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Anomalous Self-Experiences and positive symptoms are independently associated with emotion processing deficits in schizophrenia

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ABSTRACT

Social-cognitive models posit a role of Anomalous Self-Experiences (ASEs), disturbances in the subjective experience of the self, in the development and maintenance of psychosis. Theorists have suggested that ASEs may underlie the social-cognitive deficits that are common in people with schizophrenia. Positive symptoms, negative symptoms, and ASEs may interfere with the ability to perceive, use, understand, and manage emotions. In the current study, 45 people with schizophrenia and 28 healthy controls completed the Inventory of Psychotic-Like Anomalous Self-Experiences (IPASE), the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT), and were rated on the Positive and Negative Syndrome Scale (PANSS). Participants with schizophrenia had higher IPASE scores and lower MSCEIT scores than the comparison group. In a series of simultaneous regressions, ASEs, but not positive or negative symptoms, were associated with Total MSCEIT scores and the Using Emotions branch score. In contrast, positive symptoms, but not ASEs or negative symptoms were associated with Perceiving and Managing Emotions branches. Both ASEs and positive symptoms independently contributed to Emotional Experiencing scores. The severity of negative symptoms was not associated with deficits in any MSCEIT scores. These results suggest unique roles for ASEs and positive symptoms in emotion processing deficits in people with schizophrenia.

1. Introduction

Schizophrenia is a heterogeneous disorder with primary symptoms, including positive and negative symptoms (Andreasen et al., 1995). Theorists have called for more work understanding the role of Anomalous Self-Experiences (ASEs) in schizophrenia (Bleuler, 1911; Parnas, 2011). ASEs are disturbances in the subjective experience of the self and have a long history in psychopathology research dating back to Bleuler, who defined schizophrenia as primarily a disorder of the self (Bleuler, 1911; Parnas, 2011). Contemporary phenomenologists have described ASEs with the Ipseity-Disturbance Model (Sass, 2014), which suggests that the *ipse* (self) is the core of an individual and is disturbed in schizophrenia in ways that can manifest, as hyper-reflexivity and diminished self-affection. Hyper-reflexivity refers to excessive attention to self-processes that normally are experienced nonconsciously. Diminished self-affection refers to disturbances in the perception that one is acting out one's behaviors, or a disturbance in self-agency, or a diminished sense of possession of one's experiences.

Research on ASEs is important to our understanding of schizophrenia. Previous research suggests that ASEs are central to schizophrenia (Park and Nasrallah, 2014; Sass and Parnas, 2003) and are present in different forms at varying magnitudes in the premorbid (Brent et al., 2014), prodromal (Moller and Husby, 2000; Nelson et al., 2012; Parnas et al., 1998), first episode (Haug et al., 2012; Nordgaard and Parnas, 2014), chronic (Parnas et al., 2003), and recovery phases of the disorder (Lysaker et al., 2001). Research on ASEs may aid in our understanding of all phases of schizophrenia.

In addition to being present in all phases of schizophrenia, theorists have suggested that ASEs may underlie the social-cognitive deficits commonly seen in people with schizophrenia (Ebisch et al., 2014; Ebisch et al., 2013; Nelson et al., 2009b; van der Weiden et al., 2015). Social cognition refers to the ability to understand social aspects of the world. Recent work has identified emotion processing as one of four major components of social cognition (Green and Horan, 2010; Pinkham et al., 2014). Emotion processing can be defined as the ability to perceive and understand one's own and others' emotions, including the use and understanding of spoken language, non-verbal behaviors, and facial expressions, as well as the ability to use and manage one's own emotions (Green et al., 2008).

There are several explanations for why ASEs may interfere with an individual's ability to process emotions. First, self-information processing and social cognition are related in healthy individuals (Uddin et al., 2007), suggesting an overlap in neural mechanisms for self-relevant and social-cognitive information processing, including cortical midline

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structures (Northoff and Bermpohl, 2004; Schilbach et al., 2006) and the mirror neuron network (Gallese et al., 2004; Uddin et al., 2005). Abnormalities in the mirror neuron network have also been found in schizophrenia (Jardri et al., 2011; Mehta et al., 2014; Thakkar et al., 2014). Second, people with schizophrenia have abnormalities in the connectivity among the ventral premotor cortex (vPMC), the posterior cingulate cortex (PCC), and the posterior insular cortex (pIC; Ebisch et al., 2014). The vPMC and pIC are associated with deficits in the processing of both self- and other-related information, and the PCC is a major component of the default mode network (Buckner et al., 2008). This suggests that abnormalities in the connectivity of the vPMC and pIC with the PCC may be a neurobiological mechanism that links ASEs with social-cognitive deficits.

Third, from a phenomenological perspective, ASEs involve a disturbance in self-presence or self-affection, such that individuals no longer feel at the center of their first-person experiences (Park and Nasrallah, 2014; Sass and Parnas, 2003). They may feel a lack of identity or sense of a distance between self and experience. This distance may interfere with individuals' ability to perceive and understand their own emotions or interfere with emotion use and management (Nelson et al., 2009b). At the same time, ASEs are accompanied by a loss of "common sense," the obviousness, or "natural self-evidence" of normal everyday experience. Individuals report being alienated from the shared social-experience of the world. In terms of social stimuli, people experiencing ASEs may suddenly find it difficult to read facial expressions or find themselves explicitly trying to decipher others' intentions, when these would normally be processed implicitly (Nelson et al., 2009a). The individual may have difficulty perceiving the emotions of others.

Despite the strong theoretical rationale for a link between ASEs and social cognition few studies have empirically examined the associations between ASEs and social cognition from a phenomenological perspective, and results have been inconclusive. Some research has shown that higher levels of ASEs are associated with poorer social functioning, but has not examined whether this effect is driven by social cognition deficits (Haug et al., 2014). In prodromal individuals, ASEs were not associated with scores on a facial affect recognition task in which participants were shown faces and asked to identify the emotion that was displayed and shown emotion words and asked to identify the corresponding facial expression (Comparelli et al., 2016). Given the paucity of empirical work on the relation between ASEs and social cognition, more work is needed to understand this hypothesized link.

The first goal of the current research was to replicate previous findings that people with schizophrenia have deficits in emotion processing and increased ASEs compared to a healthy comparison group. The second goal was to examine whether ASEs are associated with emotion processing deficits. The third goal was to examine whether ASEs are associated with emotion processing over and above the effects of positive and negative symptoms.

2. Method

2.1. Participants

Participants were 45 people with schizophrenia or schizoaffective disorder and 28 non-psychiatric controls. Participants in the schizophrenia group were recruited from the Adult Mental Health Division of the Hawaii Department of Health outpatient centers and clubhouses as well as other community outpatient clinics. All schizophrenia participants were outpatients, and 21 of the 45 participants had at least one positive symptom rated moderate (i.e., 4) or higher on the PANSS, suggesting that nearly half of the participants had moderate active psychotic symptoms. Healthy controls were recruited via fliers posted around the community and Craigslist advertisements, and were screened for a history of any Axis I mental disorder. Potential participants with an Axis I disorder were excluded from the study. The demographic characteristics of both groups of participants can be found in Table 1. The groups did not significantly differ by gender (χ^2 (1) = 0.001, p = 0.925), ethnicity (χ^2 (9) = 9.99, p = 0.265), age (t (67) = 1.73, p = 0.089), or parental education (t (57) = 1.830, p = 0.073). Participants were compensated $50–75 for their time, depending on the length of time needed to complete the study.

Table 1
Demographic information of the schizophrenia and control group.

Variable	Schizophrenia group (n = 45)	Control group (n = 28)
Sex (% female)	48.8%	50.0%
Ethnicity		
White (%)	29.2%	48.4%
Asian	20.8%	6.4%
Pacific Islander	20.9%	9.7%
African-American	8.3%	0
Multiethnic	14.6%	22.6%
Other	6.3%	12.9%
Mean (SD) age (years)	49.49 (10.67)	44.31 (14.14)
Mean (SD) parental education	11.95 (3.45)	13.75 (3.71)

2.2. Diagnosis and symptom ratings

Diagnoses were made with the Structured Clinical Interview for the DSM-IV (SCID; First et al., 1998). The SCID is a structured interview that assesses all Axis I disorders and has high test-retest and inter-rater reliability (Zanarini and Frankenburg, 2001; Zanarini et al., 2000). Symptom ratings were done with the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987). The PANSS includes positive symptoms, negative symptoms, and general psychopathology. Previous research has shown that PANSS scores have high inter-rater reliability and convergent validity when compared to other symptom ratings (Peralta and Cuesta, 1994).

2.3. Anomalous Self-Experiences

ASEs were measured with the Inventory for Psychotic-Like Anomalous Self-Experiences (IPASE; Cicero et al., 2016). The IPASE is a 57-item self-report scale in which participants indicate how much they agree with statements on a scale of 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). The IPASE measures basic self-disturbances, but not higher cognitive level self-disturbances such as disturbances in narrative self. It contains subscales for disturbances in Self-Awareness and Presence (e.g., I feel as though I no longer have an identity), Consciousness (e.g., I have difficulty telling whether I am experiencing something or just imagining it), Somatization (e.g., I have had the feeling that I am watching myself from outside of my body), Cognition (e.g., I feel like my thoughts are being generated by someone else), and Demarcation/Transitivism (e.g., I wonder whether or not I truly exist). The IPASE has been shown to have high internal reliability ($\alpha = 0.97$) and to be positively correlated with measures of psychotic-like experiences and self-consciousness, but negatively correlated with task and behavioral measures of self-concept clarity (Cicero et al., 2016). Moreover, people at risk for psychosis and people with schizophrenia have elevated IPASE scores compared to appropriately matched comparison groups. The IPASE is similar to the Examination of Anomalous Self-Experiences (EASE; Parnas et al., 2005) because the IPASE was developed to include similar concepts to the EASE. However, the IPASE is a self-report while the EASE is an interview. The IPASE items were developed independently and are not the same as the interview questions on the EASE.

2.4. Emotion processing

Emotion processing was measured with the Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT; Mayer et al., 2003). The MSCEIT is a 141 item test that includes four "branches," each with two

subscales: 1) Perceiving Emotions, 2) Using Emotions, 3) Understanding Emotions, and 4) Managing Emotions. The Perceiving Emotions branch (1) measures the ability to perceive emotions in others as well as in inanimate stimuli. On the Perceiving Emotions/Faces subscale, participants are shown faces and asked to indicate how much the face is displaying different emotions. On the Perceiving Emotions/Pictures subscale, participants are shown pictures, some abstract and some pictures of objects or landscapes, and are asked to indicate how much different emotions are present in the pictures. The Using Emotions branch (2) measures the ability to use emotions to aid in the clarity of thinking. In the Using Emotions/Facilitation task, participants are presented with five situations or tasks and asked to rate how much three different emotions would help with each task. In the Using Emotions/Sensations task, participants are asked to generate five emotions and then match three sensations to each emotion. The Understanding Emotions branch (3) measures the ability to understand emotional information from oneself and others. In the Blends task, participants are asked to select which emotions can be combined to form another emotion. The Changes task requires participants to report what emotion would arise as other emotions become stronger. Finally, the Managing Emotions branch (4) measures the ability to use information about emotions in making decisions and taking appropriate actions. In the Managing Emotions task, participants are asked to indicate what actions characters may engage in to change their emotional states. In the Emotional Relationships task, participants are asked what characters may do to manage the emotions of another person. The Emotional Experiencing area score is a combination of the Perceiving and Using branches, and the Emotional Reasoning area score is a combination of the Understanding and Managing branches.

3. Results

3.1. Preliminary analyses

We examined the means, standard deviations, histograms, scatterplots, and stem and leaf plots of the variables in the study to identify outliers. Two participants in the schizophrenia group were identified as outliers on the IPASE and were excluded listwise from all analyses. These participants' scores were 5.0 and 4.02, indicating that one participant answered 5 (*Strongly Agree*) to all 57 questions and the other was 2.39 SDs above the mean, with a clear break in the distribution between the rest of the scores and these two outliers. It is likely these two participants were not paying attention as they completed the inventory; they were removed from all analyses.

3.2. Group comparisons

The first goal of the current research was to examine whether people with schizophrenia had elevated IPASE scores and decreased MSCEIT scores. Participants with schizophrenia had higher IPASE scores and lower MSCEIT Total along with all four branch scores and both area scores (Table 2).

3.3. Relations between ASEs, symptoms, and emotion processing

Next, we examined the bivariate correlations between ASEs, positive symptoms, negative symptoms, and emotion processing variables in the schizophrenia group only. IPASE scores were negatively correlated with total MSCEIT scores, as well as Perceiving Emotions and Using Emotions branch scores (Table 3). There was a negative correlation of ASEs with Emotional Experiencing, but not Emotional Reasoning, and a trend toward a significant negative correlation with the Managing Emotions branch score. Positive symptoms were negatively correlated with Perceiving Emotions and Managing Emotions branch scores, and Emotional Experiencing area scores. There was a trend for a significant negative correlation between positive symptoms and MSCEIT total scores. Negative symptoms were not significantly associated with any MSCEIT scores.

Table 2
Mean comparisons of Anomalous Self-Experiences and emotional processing between groups.

Variable	Schizophrenia group M (SD)	Control group M (SD)	T-score
IPASE	2.29 (0.81)	1.35 (0.39)	6.12**
MSCEIT total	0.42 (0.10)	0.53 (0.09)	4.36**
Perceiving Emotions	0.46 (0.17)	0.61 (0.14)	3.43**
Using Emotions	0.39 (0.12)	0.49 (0.06)	3.95**
Understanding Emotions	0.46 (0.15)	0.61 (0.14)	4.02**
Managing Emotions	0.34 (0.10)	0.42 (0.09)	2.84*
Emotional Experiencing	0.43 (0.12)	0.55 (0.11)	4.29**
Emotional Reasoning	0.41 (0.11	0.51 (0.10)	3.60**

IPASE = Inventory of Psychotic-Like Anomalous Self-Experiences, MSCEIT = the Mayer-Salovey-Caruso Emotional Intelligence Test.
* $p < 0.01$.
** $p < 0.001$.

3.4. Independent associations among Anomalous Self-Experiences, symptoms, and emotion processing

To examine whether ASEs were incrementally associated with Emotion Processing over and above the effects of positive symptoms, IPASE scores and Composite Positive Symptom Ratings were entered into a series of simultaneous regressions with MSCEIT scores as the outcome variables. Since negative symptoms were not associated with any MSCEIT scores, they were not included in the regression analyses. These analyses were done with the schizophrenia group only. When entered simultaneously, ASEs, but not positive symptoms, were negatively associated with MSCEIT total scores and with Using Emotion branch scores (Table 4). Positive symptoms, but not ASEs, were negatively associated with Perceiving Emotion and Managing Emotion branch scores. Finally, both ASEs and positive symptoms were independently negatively associated with Emotional Experiencing scores.

4. Discussion

The current study is the first to find that ASEs are associated with deficits in emotion processing. This association remained significant even after removing variance shared with positive symptoms, which suggests that ASEs have incremental validity in explaining emotion processing deficits over and above traditional schizophrenia symptoms. At the same time, there were still significant relations between positive symptoms and emotion processing deficits after removing variance shared with ASEs, which suggests that ASEs cannot completely explain the social-cognitive deficits that are common in schizophrenia. Finally, the current research replicated previous findings that people with schizophrenia have increased ASEs and social-cognitive deficits compared to a healthy comparison group.

The finding that ASEs are associated with social-cognitive deficits is consistent with theoretical and neuroimaging work suggesting this link (Ebisch et al., 2014; Ebisch et al., 2013; Nelson et al., 2009b). However, the current study is the first to examine the relations between ASEs and the MSCEIT, and is one of the first to examine the relations between phenomenological-based ASEs and any aspect of social cognition. We found that ASEs were associated with MSCEIT total, the Using Emotions branch, and the Emotional Experiencing scores. In contrast, positive symptoms were associated with the Perceiving Emotions branch, Managing Emotions branch, and Emotional Experiencing scores. The Using Emotions branch refers to the individual's ability to use emotion to inform the individual's thoughts and cognitions. A person with low Using Emotions branch scores may block feelings or emotions and have difficulty incorporating them into decision making. ASEs may be

Table 3
Spearman correlation matrix for all variables in the current research.

	1	2	3	4	5	6	7	8	9	10
1) IPASE	*0.98*									
2) PANSS positive	0.33*	*0.82*								
3) PANSS negative	0.03	0.16	*0.78*							
4) MSCEIT total	−0.42*	−0.32+	−0.12	*0.75*						
5) Perceiving Emotions	−0.34*	−0.39*	0.11	0.72*	0.69					
6) Using Emotions	−0.39*	−0.25	−0.27	0.61*	0.31+	*0.75*				
7) Understanding Emotions	−0.17	0.08	−0.04	0.74*	0.30+	0.37*	*0.84*			
8) Managing Emotions	−0.29+	−0.51*	−0.17	0.60*	0.15	0.24	0.51*	*0.81*		
9) Emotional Experiencing	−0.43*	−0.39*	−0.17	0.88*	0.85*	0.69*	0.50*	0.31+	*0.77*	
10) Emotional Reasoning	−0.26	−0.15	−0.07	0.76*	0.24	0.32+	0.91*	0.80*	0.42*	*0.73*
Mean	2.29	17.46	15.32	0.42	0.46	0.39	0.46	0.35	0.43	0.40
Standard deviation	0.81	6.30	4.70	0.10	0.17	0.12	0.15	0.10	0.12	0.11

IPASE = Inventory of Psychotic-Like Anomalous Self-Experiences, PANSS positive = sum of the Positive and Negative Syndrome Scale positive items, PANSS negative = sum of the Positive and Negative Syndrome Scale negative items. Numbers on the diagonal represent Cronbach's Alpha for IPASE, intraclass correlation coefficient for PANSS positive and PANSS negative, and split half reliability for MSCEIT scores.
* $p < 0.05$.
+ $p < 0.10$.

associated with decreased use of emotions because individuals with ASEs feel disconnected from their emotions and experiences.

The Perceiving Emotions Branch measures how people understand their own and others' emotions. People with low ability in perceiving emotions may pay little attention to the emotional expression of others or have trouble understanding others' emotions because they do not understand nonverbal cues. Positive symptoms, such as delusions or persecutory ideation, may interfere with people's ability to identify emotions because they see the world as hostile or in an overly negative context. Likewise, the IPASE had a significant zero-order negative correlation with the Perceiving Emotions branch, but the relation was not significant in the simultaneous regression. This suggests that ASEs may interfere with the perception of emotions in others, and particularly in oneself, but that this effect may be partially accounted for by shared variance with positive symptoms. Since the Experiencing Emotions area score is a combination of the Using Emotions branch and the Perceiving Emotions branch, it is not surprising that both positive symptoms and IPASE scores were associated with the Experiencing Emotions area scores.

In addition to perceiving emotions, positive symptoms were associated with the Managing Emotions branch, which measures the ability to be appropriately aware of emotions, accept them, and use the emotions in problem solving. People with low ability to manage emotions may be too logical and focus too much on the concrete aspects of social interactions, while ignoring how they or others feel about the interaction. Moreover, poor managing of emotions may lead to someone acting on emotions too quickly without thinking. Positive symptoms may interfere with the managing of emotions because individuals are focused on the concrete aspects of these experiences. In contrast, neither positive symptoms nor ASEs were associated with the Understanding Emotions branch, which measures the ability to label emotions and to understand groups of related emotional terms. It is possible that positive symptoms and ASEs do not interfere with basic emotional knowledge, but do interfere with the use, management, and perception of emotions in real life situations. This may explain, in part, why social skills training programs focus on the practice of social interactions in real life or role play situations, rather than taking a solely educational approach and teaching what different emotions mean (Bellack et al., 2013). The finding that Perceiving and Managing Emotions branch scores and Emotional Experiencing scores were negatively associated with positive symptoms is somewhat consistent with previous work that found negative correlations between positive symptom scores and MSCEIT scores (Green et al., 2012a; Lin et al., 2012), although other work has found correlations with the Perceiving Emotions branch only (Eack et al., 2010).

In contrast to positive symptoms and ASEs, negative symptoms were not correlated with any aspect of emotion processing in the current research. This finding is somewhat surprising because negative symptoms have been found to be associated with broad measures of social cognition (Browne et al., 2016) and the experience and processing of emotions in particular (e.g., Browne et al., 2016; Engel et al., 2016; Martin et al., 2005). However, it is consistent with the results of some studies (Eack et al., 2010) but not others (Green et al., 2012a; Lin et al., 2012). Still, other research has found no correlations among MSCEIT scores with any positive or negative symptoms (Bell et al., 2011). Although this study was the first to examine the relations between ASEs and emotion processing with the MSCEIT, the MSCEIT has frequently been used to assess social cognition in people with schizophrenia. The Managing Emotions branch is included in the MATRICS Consensus Cognitive Battery (MCCB; Green et al., 2005). Previous research has consistently found social cognition deficits in people with schizophrenia with the MSCEIT, whether using the full version or the Managing Emotions branch score (Dawson et al., 2012; Eack et al., 2010; Green et al., 2012a). More research is needed to clarify the associations between MSCEIT scores and positive and negative symptoms. Still, the current work provides further evidence for the reliability and validity of MSCEIT scores in people with schizophrenia.

In addition to understanding the relations among social-cognitive deficits, ASEs, and positive and negative symptoms, the current research provides further support for the validity of IPASE scores in people with schizophrenia. Other studies examining the relation between ASEs and positive symptoms have used other measures of ASEs such as the Examination for Anomalous Self-Experiences (EASE; Parnas et al., 2005). The most notable difference between the EASE and the IPASE is that the EASE is a phenomenological interview and the IPASE is a self-report scale. One potential limitation of the current research is that

Table 4
Results of the simultaneous regressions.

	MSCEIT total	Perceiving Emotions	Using Emotions	Understanding Emotions	Managing Emotions	Emotional Experiencing	Emotional Reasoning
IPASE	−0.36*	−0.27	−0.47*	−0.18	−0.17	−0.42*	−0.22
Positive	−0.27	−0.31*	−0.21	0.07	−0.46*	−0.32*	−0.16

IPASE = Inventory of Psychotic-like Anomalous Self-Experiences, positive ratings from the Positive and Negative Syndrome Scale.
* $p < 0.05$.

some basic self-experiences may be difficult for people to recognize and understand in themselves. People need a relatively high level of cognitive ability to be able to recognize these experiences and report them correctly. At the same time, the IPASE was designed to measure the same constructs as the EASE and care was taken to include all constructs measured in the EASE in the initial item pool for the IPASE (Cicero et al., 2016). Like the EASE, the final IPASE measure includes five subscales. However, the items written to represent the "Cognition and Consciousness" factor of the EASE split into separate cognition and consciousness factors in the exploratory factor analysis in the IPASE development study, and an "Existential Reorientation" factor did not emerge on the IPASE. Both the IPASE and the EASE include measures of disturbances in Self-Awareness and Presence, Bodily Experiences, and Demarcation/Transitivism. Future research could examine whether the IPASE and the EASE measure the same construct by examining the correlations between the measures.

One area for future research is to examine how much overlap there is between ASEs and positive symptoms of psychosis. In the current research, ASEs and positive symptoms were only moderately correlated, but correlations have been stronger in previous work (Cicero et al., 2016). The finding of differential relations with emotion processing variables suggests that they may be distinct constructs. Future research could continue to examine whether ASEs and positive symptoms are distinct by testing whether they load on the same or different factors in a confirmatory factor analysis and by examining whether they have differential relations with other variables such as measures of self-processing and other clinical symptoms common in schizophrenia.

One potential limitation of the current work is that the sample sizes of 45 people with schizophrenia and 28 healthy controls are relatively small. Some of the correlations and the simultaneous regression beta weights that were not statistically significant would have been significant if the sample were larger. For example, the lack of significant associations between positive scores and MSCEIT total scores and between IPASE scores and the Managing Emotions branch may be a result of a lack of statistical power, rather than differential relations among the variables. Although there were no significant differences between groups on sex, ethnicity, age, or parental education, the groups may not have been perfectly matched. The control group tended to be White, young, and to have parents with more education. However, given that social-cognitive deficits are well established in people with schizophrenia, it is unlikely that differences in demographics were driving this effect in the current research.

Another potential limitation of the current work is a lack of a comprehensive measure of social or occupational functional outcome. Previous work has found associations between functional outcome and social cognition (Fett et al., 2011; Green et al., 2012b) and between functional outcome and ASEs (Haug et al., 2014). Future work could examine whether ASEs mediate the relation between social-cognitive deficits and functional outcome. Another limitation of the current research is that it was a cross-sectional study, and causal relations could not be established. Theorists have suggested that ASEs may be a mechanism contributing to social-cognitive deficits in people with schizophrenia (Nelson et al., 2009b). Future research could follow people with schizophrenia, or people at risk for its development, longitudinally to see if ASEs precede the development of social-cognitive deficits. Moreover, researchers have called for more work treating ASEs as independent variables (Sass, 2014). ASEs could be temporarily induced in either healthy individuals or in people with schizophrenia to see if this contributes to poorer performance on social-cognitive tasks.

The current research assessed just one area of a much broader social-cognition construct. Future research could examine associations between ASEs and other aspects of social cognition, such as social perception, theory of mind, and attributional style/bias (Pinkham et al., 2014). The current research only used an objective, ability-based measure of emotion processing. Future research could include subjective or perceived measures of emotion processing, such as the Trait-Meta Mood Scale (Salovey et al., 1995; Tabak et al., 2015). Additionally, ASEs were measured in just one way in the current research. Future research could include measures of self-agency (Ford et al., 2014; Schimansky et al., 2010), self-monitoring (Farrer and Franck, 2007; Knoblich et al., 2004; Nelson et al., 2014), self-knowledge or insight into illness,(Baier, 2010; Mintz et al., 2003) or personal narratives (Lysaker et al., 2005), and examine whether these variables are also associated with emotion-processing deficits with measures like the MSCEIT.

Contributors

David C. Cicero designed the study, conducted the statistical analyses, and wrote the first draft of the manuscript. Mallory J. Klaunig, Christi L. Trask, and Aaron M. Neis collected the data, managed the data, and assisted with editing the manuscript. All authors contributed to and have approved the final manuscript.

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Conflict of interest

All authors declare that they have no conflicts of interest.

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