat source. In turn, this motivates information gathering from the environment. By contrast, angry faces signal direct threat to the observer (Davis et al., 2011), thus not demanding information gathering. Discrete negative emotions also may serve differential survival and adaptive functions. For example, whereas fear is associated with facial expressions (expansion of the visual field and nasal cavities) that signal need for information gathering, the disgust response involves facial expressions of rejection (narrowing of the nasal cavities and visual fields) (Susskind et al., 2008).

Commensurate with the global (and threat-specific) emotion processing literature, the majority of studies to date examining attentional interference across the psychosis spectrum focus on negative valence broadly, without considering differential specificity across negatively valenced emotion subcategories (anger, fear, sadness, disgust) and modalities of stimulus presentation (e.g., visual, auditory). Elucidation of negative valence specificity (and variability as a function of stimulus presentation modality) in this context is warranted to better determine whether emotion-related attentional interference effects in psychosis-risk are attributable to a threat-specific emotion, or perhaps to negative valence more generally (Green and Phillips, 2004).