



An electrophysiological investigation of emotional abnormalities in groups at risk for schizophrenia-spectrum personality disorders



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ABSTRACT

Both extreme levels of social anhedonia (SocAnh) and perceptual aberration/magical ideation (PerMag) are associated with risk for schizophrenia-spectrum disorders and with emotional abnormalities. Yet, the nature of any psychophysiological-measured affective abnormality, including the role of automatic/controlled processes, is unclear. We examined the late positive potential (LPP) during passive viewing (to assess automatic processing) and during cognitive reappraisal (to assess controlled processing) in three groups: SocAnh, PerMag, and controls. The SocAnh group exhibited an increased LPP when viewing negative images. Further, SocAnh exhibited greater reductions in the LPP for negative images when told to use strategies to alter negative emotion. Similar to SocAnh, PerMag exhibited an increased LPP when viewing negative images. However, PerMag also exhibited an increased LPP when viewing positive images as well as an atypical decreased LPP when increasing positive emotion. Overall, these results suggest that at-risk groups are associated with shared and unique automatic and controlled abnormalities.

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1. Introduction

Schizophrenia and schizophrenia-spectrum personality disorders (e.g., schizotypal personality disorder, schizoid personality disorder, paranoid personality disorder) are associated with abnormalities in emotional information processing, generation, and expression (Cohen & Minor, 2010; Kohler & Martin, 2006; Kring & Moran, 2008), and these abnormalities are associated with poor outcomes (Green, Helleman, Horan, Lee, & Wynn, 2012; Kring, Gur, Blanchard, Horan, & Reise, 2013). Similarly, other evidence suggests that people at risk for schizophrenia-spectrum personality disorders also have abnormalities related to emotions. For example, social anhedonia (SocAnh), which is associated with increased risk of schizophrenia-spectrum personality disorders (Gooding, Tallent, & Matts, 2005; Kwapil, 1998), is characterized by diminished self-reported experience of positive emotion (e.g., Brown, Silvia, Myin-Germeys, & Kwapil, 2007; Kerns, Docherty, & Martin, 2008; Martin, Becker, Cicero, Docherty, & Kerns, 2011). Further,

there is evidence that SocAnh is associated with decreased attention to emotions, including increased reports of wanting to ignore positive emotions and decreased influence of negative mood on judgment (Martin et al., 2011; Martin, Becker, Cicero, & Kerns, 2013; Martin, Cicero, Bailey, Karcher, & Kerns, 2015). Alternately, there is some evidence that individuals who report increased frequency of psychotic-like experiences, and thus are also at risk for the development of schizophrenia-spectrum disorders (e.g., extremely elevated perceptual aberrations and/or magical ideation, or PerMag; Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994), might exhibit greater reactivity to both positive and negative stimuli (e.g., Karcher & Shean, 2012). Also, when they are exposed to a stressor, they report increased psychotic-like symptoms (Collip et al., 2013). Hence, understanding the nature of specific emotion mechanisms in at-risk individuals could not only help treat functional disability in people with a schizophrenia-spectrum personality disorder, but also potentially could help prevent onset of a spectrum personality disorder. However, the nature of deficits in these emotion mechanisms in at-risk populations is still unclear (e.g., Kring & Moran, 2008). The current research used event-related potentials (ERPs) to examine whether people with elevated SocAnh or PerMag exhibit altered neural activation either when passively viewing emotional

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images or when actively attempting to regulate their emotional responses.

Affective neuroscience theory and previous research suggests multiple neural systems are associated with more automatic, reflexive processing of affective stimuli and more controlled, reflective processing of affective stimuli (Barrett, 2006; Cunningham, Dunfield, & Stillman, 2013; Gross & Thompson, 2007; Ochsner & Gross, 2007). More automatic affective processing occurs when one is presented with an affective stimulus that elicits an implicit evaluation which is “rapid, unconscious and robust across situations” (Cunningham & Zelazo, 2007; p. 97) and occurs in the first few hundred milliseconds after stimulus presentation (Barrett, Mesquita, Ochsner, & Gross, 2007; Cunningham & Zelazo, 2007; Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007; Ochsner & Gross, 2005). In contrast, more controlled affective processing refers to the deliberate control of one’s emotional response (Cunningham et al., 2013; Ochsner & Gross, 2007; Phillips et al., 2008). According to the Iterative Reprocessing Model of emotion (Cunningham et al., 2013), there is a bidirectional ongoing relationship of mechanisms subserving more automatic and controlled processes. Hence, abnormalities in emotion processing associated with SocAnh or PerMag could involve either automatic and/or controlled processes.

There is evidence consistent with abnormalities of both automatic and controlled affective processing in SocAnh. For instance, decreased self-reported positive affect in SocAnh is generally consistent with a decreased automatic focus specifically on positive information and on positive emotional experience (Cohen, Callaway, Najolia, Larsen, & Strauss, 2012; Kerns et al., 2008). At the same time, increased self-reported negative affect in SocAnh is generally consistent with an increased automatic focus specifically on negative information (Cohen et al., 2012; Kerns et al., 2008). Additionally, there is also evidence consistent with increased controlled avoidance of both positive and negative affective information in SocAnh. For instance, SocAnh is associated with an increased self-reported desire to ignore positive emotions (Martin et al., 2011). This might result in increased controlled avoidance of positive emotional information and experience. Further, this increased controlled avoidance could result in a decreased habitual or automatic decreased processing of positive emotional information in SocAnh. However, in addition to increased avoidance of positive affect, some evidence also suggests decreased attention to negative information in SocAnh. In particular, despite a strong association between current negative mood and judgment of future risk in both healthy controls and PerMag individuals, there was no association between current negative mood and risk judgment in SocAnh ($r=0.00$; Martin et al., 2011). Hence, overall, evidence suggests that SocAnh could be associated with blunted automatic processing of positive affect but also exaggerated automatic processing of negative affect as well as increased controlled avoidance of both positive and negative affect. However, there is little evidence of altered neural responses to affective stimuli in SocAnh (Hooker et al., 2014).

In contrast to SocAnh, there is some evidence suggesting elevated scores on measures of PerMag and related scales (e.g., Schizotypal Personality Questionnaire), might involve increased reactivity to both positive and negative stimuli (e.g., Karcher & Shean, 2012; Ragsdale, Mitchell, Cassisi, & Bedwell, 2013). This increased reactivity could be related to either exaggerated automatic processing or deficits in controlled regulation. For example, other positive schizotypy scales strongly correlated with PerMag have been associated with increased self-reports of positive emotions in response to pleasurable events compared to controls (Shi et al., 2012). Relatedly, PerMag scores are at least moderately positively correlated ($r=0.43$ – 0.49 ; Eckblad & Chapman, 1986) with the Hypomanic Personality Scale which is characterized by subsyndromal mania, with both PerMag and Hypomanic Personality predictive of future onset of bipolar disorders (Chapman et al.,

1994; Kwapiil et al., 2000). At the same time, in response to a daily stressor, individuals with increased self-reported psychotic experiences report greater increases in negative affect than healthy controls (Myin-Germeys, van Os, Schwartz, Stone, & Delespaul, 2001). This suggests that PerMag might be associated with elevated stress reactivity, which has been consistently linked to the clinical course and functional outcome in psychotic disorders (Myin-Germeys & van Os, 2007). Overall, such an increased reactivity to emotional stimuli could potentially reflect an exaggerated automatic response or potentially a deficit in controlled regulation of emotional responses.

Hence, there is evidence that both SocAnh and PerMag may be associated with altered automatic and/or controlled processing of emotion. One way to examine automatic and controlled processing of affective stimuli and affective experience is to examine ERPs, including the late positive potential (LPP; Hajcak, MacNamara, & Olvet, 2010). Both research (e.g., Briggs & Martin, 2008; Hilgard, Weinberg, Hajcak Proudfit, & Bartholow, 2014; Schupp et al., 2000; Schupp et al., 2004; Weinberg & Hajcak, 2010) and theory (see Nieuwenhuis, Aston-Jones, & Cohen, 2005) have linked the amplitude of the LPP to the motivational significance of the eliciting stimulus. For example, studies using affective images, such as those comprising the International Affective Picture Set (IAPS; Lang, Bradley, & Cuthbert, 2005), consistently shows that both positive and negative images elicit larger LPP amplitudes than do neutral images (Schupp et al., 2000, 2004). This property of the LPP makes it particularly well suited to the aims of the current research because it allows for the covert assessment of automatic processing of affective stimuli without the reliance on self-reports. For example, if SocAnh is associated with a blunted automatic processing of positive affective stimuli, then SocAnh might be associated with a smaller increase in the LPP for passive viewing of positive affective stimuli than for neutral stimuli when compared to control or PerMag participants. In contrast, if risk for a schizophrenia-spectrum personality disorder more generally is associated with exaggerated automatic processing of negative affective stimuli, then both the SocAnh and PerMag groups might be associated with a larger increase in the LPP for passive viewing of negative affective stimuli than for neutral stimuli when compared to control participants.

In contrast to automatic processing, one way to examine the efficacy of controlled processing of affective stimuli is to examine the LPP in emotion regulation conditions (e.g., in conditions where participants are instructed to use cognitive appraisal to either increase or decrease affective response to affective stimuli) compared to the passive viewing of affective stimuli. Some previous ERP research which has utilized emotion regulation paradigms has found that the instruction to *increase* affect results in larger LPP amplitudes compared to passively viewing affective stimuli (e.g., Gardener, Carr, Macgregor, & Felmingham, 2013; Moser, Most, & Simons, 2010). In contrast, previous research has found that the instruction to *decrease* one’s emotional response results in smaller LPP amplitudes compared to passively viewing affective stimuli (Gardener et al., 2013; Hajcak & Nieuwenhuis, 2006; Kropfing, Moser, & Simons, 2008; Moser, Hajcak, Bukay, & Simons, 2006; Moser et al., 2010). If SocAnh is associated with increased controlled avoidance of both positive and negative affective stimuli, then SocAnh might be associated with an altered LPP when attempting to regulate either positive or negative affect. In contrast, if risk for a schizophrenia-spectrum personality disorder more generally is associated with a deficit in controlled regulation of emotional responses, then both the SocAnh and PerMag groups might be associated with altered LPPs when attempting to regulate either positive or negative affect when compared to control participants.

In the current study, we examined automatic and controlled affective processing in SocAnh, PerMag, and control participants. An advantage to studying individuals at risk for a schizophrenia-

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